SOUTH ORANGE COUNTY
COMMUNITY COLLEGE DISTRICT

BID NO. 1094

JAMES B. UTT LEARNING RESOURCE CENTER RENOVATION

AT

SADDLEBACK COLLEGE

28000 Marguerite Parkway
Mission Viejo, California 92692

PROJECT MANUAL

VOLUME #1

gkkworks
2355 Main Street
Suite 220
Irvine, CA 92501
949 250 1500
FAX: 949 955 2708

FEBRUARY, 2010

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***If the following items are not returned at the time of the bid opening, the bidder will be declared nonresponsive**
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NOTICE CALLING FOR BIDS

District:	**SOUTH ORANGE COUNTY COMMUNITY COLLEGE DISTRICT**
Project:	**BID NO. 1094: James B. Utt Memorial Learning Resource Center Renovation at Saddleback College**
Bid Deadline:	**2:00 P.M., March 25, 2010**
Mailing Address & Place of Bid Receipt:	**South Orange County Community College District Health Sciences Building, 3rd Floor, Room HS-357 Purchasing & Facilities Planning Department 28000 Marguerite Parkway Mission Viejo, CA 92692**

NOTICE IS HEREBY GIVEN that the South Orange County Community College District, of Orange County, California, acting by and through its Governing Board, hereinafter referred to as "DISTRICT," will receive up to, but not later than, the above-stated time, sealed bids for the award of a contract for the above Project.

Project's Preliminary Cost Estimate: Learning Resource Center - $16,200,000

Complete description, specifications and general conditions may be viewed at the Office of the Director of Facilities Planning and Purchasing Department at the above address, telephone (949) 582-4678 or previewed on-line at socccd.edu **Interested bidders may purchase complete bid documents from Repro X-press, 18207 McDurmott St., Suite I, Irvine, CA 92614, Phone: (866) 364-8569, Fax: (949) 336-7757.** Payment will not be refunded, and the Project Documents are not required to be returned.

There will be a mandatory job walk and conference at 9:00 am, February 11, 2010 starting in front of the James B. Utt Learning Resource Center located adjacent to parking lot 7A at Saddleback College, 28000 Marguerite Parkway, Mission Viejo, CA 92692. Any bidder failing to attend the entire pre bid conference shall be deemed a non-responsive bidder and will have his bid returned unopened.

In accordance with the provisions of California Business and Professions Code Section 7028.15 and Public Contract Code Section 3300, the DISTRICT requires that the bidder possess the following classification of contractor's license at the time the bid is submitted: **Class B**. Any bidder not so licensed at the time of the bid opening will be rejected as non-responsive.

Time is of the essence. Failure to complete the work within the time set forth in the bid documents will result in the imposition of liquidated damages for each day of delay in the amount set forth in the Information for Bidders.

Each bid shall be accompanied by a bid security in the form of cash, a certified or cashier's check or bid bond in an amount not less than ten percent (10%) of the total bid price, payable to the DISTRICT. In the event the successful bidder fails to enter into the contract and execute the required documents, the bid security shall be forfeited. The successful bidder shall furnish a satisfactory Performance Bond and a Payment Bond in amounts not less than one hundred percent (100%) of the total bid price.

The DISTRICT reserves the right to reject any or all bids or to waive any irregularities or informalities in any bids or in the bidding process.

The California Department of Industrial Relations has determined the general prevailing rates of per diem wages for the locality in which the work is to be performed for the Project. Copies of these wage rate determinations, entitled Prevailing Wage Scale, are maintained at the DISTRICT office and are available at the following website: www.dir.ca.gov. It shall be mandatory upon the successful bidder to whom the contract is awarded, and upon any subcontractor listed, to pay not less than the said specified rates to all workers employed by them for the Project. These requirements will be enforced through our Labor Compliance consulting firm.

No bidder may withdraw any bid for a period of ninety (90) calendar days after the date set for the opening of bids.

The general prevailing rate of per diem wages is based upon a working day of eight (8) hours. The rate for holiday and overtime work shall be at least time and one-half.

Pursuant to Section 22300 of the Public Contract Code, the Agreement will contain provisions permitting the successful bidder to substitute securities for any monies withheld by the DISTRICT to ensure performance under the Agreement or permitting payment of retention earned directly into escrow.

Prequalification is a requirement for bidding this project. Prequalification documents will be distributed at the mandatory job walk and conference.

Brandye K. D'Lena
Director,
Facilities Planning &
Purchasing

PUBLISH: THE REGISTER

February 1, 2010

&

February 8, 2010

ATTENTION: LEGAL AD DEPARTMENT

In order for our Department to process payment, you MUST send Proof of Advertisement (Affidavit) on the date of publication to:

South Orange County Community College District

ATTN: Facilities Planning & Purchasing

28000 Marguerite Parkway

Mission Viejo, CA 92692

NOTE: **PLEASE CALL LINDA HALL AT (949) 348-6017 WHEN AD IS RECEIVED.**

INFORMATION FOR BIDDERS

WARNING:
READ THIS DOCUMENT CAREFULLY. DO NOT ASSUME
THAT IT IS THE SAME AS OTHER SIMILAR DOCUMENTS
YOU MAY HAVE SEEN, EVEN IF FROM THE SAME DISTRICT.

1. Preparation of Bid Form. Bids shall be submitted on the prescribed Bid Form, completed in full. All bid items and statements shall be properly and legibly filled out. Numbers shall be stated both in words and in figures where so indicated, and where there is a conflict in the words and the figures, the words shall control over the numbers. The signatures of all persons shall be in longhand and in ink. Prices, wording and notations must be in ink or typewritten.

2. Form and Delivery of Bids. The bid must conform and be responsive to all Project Documents and shall be made on the Bid Form provided, and the complete bid, together with any and all additional materials as required, shall be enclosed in a sealed envelope, addressed and hand delivered or mailed to the DISTRICT at:

South Orange County Community College District
Health Science Building, 3rd Floor
28000 Marguerite Parkway
Mission Viejo, CA, 92692

and must be received on or before the bid deadline (Public Contract Code Section 20112) The envelope shall be plainly marked in the upper left hand corner with the bidder's name, the Project designation and the date and time for the opening of bids. **It is the bidder's sole responsibility to ensure that its bid is received prior to the bid deadline.** In accordance with Government Code Section 53068, any bid received after the scheduled closing time for receipt of bids shall be returned to the bidder unopened. At the time and place set forth for the opening of bids, the sealed bids will be opened and publicly read aloud. However, if prequalification of bidders is required pursuant to Public Contract Code Section 20111.5 only those sealed bids received from prequalified bidders shall be opened and publicly read aloud.

3. Bid Security. Each bid shall be accompanied by a bid security in the form of cash, a certified or cashier's check or bid bond in the amount of not less than ten percent (10%) of the total bid price payable to the DISTRICT and shall be given as a guarantee that the bidder, if awarded the contract, will execute the Agreement within ten (10) working days after notice of award of the contract, and will furnish, on the prescribed forms, a satisfactory Faithful Performance Bond in an amount not less than one hundred percent (100%) of the total bid price and separate Payment (labor and material) Bond in an amount not less than one hundred percent (100%) of the total bid price, furnish certificates and endorsements evidencing that the required insurance is in effect, the Workers' Compensation Certificate, Drug-Free Work Place Certification, the Criminal Records Check Certification, Contractor's Certificate Regarding Non-Asbestos Containing Materials, and the Disabled Veteran Business Enterprises Certification, if applicable, all within ten(10) working days of the notice of award of the contract or as otherwise requested in writing by the DISTRICT. It is understood and agreed that should bidder fail or refuse to return these documents as required by the DISTRICT, the bid security shall be forfeited to the DISTRICT. If the Bidder elects to furnish a bid bond as its Bid Security, the Bidder shall use the bid bond form included in the Project Documents.

4. Signature. Any signature required on Project Documents must be signed in the name of the bidder and must bear the signature of the person or persons duly authorized to sign these documents. Where indicated, if bidder is a corporation, the legal name of the corporation shall first be set forth, together with two

signatures: one from among the chairman of the board, president or vice president and one from among the secretary, chief financial officer, or treasurer. Alternatively, the signature of other authorized officers or agents may be affixed, if duly authorized by the corporation. Such documents shall include the title of such signatories below the signature and shall bear the corporate seal. Where indicated, in the event that the bidder is a joint venture or partnership, there shall be submitted with the bid certifications signed by authorized officers of each of the parties to the joint venture or partnership, naming the individual who shall sign all necessary documents for the joint venture or partnership and, should the joint venture or partnership be the successful bidder, who shall act in all matters relative to the Project for the joint venture or partnership. If bidder is an individual, his/her signature shall be placed on such documents.

5. Modifications. Changes in or additions to any of the bid documents, summary of the work bid upon, alternative proposals, or any other modifications which are not specifically called for by the DISTRICT may result in the DISTRICT'S rejection of the bid as being nonresponsive. No oral, telephonic, facsimile or electronic modification of any of the bid documents will be considered.

6. Erasures, Inconsistent or Illegible Bids. The bid submitted must not contain any erasures, interlineations, or other corrections unless each such correction is authenticated by affixing the initials of the person(s) signing the bid in the margin immediately adjacent to the correction. In the event of inconsistency between words and numbers in the bid, words shall control numbers. In the event that DISTRICT determines that any bid is unintelligible, illegible or ambiguous, the DISTRICT may reject such bid as being nonresponsive.

7. Examination of Site and Project Documents. At its own expense and prior to submitting its bid, each bidder shall examine all documents relating to the Project; visit the site and determine the local conditions which may in any way affect the performance of the work, including the general prevailing rates of per diem wages and other relevant cost factors; familiarize itself with all Federal, State and Local laws, ordinances, rules, regulations and codes affecting the performance of the work, including the cost of permits and licenses required for the work; make such surveys and investigations, including investigation of subsurface or latent physical conditions at the site or where work is to be performed, as it may deem necessary for performance of the work at its bid price ; determine the character, quality, and quantities of the work to be performed and the materials and equipment to be provided; and correlate its observations, investigations, and determinations with all requirements of the Project. The Project Documents show and describe the existing conditions as they are believed to have been used in the design of the work and are only provided as information for the bidder. The DISTRICT is not making any warranties regarding said information. The DISTRICT shall not be liable for any loss sustained by the successful bidder resulting from any variance between the conditions and design data given in the Project Documents and the actual conditions revealed during the bidder's pre-bid examination or during the progress of the work. **Bidder agrees that the submission of a bid shall be incontrovertible evidence that the bidder has complied with all the requirements of this provision of the Information for Bidders.**

8. Withdrawal of Bids. Any bid may be withdrawn, either personally or by written request signed by the bidder, at any time prior to the scheduled closing time for receipt of bids. The bid security for a bid withdrawn prior to the scheduled closing time for receipt of bids, in accordance with this paragraph, shall be returned. No bidder may withdraw any bid for a period of ninety (90) calendar days after the date set for the opening of bids.

9. Agreement and Bonds. The Agreement which the successful bidder will be required to execute and the payment bond required in accordance with Civil Code Section 3247, are included in the Project Documents. The payment bond shall be in the amount not less than one hundred percent (100%) of the amount of the contract in accordance with Civil Code Section 3248. The successful bidder will also be required to furnish a separate faithful performance bond in the amount of one hundred percent (100%) of the contract and in the form included in the Project Documents, which shall remain in full force and effect through the guarantee period as specified in the General Conditions. All bond premiums shall be at bidder's cost.

10. Interpretation of Project Documents. If any bidder is in doubt as to the true meaning of any part of the Project Documents, or finds discrepancies in, or omissions from the Project Documents, a written request for an interpretation or correction thereof must be submitted to the DISTRICT no later than four (4) days before bid deadline. No requests shall be considered after this time. The bidder submitting the written request shall be responsible for its prompt delivery. Any interpretation or correction of the Project Documents will be made solely at DISTRICT's discretion and only by written addendum duly issued by the DISTRICT, and a copy of such addendum will be hand delivered or mailed or faxed to each bidder known to have received a set of the Project Documents. No person is authorized to make any oral interpretation of any provision in the Project Documents, nor shall any oral interpretation of Project Documents be binding on the DISTRICT. If there are discrepancies of any kind in the Project Documents, the interpretation of the DISTRICT shall prevail. SUBMITTAL OF A BID WITHOUT A REQUEST FOR CLARIFICATIONS SHALL BE INCONTROVERTIBLE EVIDENCE THAT THE BIDDER HAS DETERMINED THAT THE PROJECT DOCUMENTS ARE ACCEPTABLE AND SUFFICIENT FOR BIDDING AND COMPLETING THE WORK; THAT BIDDER IS CAPABLE OF READING, FOLLOWING AND COMPLETING THE WORK IN ACCORDANCE WITH THE PROJECT DOCUMENTS; AND THAT BIDDER AGREES THAT THE PROJECT CAN AND WILL BE COMPLETED ACCORDING TO THE DISTRICT's TIMELINES AND ACCORDING TO THE PROGRESS SCHEDULE TO BE SUBMITTED BY THE SUCCESSFUL BIDDER INCORPORATING THE DISTRICT's TIMELINES FOR COMPLETION OF THE PROJECT.

11. Bidders Interested in More Than One Bid. No person, firm or corporation shall be allowed to make, or file, or be interested in more than one bid for the same work unless alternate bids are specifically called for by the DISTRICT. A person, firm, or corporation that has submitted a subproposal to a bidder, or that has quoted prices of materials to a bidder, is not thereby disqualified from submitting a proposal or quoting prices to other bidders or submitting a bid on the Project.

12. Award of Contract. The DISTRICT reserves the right to reject any or all bids, or to waive any irregularities or informalities in any bids or in the bidding process. The award of the contract, if made by the DISTRICT, will be by action of the Governing Board and to the lowest responsive and responsible bidder. If two identical low bids are received from responsive and responsible bidders, the DISTRICT will determine which bid will be accepted pursuant to Public Contract Code Section 20117. In the event an award of the contract is made to a bidder, and such bidder fails or refuses to execute the Agreement and provide the required documents within fifteen (15) working days after the notice of award of the contract to bidder, the DISTRICT may award the contract to the next lowest responsive and responsible bidder or reject all bidders.

13. Alternate Bids. If alternate bids are called for, the DISTRICT will award the contract to the lowest responsive and responsible bidder in a manner that prevents any information that would identify any of the bidders from being revealed to the DISTRICT before the ranking of all bidders from lowest to highest has been determined. If alternate bids are called for, in addition to submitting all bid documents in a sealed envelope as indicated, bidders must submit, in a **separate, plain unmarked,** sealed envelope, the **BID SUMMARY** completed with all the prices and the **BIDDER NUMBER**. Bidders must obtain their bidders numbers at the office of the Construction Manager:

IF APPLICABLE INSERT INFORMATION

Aside from the bidder number, there should be no return address, logo, signature, or other means of identifying the bidder on either the bid summary or the envelope. The bid summaries will be opened and read in public at the time and place specified. The District will use these bid summaries to determine which alternates to accept, if any, and rank all bidders from lowest to highest.

14. Competency of Bidders. In selecting the lowest responsive and responsible bidder, consideration will be given not only to the financial standing but also to the general competency of the bidder for the performance of the Project. By submitting a bid, each bidder agrees that the DISTRICT, in determining the

successful bidder and its eligibility for the award, may consider the bidder's experience and facilities, conduct and performance under other contracts, financial condition, reputation in the industry, and other factors which could affect the bidder's performance of the Project. To this end, each bid shall be supported by a statement of the bidder's experience on the form entitled "INFORMATION REQUIRED OF BIDDER."

The DISTRICT may also consider the qualifications and experience of subcontractors and other persons and organizations (including those who are to furnish the principal items of material and equipment) proposed for those portions of the work. Operating costs, maintenance considerations, performance data and guarantees of materials and equipment may also be considered by the DISTRICT. In this regard, the DISTRICT may conduct such investigations as the DISTRICT deems necessary to assist in the evaluation of any bid and to establish the responsibility, qualifications and financial ability of the bidder, proposed subcontractors, and other persons and organizations to do the work to the DISTRICT's satisfaction within the prescribed time. The DISTRICT reserves the right to reject the bid of any bidder who does not pass any such evaluation to the satisfaction of the DISTRICT.

15. Bidder's Prequalification. Only Bid Proposals submitted by Prequalified Bidders will be considered. A Bid Proposal submitted by a Bidder who is not prequalified will be deemed a non-responsive Bid Proposal and will be rejected by the District. A Bidder who has not completed the Prequalification Application and has not been deemed a "Qualified Bidder" must complete the Prequalification Application and submit the Prequalification Application to the District (via the Construction Manager) by the date and in the manner set forth in the Prequalification Application. The failure to submit a completed Prequalification Application on or prior to such date will render the Bid Proposal of the Bidder untimely submitting a completed Prequalification Application to be non-responsive and rejected. If the District determines that any information provided by a Bidder in the Prequalification Application is false or misleading, or is incomplete so as to be false or misleading, the District may reject the Bid Proposal submitted by such Bidder as being non-responsive.

16. Listing Subcontractors. Each bidder shall submit, on the form furnished with the Project Documents, a list of the proposed subcontractors on this Project as required by the Subletting and Subcontracting Fair Practices Act (Public Contract Code Section 4100, et seq.). If alternate bids are called for and the bidder intends to use different or additional subcontractors, a separate list of subcontractors must be submitted for each such alternate bid. If the bidder fails to specify a subcontractor for any portion of the work in excess of one half (1/2) of one percent (1%) of the bidder's total bid, the bidder agrees that he/she is fully qualified to perform that work and agrees to perform that portion of the work. Violation of this requirement (including the procurement of a subcontractor for the Project if no subcontractor is specified) can result in the DISTRICT invoking the remedies of Public Contract Code Sections 4110 and 4111.

17. Insurance and Workers' Compensation. The successful bidder shall be required to furnish certificates and endorsements evidencing that the required insurance is in effect. DISTRICT may request that such certificates and endorsements are completed on DISTRICT provided forms. In accordance with the provisions of Section 3700 of the Labor Code, the successful bidder shall secure the payment of compensation to all employees. The successful bidder who has been awarded the contract shall sign and file with DISTRICT prior to performing the work, the Workers' Compensation Certificate included as a part of the Project Documents. Labor Code Section 1861.

18. Contractor's License. If, at the time and date of the contract execution, bidder is not properly licensed to perform the Project in accordance with Division 3, Chapter 9, of the Business and Professions Code and the Project Documents, such bid will be rejected as nonresponsive. (Public Contract Code Section 3300) Pursuant to Business and Professions Code Section 7028.15, no payment shall be made for work or materials under the contract unless and until the Registrar of Contractors verifies to the DISTRICT that the bidder was properly licensed at the time the bid was submitted. Any bidder not so licensed is subject to penalties under the law and the contract will be considered void and DISTRICT shall have the right to bring an action against the unlicensed bidder awarded the contract for recovery of all compensation paid under the contract. (Business and Professions Code Section 7031(b)) If the license classification specified hereinafter is that of a "specialty contractor" as defined in Section 7058 of the

Business and Professions Code, the specialty contractor awarded the contract for this work shall construct a majority of the work, in accordance with the provisions of Business and Professions Code Section 7059. The bidder may not use the contractor license of a third party for this bid.

19. Anti-Discrimination. In connection with all work performed under this Project, there shall be no unlawful discrimination against any prospective or active employee engaged in the work because of race, color, ancestry, national origin, religious creed, sex, age, marital status, physical disability, mental disability, or medical condition. The successful bidder agrees to comply with applicable Federal and State laws including, but not limited to, the California Fair Employment and Housing Act, beginning with Government Code Section 12900 and Labor Code Section 1735. In addition, the successful bidder agrees to require like compliance by any subcontractors employed on the Project by such bidder.

20. Hold Harmless and Indemnification. The successful bidder awarded the contract will be required to indemnify and hold harmless the DISTRICT, its Governing Board, officers, agents, and employees as set forth in the Agreement.

21. Substitutions. Should the bidder wish to request any substitution for the materials, process, service, or equipment specified, the bidder shall be required to comply with Article 30 of the General Conditions.

22. Surety Qualifications for Bonds. Bidders shall ensure all surety companies have a minimum rating of "A-VIII," as rated by the current edition of Best's Key Rating Guide, published by A.M. Best Company, Oldwick, New Jersey 08858. Only California admitted surety insurers will be acceptable for the issuance of bonds. (Code of Civil Procedure Section 995.311) DISTRICT shall verify the status of the surety by one of the following ways: (1) printing out information from the website of the California Department of Insurance confirming the surety is an admitted surety insurer and attaching it to the bond, or (2) obtaining a certificate from the county clerk for the county in which the DISTRICT is located that confirms the surety is an admitted surety insurer and attaching it to the bond. Any admitted surety insurer who cannot satisfy the minimum rating specified above, but who satisfies the following requirements set forth in Code of Civil Procedure Section 995.660 shall be accepted and approved for the issuance of bonds:

(a) There must be on file in the office of the county clerk, for the county in which the DISTRICT is located, an unrevoked appointment, power of attorney, bylaws, or other instrument, duly certified by the proper authority and attested by the seal of the insurer authorizing the person who executed the bond to do so for and on behalf of the insurer within ten (10) calendar days of the insurer's receipt of a request to submit such document from the DISTRICT, and an original or certified copy of the document must be submitted to the DISTRICT.

(b) A certified copy of the certificate of authority of the insurer issued by the Insurance Commissioner must be submitted to the DISTRICT within ten (10) calendar days of the insurer's receipt of a request to submit such document from the DISTRICT.

(c) A certificate from the clerk of the county that the certificate of authority of the insurer has not been surrendered, revoked, cancelled, annulled, or suspended, and in the event it has, whether renewed authority has been granted must be submitted to DISTRICT within ten (10) calendar days of the insurer's receipt of a request to submit such document from the DISTRICT.

(d) Copies of the insurer's most recent annual statement and quarterly statement filed with the California Department of Insurance must be submitted to the DISTRICT within ten (10) calendar days of the insurer's receipt of a request to submit the statements.

23. Liquidated Damages. All work must be completed within the time limits set forth in the Project Documents. It is agreed that damages for the failure to complete the Project described herein within the time limits required are impossible to ascertain. Should the work not be completed within the specified time for completion, the successful bidder awarded the contract shall be liable for liquidated damages, payable to the DISTRICT, in an

amount of Two Thousand_Dollars ($2,000 .00) for each consecutive calendar day of delay in completion. Such damages shall be deducted from any payments due or to become due to the successful bidder. Government Code Section 53069.85, Civil Code Section 1671.

24. Drug-Free Workplace Certification. Pursuant to Government Code Sections 8350, et seq., the successful bidder will be required to execute a Drug-Free Workplace Certification upon execution of the Agreement. The bidder will be required to take positive measures outlined in the certification in order to ensure the presence of a drug-free workplace. Failure to abide with the conditions set forth in the Drug-Free Workplace Act could result in penalties including termination of the Agreement or suspension of payment thereunder.

25. Noncollusion Affidavit. In accordance with the provisions of Section 7106 of the Public Contract Code, each bid must be accompanied by a noncollusion affidavit properly notarized.

26. Escrow Agreement. Public Contract Code Section 22300 permits the substitution of securities for any monies withheld by a public agency to ensure performance under a contract. At the request and expense of the successful bidder awarded the contract, securities equivalent to the amount withheld as retention shall be deposited with the DISTRICT, or with a state or federally chartered bank in California as the escrow agent, who shall then pay such monies to the successful bidder. The DISTRICT retains the sole discretion to approve the bank selected by the successful bidder to serve as escrow agent. Upon satisfactory completion of the contract, the securities shall be returned to the successful bidder. Securities eligible for investment shall include those listed in Government Code Section 16430 or bank or savings and loan certificates of deposit. The successful bidder shall be the beneficial owner of any securities substituted for monies withheld and shall receive any interest thereon.

In the alternative, under Section 22300, the successful bidder may request DISTRICT to make payment of earned retentions directly to the escrow agent at the expense of the successful bidder. Also at the successful bidder's expense, the successful bidder may direct investment of the payments into securities, and the successful bidder shall receive interest earned on such investment upon the same conditions as provided for securities deposited by successful bidder. Upon satisfactory completion of the contract, successful bidder shall receive from the escrow agent all securities, interest and payments received by escrow agent from DISTRICT pursuant to the terms of Section 22300.

The successful bidder who elects to receive interest on monies withheld in retention by the DISTRICT shall, at the request of any subcontractor performing more than five percent (5%) of the successful bidder's total bid, make that option available to the subcontractor regarding any monies withheld in retention by the successful bidder from the subcontractor. If the successful bidder elects to receive interest on any monies withheld in retention by the DISTRICT, then the subcontractor shall receive the identical rate of interest received by the successful bidder on any retention monies withheld from the subcontractor by the successful bidder, less any actual pro rata costs associated with administering and calculating that interest. In the event that the interest rate is a fluctuating rate, the rate for the subcontractor shall be determined by calculating the interest rate paid during the time that retentions were withheld from the subcontractor. If the successful bidder elects to substitute securities in lieu of retention, then, by mutual consent of the successful bidder and subcontractor, the subcontractor may substitute securities in exchange for the release of monies held in retention by the successful bidder. Public Contract Code Section 22300(d)(1).

The successful bidder wishing to utilize Public Contract Code Section 22300 and enter into an Escrow Agreement shall complete and execute the form Escrow Agreement included in the Project Documents and submit it to the DISTRICT.

27. Change Orders. All change order requests must be submitted in the form set forth in the Project Documents and pursuant to Article 60 of the General Conditions. The amount of allowable charges submitted pursuant to a change order shall be limited to the charges allowed under Article 60 of the General Conditions. Indirect, consequential and incidental costs, project management costs, extended home office and field office

overhead, administrative costs and profit and other charges not specifically authorized under Article 60 of the General Conditions will not be allowed.

28. Tobacco-Free Policy. The successful bidder shall agree to enforce a tobacco-free work site.

29. Lead. Pursuant to the Lead-Safe Schools Protection Act (Education Code Sections 32240, et seq.) and other applicable law, the successful bidder shall not use lead-based paint, lead plumbing and solders, or other potential sources of lead contamination in the construction of any new school facility or the modernization or renovation of any existing school facility.

30. The number of executed copies of the Agreement, the Faithful Performance Bond, and the Payment Bond required is THREE (3).

BID FORM

Name of Bidder: _____

To: South Orange County Community College District, acting by and through its Governing Board, herein called the "DISTRICT."

1. The undersigned Bidder, having become familiarized with all the following documents including but not limited to the Notice Calling for Bids, Information for Bidders, Bid Form, Bid Security, Designation of Subcontractors Form, Information Required of Bidder, all prequalification forms pursuant to Public Contract Code Section 20111.5, if any, Noncollusion Affidavit, Workers' Compensation Certificate, Faithful Performance Bond, Payment Bond, Agreement, Escrow Agreement, Drug-Free Workplace Certification, Criminal Records Check Certification, Change Order Forms, Shop Drawing Transmittal Form, all insurance requirements, Guarantee forms, Contractor's Certificate Regarding Non-Asbestos Containing Materials, Disabled Veteran Business Enterprises Certification, if applicable, General Conditions and Supplemental Conditions, if any, Special Conditions, if any, drawings, specifications, and all modifications, addenda and amendments, if any (hereinafter Project Documents), the local conditions affecting the performance of the work and the cost of the work at the place where the work is to be done, hereby proposes and agrees to be bound by all the terms and conditions of the Project Documents and agrees to perform, within the time stipulated, the work, including all of its component parts, and everything required to be performed, and to provide and furnish and pay for any and all of the labor, materials, tools, expendable equipment, and all applicable taxes, utility and transportation services necessary to perform the work and complete in a good workmanlike manner all of the work required in accordance with laws, codes, regulations, ordinances and any other legal requirements governing the work, in connection with the following:

Project: James B. Utt Memorial Library Learning Resource Center Renovation at Saddleback College
Project No.: Bid No. #1094

all in strict conformity with the Project Documents, including Addenda Nos. ____, ____, _____ and _____, on file at the office of the Director of Facilities Planning and Purchasing of said DISTRICT for the following sums:

Handwritten	*Numeric*
BASE BID FOR LCRC BUILDING @ SADDLEBACK COLLEGE $_____/100	$_____
ALLOWANCE: *Refer to Supplemental Conditions* $ Two Hundred Fifty Thousand and no/100_____	$ 250,000.00
BID TOTAL (INCLUDING ALLOWANCE)	$_____

Each individual bid term shall be determined from visiting the work site, reviewing the drawings and specifications and all portions of the Project Documents, and shall include all items necessary to complete the work, including the assumption of all obligations, duties, and responsibilities necessary to the successful completion of the Project, and the furnishing of all materials and equipment required to be incorporated in and form a permanent part of the work, and the furnishing of tools, equipment, supplies, transportation, facilities, labor, superintendence, and services required to perform and complete the work, all as per the requirements of the Project Documents, whether or not expressly listed or designated.

2. It is understood that the DISTRICT reserves the right to reject any or all bids or to waive any irregularities or informalities in any bids or in the bidding process. Bidder agrees that this bid shall remain open and not be withdrawn for the period specified in the Information for Bidders.

3. The required bid security is attached.

4. The required list(s) of proposed subcontractors is attached hereto, and the undersigned represents and warrants that such list(s) is complete and in compliance with the Subletting and Subcontracting Fair Practices Act. Public Contract Code Sections 4100, et seq.

5. It is understood and agreed that if written notice of the award of a contract is mailed, faxed, or delivered to the bidder, the bidder will execute and deliver to the DISTRICT the Agreement and will also furnish and deliver to the DISTRICT the Faithful Performance Bond and a separate Payment Bond as specified, and certificates and endorsements of insurance, the Workers' Compensation Certificate, Drug-Free Work Place Certification, the Criminal Records Check Certification, Contractor's Certificate Regarding Non-Asbestos Containing Materials, and the Disabled Veteran Business Enterprises Certification, if applicable, within 10 working days of the notice of award of the contract, or as otherwise requested in writing by the DISTRICT. It is understood that should bidder fail or refuse to return these documents as required by the DISTRICT, the bid security shall be forfeited to the DISTRICT. The bidder further agrees that the work shall be commenced by the bidder, if awarded the contract, on or before the fifth day after receiving the DISTRICT's Notice to Proceed, and shall be completed by the bidder in the time specified by the DISTRICT.

6. Communications conveying notice of award of the contract, requests for additional information or other correspondence should be addressed to the bidder at the address stated below.

7. The name(s) of all persons interested in the bid as principals are as follows:

_____

_____

_____

8. In submitting this bid, the bidder offers and agrees that if the bid is accepted, it will assign to DISTRICT all rights, title and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Section 15) or under the Cartwright Act (Business & Professions Code Section 16700, et seq.) arising from purchases of goods, materials, or services by the bidder for sale to the DISTRICT pursuant to the bid. Such assignment shall be made and become effective at the time the DISTRICT tenders final payment under the contract. (Public Contract Code Section 7103.5; Government Code Section 4450, 4451 and 4552).

9. The undersigned hereby warrants that the bidder has an appropriate license, License No. _____, Class B, at the time of the bid opening, that such license entitles bidder to provide the work, that such license will be in full force and effect throughout the duration of performance of this Project. Bidder shall be nonresponsive if the Bidder is not licensed as required by the DISTRICT at the time of the bid opening. Any and all subcontractors to be employed by the undersigned shall have appropriate licenses at the time of the bid opening.

10. The bidder hereby certifies that it is, and at all times during the performance of work hereunder shall be, in full compliance with the provisions of the Immigration Reform and Control Act of 1986 ("IRCA") in the hiring of its employees, and the bidder shall indemnify, hold harmless and defend the DISTRICT against any and all actions, proceedings, penalties or claims arising out of the bidder's failure to comply strictly with the IRCA.

11. It is understood and agreed that if requested by the DISTRICT, the bidder shall furnish a notarized financial statement, references, and other information required by the DISTRICT sufficiently comprehensive to permit an appraisal of bidder's ability to perform the Project.

12. The undersigned hereby warrants that all work, except work of a maintenance period, shall be completed within 387 consecutive calendar days for the Main Building, Site Work, and "SA" Building, plus an additional 47 consecutive calendar days (phased) for work involved with the "CC Building" from the date specified on the Notice to Proceed issued by the District. Time is of the essence. The undersigned agrees that failure to complete the work within the time set forth herein will result in the imposition of liquidated damages for each consecutive calendar day of delay in the amount of Two Thousand Dollars ($2,000.00). (Government Code Section 53069.85)

13. The required non-collusion affidavit properly notarized is attached as required by Public Contract Code Section 7106. Bidder understands and agrees that failure to submit a completed and signed affidavit will render the bidder automatically nonresponsive.

14. It is understood and agreed that all change order requests must be submitted in the form set forth in the Project Documents and pursuant to Article 60 of the General Conditions. The amount of allowable charges submitted pursuant to a change order shall be limited to the charges allowed under Article 60 of the General Conditions. Indirect, consequential and incidental costs, project management costs, extended home office and field office overhead, administrative costs and profit and other charges not specifically authorized under Article 60 of the General Conditions will not be allowed.

15. The Information Required of Bidder form has been fully completed and is attached hereto.

The undersigned hereby declares that all of the representations of this bid are made under penalty of perjury under the laws of the State of California.

Individual

Name: _____

Signed by: _____

Print Name: _____

Date: _____

Business Address: _____

_____

Telephone: _____

****

Partnership

Name: _____

Signed by: _____

Print Name: _____

Date: _____

Business Address: _____

_____

Telephone: _____

****

Corporation

Name: _____

(a _____ Corporation[1])

_____

[1] A corporation awarded the contract shall furnish evidence of its corporate existence and evidence that the officer signing the Agreement and bonds is duly authorized to do so.

Business Address: _____

_____

Telephone:_____

Signed by:_____, President, Date: _____

Print Name:_____ President

Signed by:_____, Secretary, Date: _____

Print Name:_____, Secretary

[Seal]

Joint Venturer

Name: _____

Signed by: _____, Joint Venturer

Print Name: _____

Date: _____

Business Address _____

_____

Telephone: _____

Other Parties to Joint Venture: ***If an individual***: _____

(Name)

Signed by: _____

Print Name: _____

Date: _____

Doing Business as: _____

Business Address: _____

_____

Telephone: _____

If a Partnership:_____

(Name)

Signed by:_____, Partner

Print Name: _____

Date: _____

Business Address_____

_____

Telephone: _____

If a Corporation: _____

(a_____ Corporation)

Signed By:_____ Date: _____

Print Name:_____

Title: _____

Date: _____

Business Address:_____

_____

Telephone: _____

Bid Bond No.: _____

BID BOND

KNOW ALL PERSONS BY THESE PRESENT, that we_____
_____,

as Principal, and _____as Surety, a California admitted surety insurer, are held and firmly bound unto the ___South Orange County Community College District, hereinafter called the DISTRICT, in the sum of _____ PERCENT (____%) OF THE TOTAL AMOUNT OF THE BID of the Principal submitted to the said DISTRICT for the work described below for the payment of which sum in lawful money of the United States, well and truly to be made, we jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of this obligation is such that whereas the Principal has submitted the accompanying bid dated _____, 200_, for _____
_____
_____
_____
_____.

NOW, THEREFORE, if the Principal shall not withdraw said bid within the period specified therein after the opening of the same, or, if no period be specified, within sixty (60) days after said opening; and if the Principal is awarded the contract, and shall within the period specified therefore, or, if no period be specified, within 10 working days after the notice of award of the contract, or as otherwise requested in writing by the DISTRICT, enter into a written contract with the DISTRICT, in accordance with the bid as accepted and give bonds with good and sufficient surety or sureties, as may be required for the faithful performance and proper fulfillment of such contract and for the payment for labor and materials used for the performance of the contract, furnish certificates and endorsements evidencing the required insurance is in effect and furnish and deliver to the DISTRICT the Workers' Compensation Certificate, Drug-Free Work Place Certification, the Criminal Records Check Certification, Contractor's Certificate Regarding Non-Asbestos Containing Materials, and the Disabled Veteran Business Enterprises Certification, if applicable, then the above obligation shall be void and of no effect, otherwise the bond amount shall be forfeited to the DISTRICT.

Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or the call for bids, or to the work to be performed thereunder, or the specifications accompanying the same, shall in any way affect its obligation under this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of said contract or the call for bids, or to the work, or to the specifications.

In the event suit is brought upon this bond by the DISTRICT and judgment is recovered, the Surety shall pay all costs incurred by the DISTRICT in such suit, including reasonable attorney's fees to be fixed by the court.

IN WITNESS HEREOF, the parties have executed this bond under their several seals this __ day of ____, 200__, the name and corporate seal of each corporate party being hereto affixed and duly signed by its undersigned authorized representative.

(Corporate Seal of
Principal, if
Corporation)

_____
Principal (Proper Name of Bidder)

By:_____
Signature

_____
Print Name

_____
Title

(Corporate Seal
of Surety)

_____
Surety

(Attach Attorney-in-Fact Certificate
and Required Acknowledgements)

By: _____
Signature

_____
Print Name

_____
Title

_____
Address

_____
Telephone No.

_____
Facsimile No.

DESIGNATION OF SUBCONTRACTORS

In compliance with the Subletting and Subcontracting Fair Practices Act (Public Contract Code Section 4100 et. seq.) and any amendments thereof, each bidder shall set forth below: (a) the name and the location of the place of business of each subcontractor who will perform work or labor or render service to the bidder (prime contractor) in or about the construction of the work or improvement to be performed under this contract or a subcontractor licensed by the State of California who, under subcontract to the bidder (prime contractor), specially fabricates and installs a portion of the work or improvement according to detailed drawings contained in the plans and specifications in an amount in excess of one-half of one percent of the bidder's (prime contractor's) total bid and (b) the portion of the work which will be done by each subcontractor. The bidder (prime contractor) shall list only one subcontractor for each such portion as is defined by the bidder (prime contractor) in this bid.

If a bidder (prime contractor) fails to specify a subcontractor or if a bidder (prime contractor) specifies more than one subcontractor for the same portion of work to be performed under the contract in excess of one-half of one percent of the bidder's (prime contractor's) total bid, bidder shall be deemed to have agreed that bidder is fully qualified to perform that portion, and that bidder alone shall perform that portion. Violation of this requirement (including the procurement of a subcontractor for the Project if no subcontractor is specified) can result in the DISTRICT invoking the remedies of Public Contract Code Sections 4110 and 4111.

No bidder (prime contractor) whose bid is accepted shall (a) substitute any subcontractor, (b) permit any subcontractor to be voluntarily assigned or transferred or allow it to be performed by anyone other than the original subcontractor listed in the original bid, or (c) sublet or subcontract any portion of the work in excess of one-half of one percent of the bidder's (prime contractor's) total bid as to which the original bid did not designate a subcontractor, except as authorized in the Subletting and Subcontracting Fair Practices Act. Subletting or subcontracting of any portion of the work in excess of one-half of one percent of the bidder's (prime contractor's) total bid as to which no subcontractor was designated in the original bid shall only be permitted in cases of public emergency or necessity, only after a finding reduced to writing as a public record of the DISTRICT awarding this contract setting forth the facts constituting the emergency or necessity.

James B. Utt Memorial Library Learning Resource Center Renovation at Saddleback College
Project No.: Bid No. #1094

Type of Trade, Labor or Service	Name & License # of Subcontractor, License Expiration Date (Indicate if a Disabled Veteran Business Enterprise)	Complete Address (Name of City is not sufficient) and Telephone No.

Bidder agrees that within twenty-four (24) hours of the bid opening, Bidder shall provide the DISTRICT with the license number (if applicable), expiration date of license, complete address and telephone numbers of each listed subcontractor if such information is not available at the time of the bid opening.

Dated:_____

_____
Name of Bidder

By:_____
(Signature of Bidder)

Print Name: _____

Address_____

_____

_____

Telephone: _____

FAX:_____

INFORMATION REQUIRED OF BIDDER

The Bidder shall furnish all the following information. Bidder shall carefully read and answer all questions to ensure completeness and accuracy. Failure to comply with this requirement may cause rejection of the bid. Additional sheets may be attached if necessary. "You" or "your" as used herein refers to the bidder and any of its owners, officers, directors, shareholders, principals, responsible managing officer (RMO) or responsible managing employee (RME). DISTRICT has discretion to request additional information depending on the Project.

(1) Bidder name and address (Post Office Box Number not sufficient):

_____

_____

_____

_____

(2) Telephone:_____ Fax No.: _____

Electronic Mail: _____

(3) Individual _____ Partnership _____ Corporation _____ Joint Venture _____ (check one)

(4) Bidder's License No. _____

Name of License holder _____

(5) Have you ever been licensed under a different name or different license number?

Yes ____ No ____ If "Yes," give name and license number.

_____

_____

(6) Names and titles of all your owners, officers, principals, responsible managing officers and responsible managing employees:

Name	Title
_____	_____
_____	_____
_____	_____
_____	_____

(7) Number of years as a contractor in this type of construction work:_____

(8) Person who inspected work site:

Name and Title_____

Date of Inspection:_____

(9) How many years experience have you had in school construction work?

(a) as a general contractor? _____

(b) as a subcontractor? _____

(10) How many years experience have you had in public construction work?

(a) as a general contractor? _____

(b) as a subcontractor? _____

(11) Have you ever been terminated from a school or any public construction project prior to the completion of the project? Yes _____ No _____ If the answer is "Yes," give dates, names and addresses of school/public agency and details.

_____

_____

_____

(12) Have you ever been barred from bidding on any school or public construction project? Yes ____ No ____ If the answer is "Yes," give dates, names and addresses of school/public agency and details.

_____

_____

_____

(13) Have you ever defaulted on any school or public construction project that resulted in a claim to a surety? Yes ____ No _____ If the answer is "Yes," give dates, names and addresses of school/public agency and details.

_____

_____

_____

(14) Have you been assessed damages (i.e., liquidated damages) for any public construction project in the past ten (10) years? Yes _____ No_____ If the answer is "Yes," give dates, names, and addresses of public agency and details.

_____

_____

(15) Have you ever brought any claim(s) against a public agency? Yes ____ No ___ If the answer is "Yes," please explain in detail name of public agency, nature of the claim and outcome.

(16) Have you ever failed to complete a school or public construction project in the last ten (10) years? Yes _____ No _____ If the answer is "Yes," provide name of public agency and details

(17) Have you been in litigation or arbitration or dispute of any kind on a question or questions relating to a public construction project during the past ten (10) years? Yes No ___ If the answer is "Yes," provide name of public agency and details.

(18) List the names, addresses and telephone numbers of three Architects or Engineers whose jobs you have worked on in the past five (5) years.

Name	Address	Telephone

(19) Do you now or have you ever had any direct or indirect business, financial or other connection with any officer, employee or consultant of the DISTRICT or Architect?

Yes _____ No _____ If so, please elaborate.

(20) List at least five (5) of your most recent school construction projects.

(1)_____

(2)_____

(3)_____

(4)_____

(5)_____

(21) Are you currently under contract for another project? Yes _____ No _____ If the answer is "Yes," please provide the following information:

(a) Project Number 1:

Name of Project: _____

Detailed Description:_____

_____

Name of Project Owner:_____

Contract Amount: _____

Completion Date:_____

(b) Project Number 2:

Name of Project: _____

Detailed Description:_____

_____

Name of Project Owner:_____

Contract Amount: _____

Completion Date:_____

(c) Project Number 3:

Name of Project: _____

Detailed Description:_____

_____

Name of Project Owner:_____

Contract Amount: _____

Completion Date:_____

(d) Project Number 4:

Name of Project: _____

Detailed Description:_____

_____

Name of Project Owner:_____

Contract Amount: _____

Completion Date:_____

(e) Project Number 5:

Name of Project: _____

Detailed Description:_____

_____

Name of Project Owner:_____

Contract Amount: _____

Completion Date:_____

(22) Are there projects not listed above that will be undertaken during the duration of DISTRICT's Project?

Yes _____ No _____ If the answer is "Yes," please provide the following information:

(a) Project Number 1:

Name of Project: _____

Detailed Description:_____

_____

Name of Project Owner:_____

Contract Amount: _____

Completion Date: _____

(b) Project Number 2:

Name of Project: _____

Detailed Description: _____

_____

Name of Project Owner: _____

Contract Amount: _____

Completion Date: _____

(c) Project Number 3:

Name of Project: _____

Detailed Description: _____

_____

Name of Project Owner: _____

Contract Amount: _____

Completion Date: _____

(d) Project Number 4:

Name of Project: _____

Detailed Description: _____

_____

Name of Project Owner: _____

Contract Amount: _____

Completion Date: _____

(e) Project Number 5:

Name of Project: _____

Detailed Description:_____

_____

Name of Project Owner:_____

Contract Amount: _____

Completion Date:_____

(23) Additional information required:_____

_____

_____

_____

(24) List of References - Public construction projects of similar nature in a school/community college/university within the last five (5) years. DISTRICT has discretion to require more than five (5) references.

1. Name:_____

Address and Telephone: _____

_____

Contact Person: _____

Description of Project: _____

Dates of commencement and completion of Project: _____

_____

Contract Amount: _____

Architect: _____

Architect's Address and Telephone: _____

_____

DSA or public agency inspector: _____

Address and Telephone:_____

_____

2. Name:_____

Address and Telephone: _____

_____

Contact Person: _____

Description of Project: _____

Dates of commencement and completion of Project: _____

_____

Contract Amount: _____

Architect: _____

Architect's Address and Telephone: _____

_____

DSA or public agency inspector: _____

Address and Telephone: _____

_____

3. Name: _____

Address and Telephone: _____

_____

Contact Person: _____

Description of Project: _____

Dates of commencement and completion of Project: _____

_____

Contract Amount: _____

Architect: _____

Architect's Address and Telephone: _____

_____

DSA or public agency inspector: _____

Address and Telephone: _____

_____

4. Name: _____

Address and Telephone: _____

_____

Contact Person: _____

Description of Project: _____

Dates of commencement and completion of Project: _____

_____

Contract Amount: _____

Architect: _____

Architect's Address and Telephone: _____

_____

DSA or public agency inspector: _____

Address and Telephone: _____

_____

5. Name: _____

Address and Telephone: _____

_____

Contact Person: _____

Description of Project: _____

Dates of commencement and completion of Project: _____

_____

Contract Amount: _____

Architect: _____

Architect's Address and Telephone: _____

_____

DSA or public agency inspector: _____

Address and Telephone: _____

_____

I certify and declare under penalty of perjury under the laws of the State of California that the foregoing responses to the Information Required of Bidder are true and correct.

_____

Signature

_____

Print Name

_____

Title

_____

Date

Note: DISTRICT may wish to expand the scope of the "Information Required of Bidder" form and include additional questions.

NONCOLLUSION AFFIDAVIT

(Public Contract Code Section 7106)

State of California)

) ss.

County of_____)

_____)

_____, being first duly sworn, deposes and says that he or she is _____ _____of_____, the party making the foregoing bid, that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

_____

Signature of Bidder

NOTARY FOR NONCOLLUSION AFFIDAVIT

Subscribed and sworn to (or affirmed) before me this _____ day of_____, 20____.

_____

Signature of Notary

[SEAL OF NOTARY]

_____

Typed Name of Notary

WORKERS' COMPENSATION CERTIFICATE

Labor Code Section 3700.

"Every employer except the state shall secure the payment of compensation in one or more of the following ways:

(a) By being insured against liability to pay compensation in one or more insurers duly authorized to write compensation insurance in this state.

(b) By securing from the Director of Industrial Relations a certificate of consent to self-insure either as an individual employer or as one employer in a group of employers, which may be given upon furnishing proof satisfactory to the Director of Industrial Relations of ability to self-insure and to pay any compensation that may become due to his or her employees.

(c) For any county, city, city and county, municipal corporation, public district, public agency or any political subdivision of the state, including each member of a pooling arrangement under a joint exercise of powers agreement (but not the state itself), by securing from the Director of Industrial Relations a certificate of consent to self-insure against workers' compensation claims, which certificate may be given upon furnishing proof satisfactory to the director of ability to administer workers' compensation claims properly, and to pay workers' compensation claims that may become due to its employees. On or before March 31, 1979, a political subdivision of the state which, on December 31, 1978, was uninsured for its liability to pay compensation, shall file a properly completed and executed application for a certificate of consent to self-insure against workers' compensation claims. The certificate shall be issued and be subject to the provisions of Section 3702."

I am aware of the provisions of Labor Code Section 3700 which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this contract.

_____
Name of the Contractor

By: _____
Signature

_____
Print Name

_____
Title

_____
Date

(In accordance with Article 5 [commencing at Section 1860], Chapter 1, Part 7, Division 2 of the Labor Code, the above certificate must be signed and filed with the awarding body prior to performing any work under the contract.)

FAITHFUL PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENT:

WHEREAS, the SOUTH ORANGE COUNTY COMMUNITY COLLEGE DISTRICT of Orange County, California (hereinafter referred to as "DISTRICT"), awarded _____

(hereinafter referred to as the "Contractor/Principal") the contract for the work described as

_____

_____

_____

_____;

WHEREAS, said Contractor/Principal is required under the terms of said contract to furnish a bond for the faithful performance of said contract which contract is incorporated herein by reference;

NOW, THEREFORE, we the undersigned Contractor, as Principal, and Surety, a California admitted surety insurer are held and firmly bound to the DISTRICT for one hundred percent (100%) of the total amount payable by the DISTRICT under the terms of the contract awarded by the DISTRICT to the Contractor/Principal, lawful money of the United States of America, for payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT, if the hereby bonded Contractor/Principal, its heirs, executors, administrators, successors, or assigns, shall in all things stand to and abide by and well and truly keep and perform all the undertakings, terms, covenants, conditions, and agreements in the said contract which is attached hereto and incorporated herein by reference and any alteration and/or amendments thereof, made as therein provided, including, but not limited to, the provisions regarding contract duration and liquidated damages, all within the time and in the manner therein designated in all respects according to their true intent and meaning, then this obligation shall become null and void; otherwise, it shall be and remain in full force and effect.

As a condition precedent to the satisfactory completion of the contract, the above obligation shall hold good for a period of One (1) year(s) after the acceptance of the work by DISTRICT, during which time if Contractor/Principal shall fail to make full, complete, and satisfactory repair and replacements and totally protect the DISTRICT from loss or damage made evident during the period of One (1) year(s) from the date of completion of the work, and resulting from or caused by defective materials or faulty workmanship, the above obligation in penal sum thereof shall remain in full force and effect. The obligation of Surety hereunder shall continue so long as any obligation of Contractor remains.

Whenever Contractor/Principal shall be, and is declared by the DISTRICT to be, in default under the contract, the DISTRICT having performed the DISTRICT's obligations thereunder, the Surety shall promptly remedy the default, or shall promptly:

1. Complete the contract in accordance with its terms and conditions; or

2. Obtain a bid or bids for completing the contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsive and responsible bidder, arrange for a contract between such bidder and the DISTRICT, and make available as work progresses sufficient funds to pay the cost of completion less the balance of the contract price, but not exceeding, including other costs

and damages for which Surety may be liable hereunder, the amount set forth above The term "balance of the contract price" as used in this paragraph shall mean the total amount payable to Contractor/Principal by the DISTRICT under the contract and any modifications thereto, less the amount previously properly paid by the DISTRICT to the Contractor/Principal.

Surety expressly agrees that the DISTRICT may reject any contractor or subcontractor which may be proposed by Surety in fulfillment of its obligations in the event of default by the Principal. Surety shall not utilize Contractor/Principal in completing the contract nor shall Surety accept a bid from Contractor/Principal for completion of the work if the DISTRICT, when declaring the Contractor/Principal in default, notifies Surety of the DISTRICT's objection to Contractor's/Principal's further participation in the completion of the work.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the DISTRICT named herein or the successors or assigns of the DISTRICT. Any suit under this bond must be instituted within the applicable statute of limitations period.

FURTHER, the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or modification of the Project documents, or of the work to be performed thereunder, shall in any way affect its obligations on this bond; and it does hereby waive notice of any change, extension of time, alteration or modification of the Project documents or of work to be performed thereunder.

Contractor/Principal and Surety agree that if the DISTRICT is required to engage the services of an attorney in connection with the enforcement of this bond, each shall pay DISTRICT's reasonable attorney's fees and costs incurred, with or without suit, in addition to the above amount.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this _____ day of

_____, 20____.

CORPORATE SEAL, IF APPLICABLE, AND NOTARIAL ACKNOWLEDGEMENT OF CONTRACTOR

_____
Contractor/Principal

By: _____
Signature

_____
Print Name and Title

SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY

_____
Surety

By: _____
Signature

_____
Print Name and Title

(Mailing Address, Telephone No. and Facsimile No. of Surety)

_____

_____

_____

(Attach Attorney-in-Fact Certificate and Required Acknowledgement)

PAYMENT BOND

KNOW ALL PERSONS BY THESE PRESENT:

WHEREAS, the SOUTH ORANGE COUNTY COMMUNITY COLLEGE DISTRICT of Orange County, California ("hereinafter referred to as DISTRICT"), has awarded to _____, hereinafter referred to as the "Contractor/Principal" a contract for the work described as

_____

_____

_____;

WHEREAS, said Contractor/Principal is required by Division 3, Part IV, Title XV, Chapter 7 (commencing at Section 3247) of the California Civil Code to furnish a bond in connection with said contract;

NOW, THEREFORE, we, the Contractor/Principal and_____, as Surety, a California admitted surety insurer, are held firmly bound unto the DISTRICT for one hundred percent (100%) of the total amount payable by the DISTRICT under the terms of the contract awarded by the DISTRICT to the Contractor/Principal lawful money of the United States of America for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that if said Contractor/Principal, his/her or its heirs, executors, administrators, successors, or assigns, or a subcontractor, shall fail to pay any person or persons named in Civil Code Section 3181 or fail to pay for any materials, or other supplies, used in, upon, for, or about the performance of the work contracted to be done, or for any work or labor thereon of any kind, or for amounts due under the Unemployment Insurance Code, with respect to work or labor thereon of any kind, or shall fail to deduct, withhold, and pay over to the Employment Development Department, any amounts required to be deducted, withheld, and paid over by Section 13020 of the Unemployment Insurance Code with respect to work and labor thereon of any kind, then said Surety will pay for the same, in or to an amount not exceeding the amount hereinabove set forth, and also will pay in case suit is brought upon this bond, such reasonable attorney's fees as shall be fixed by the court, awarded and taxed as provided in Division 3, Part IV, Title XV, Chapter 7 (commencing at Section 3247) of the California Civil Code.

This bond shall inure to the benefit of any of the persons named in Section 3181 of the California Civil Code, so as to give a right of action to such person or their assigns in any suit brought upon this bond.

It is further stipulated and agreed that the Surety of this bond shall not be exonerated or released from the obligation of the bond by any change, extension of time for performance, addition, alteration or modification in, to, or of any contract, plans, specifications, or agreement pertaining or relating to any scheme or work of improvement hereinabove described or pertaining or relating to the furnishing of labor, materials, or equipment therefore, nor by any change or modification of any terms of payment or extension of the time for any payment pertaining or relating to any scheme or work of improvement hereinabove described, nor by any rescission or attempted rescission of the contract, agreement or bond, nor by any conditions precedent or subsequent in the bond attempting to limit the right of recovery of claimants otherwise entitled to recover under any such contract or agreement or under the bond, nor by any fraud practiced by any person other than the claimant seeking to recover on the bond and that this bond be construed most strongly against the Surety and in favor of all persons for whose benefit such bond is given, and

under no circumstances shall Surety be released from liability to those for whose benefit such bond has been given, by reason of any breach of contract between the DISTRICT and original contractor or on the part of any obligee named in such bond, but the sole conditions of recovery shall be that claimant is a person described in Section 3110 and 3112 of the California Civil Code, and has not been paid the full amount of his/her or its claim and that Surety does hereby waive notice of any such change, extension of time, addition, alteration or modification herein mentioned.

Any claims under this bond may be addressed to:

_____ (Name and address of Surety)

_____ (Name and address of agent or representative in California, if different from above)

_____

_____ (Telephone and facsimile number of Surety or agent or representative in California)

_____

IN WITNESS HEREOF, we have hereto set our hands and seals on this _____ day of_____, 20 _____.

CORPORATE SEAL, IF APPLICABLE, AND NOTARIAL ACKNOWLEDGEMENT OF CONTRACTOR

_____
Contractor/Principal

By: _____
Signature

_____
Print Name and Title

SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY

_____
Surety

By:_____
Signature

_____
Print Name and Title

(Mailing Address, Telephone and Facsimile No. of Surety)

_____

_____

_____

(Attach Attorney-in-Fact Certificate and Required Acknowledgement)

AGREEMENT

THIS AGREEMENT, dated the _____day of_____, 20___, in the County of Orange, State of California, is by and between South Orange County Community College District, (hereinafter referred to as "DISTRICT"), and_____, (hereinafter referred to as "CONTRACTOR").

The DISTRICT and the CONTRACTOR, for the consideration stated herein, agree as follows:

1. CONTRACTOR agrees to complete the Project known as _____ _____according to all the terms and conditions set forth in the Project Documents, including but not limited to the Notice Calling For Bids, Information for Bidders, Bid Form, Bid Security, Designation of Subcontractors, Information Required of Bidder, all prequalification forms submitted pursuant to Public Contract Code Section 20111.5, if any, Non-collusion Affidavit, Workers' Compensation Certificate, Faithful Performance Bond, Payment Bond, Escrow Agreement, if applicable, Drug-Free Workplace Certification, Change Orders, Shop Drawing Transmittals, Insurance Certificates and Endorsements, Guarantees, Contractor's Certificate Regarding Non-Asbestos Containing Materials, Disabled Veteran Business Enterprises Certification, if applicable, General Conditions, Supplemental Conditions, if any, Special Conditions, if any, Drawings, Specifications, and all modifications, addenda and amendments thereto by this reference incorporated herein. The Project Documents are complementary, and what is called for by any one shall be as binding as if called for by all.

2. CONTRACTOR shall perform within the time set forth in Paragraph 4 of this Agreement everything required to be performed, and shall provide, furnish and pay for all the labor, materials, necessary tools, expendable equipment, and all taxes, utility and transportation services required for construction of the Project. All of said work shall be performed and completed in a good workmanlike manner in strict accordance with the drawings, specifications and all provisions of this Agreement as hereinabove defined and in accordance with applicable laws, codes, regulations, ordinances and any other legal requirements governing the Project. The CONTRACTOR shall be liable to the DISTRICT for any damages arising as a result of a failure to fully comply with this obligation, and the CONTRACTOR shall not be excused with respect to any failure to so comply by any act or omission of the Architect, Engineer, Inspector, Division of State Architect, or representative of any of them, unless such act or omission actually prevents the CONTRACTOR from fully complying with the requirements of the Project Documents, and unless the CONTRACTOR protests at the time of such alleged prevention that the act or omission is preventing the CONTRACTOR from fully complying with the Project Documents. Such protest shall not be effective unless reduced to writing and filed with the DISTRICT within three (3) working days of the date of occurrence of the act or omission preventing the CONTRACTOR from fully complying with the Project Documents.

3. DISTRICT shall pay to the CONTRACTOR, as full consideration for the faithful performance of this Agreement , subject to any additions or deductions as provided in the Project Documents, the sum of _____ Dollars ($_____ _____).

4. The work shall be commenced on or before the _____ (_____) day after receiving the DISTRICT'S Notice to Proceed and shall be completed within _____ (_____) consecutive calendar days from the date specified in the Notice to Proceed.

5. **Time is of the essence**. If the work is not completed in accordance with Paragraph 4 above, it is understood that the DISTRICT will suffer damage. It being impractical and infeasible to determine the amount of

actual damage, in accordance with Government Code Section 53069.85, it is agreed that CONTRACTOR shall pay to DISTRICT as fixed and liquidated damages, and not as a penalty, the sum of_____ _____Dollars($_____) for each calendar day of delay until work is completed and accepted. Time extensions may be granted by the DISTRICT as provided in Article 64 of the General Conditions. Liquidated damages shall be imposed as set forth in Article 64 of the General Conditions.

6. Termination for Cause or Non-appropriation. In the event CONTRACTOR defaults in the performance of the Agreement as set forth in General Conditions Article 13(a) or if there is a non-appropriation of funds or insufficient funds as set forth in General Conditions Article 13(d), then this Agreement shall terminate or be suspended as set forth in General Conditions Article 13.

Termination for Convenience. DISTRICT has discretion to terminate this Agreement at any time and require CONTRACTOR to cease all work on the Project by providing CONTRACTOR written notice of termination specifying the desired date of termination. Upon receipt of written notice from DISTRICT of such termination for DISTRICT's convenience, CONTRACTOR shall:

(i) Cease operations as directed by DISTRICT in the notice;

(ii) Take any actions necessary, or that DISTRICT may direct, for the protection and preservation of the work; and

(iii) Not terminate any insurance provisions required by the Project Documents.

In case of such termination for DISTRICT's convenience, CONTRACTOR shall be entitled to receive payment from DISTRICT for work satisfactorily executed and for proven loss with respect to materials, equipment, and tools, including overhead and profit for that portion of the work completed. In the case of Termination for Convenience, DISTRICT shall have the right to accept assignment of subcontractors. The foregoing provisions are in addition to and not in limitation of any other rights or remedies available to the DISTRICT.

7. Hold Harmless and Indemnification. To the fullest extent permitted by law, the CONTRACTOR, at the CONTRACTOR's sole cost and expense, agrees to fully defend, indemnify and hold harmless, the DISTRICT, including but not limited to any of its governing board members, officers, employees, Construction Manager, Architect, and all other Agents and Representatives, from and against any and all claims, actions, demands, costs, judgments, liens, penalties, liabilities, damages, losses, anticipated losses of revenues, and expenses, including any fees of accountants, attorneys or other professionals, arising out of, in connection with, resulting from or related to, or claimed to be arising out of, in connection with, resulting from or related to any act or omission by the CONTRACTOR or any of its officers, agents, employees, subcontractors, sub-subcontractors, any person performing any of the work pursuant to a direct or indirect contract with the CONTRACTOR or individual entities comprising the CONTRACTOR, in connection with or relating to, or claimed to be in connection with or relating to the work, this Agreement, or the Project, including but not limited to any costs or liabilities arising out of or in connection with:

(a) failure to comply with any applicable law, statute, code, ordinance, regulation, permit or orders;

(b) any misrepresentation, misstatement or omission with respect to any statement made in the Project Documents or any document furnished by the CONTRACTOR in connection therewith;

(c) any breach of duty, obligation or requirement under the Project Documents;

(d) any failure to coordinate the work of other contractors;

(e) any failure to provide notice to any party as required under the Project Documents;

(f) any failure to act in such a manner as to protect the DISTRICT and the Project from loss, cost, expense or liability; or

(g) any failure to protect the property of any utility company or property owner.

This indemnity shall survive termination of the contract or final payment thereunder. This indemnity is in addition to any other rights or remedies which the DISTRICT may have under the law or under the Project Documents. In the event of any claim or demand made against any party which is entitled to be indemnified hereunder, the DISTRICT may in its sole discretion reserve, retain or apply any monies due to the CONTRACTOR under the Project Documents for the purpose of resolving such claims; provided, however, that the DISTRICT may release such funds if the CONTRACTOR provides the DISTRICT with reasonable assurance of protection of the DISTRICT's interests. The DISTRICT shall in its sole discretion determine whether such assurances are reasonable.

8. CONTRACTOR shall take out, prior to commencing the work, and maintain, during the life of this Agreement, and shall require all subcontractors, if any, whether primary or secondary, to take out and maintain the insurance coverages set forth below and in Articles 16, 17, 18 and 19 of the General Conditions. CONTRACTOR agrees to provide all evidences of coverage required by DISTRICT including certificates of insurance and endorsements.

Public Liability Insurance for injuries including accidental death, to any one person in an amount not less than	$2,000,000
Subcontractors of every tier	$1,000,000
and	
Subject to the same limit for each person on account of one accident, in an amount not less than	$2,000,000
Subcontractors of every tier	$1,000,000
Property Damage Insurance in an amount not less than	$2,000,000
Subcontractors of every tier	$1,000,000
Course of Construction Insurance without exclusion or limitation in an amount not less than	$2,000,000
Excess Liability Insurance (Contractor only)	$2,000,000

Insurance Covering Special Hazards: The following special hazards shall be covered by rider or riders to above-mentioned public liability insurance or property damage insurance policy or policies of insurance, or by special policies of insurance in amounts as follows:

Automotive and truck where operated in amounts as above

Material hoist where used in amounts as above

Waiver Of Subrogation

Contractor waives (to the extent permitted by law) any right to recover against the District, and its respective elected officials, officers, employees, agents, and representatives for damages to the Work, any part thereof, or any and all claims arising by reason of any of the foregoing, but only to the extent that such damages and/or claims are covered by property insurance and only to the extent of such coverage (which shall exclude deductible amounts) actually carried by the District.

The provisions of this section are intended to restrict each party to recovery against insurance carriers only to the extent of such coverage and waive fully and for the benefit of each, any rights and/or claims which might give rise to a right of subrogation in any insurance carrier. The District and the Contractor shall each obtain in all policies of insurance carried by either of them, a waiver by the insurance companies there under of all rights of recovery by way of subrogation for any damages or claims covered by the insurance.

Additional Insured Endorsement Requirements.

The Contractor shall name, on any policy of insurance required the District, their officers, employees, Construction Manager, Architect, and all other Agents and Representatives as additional insureds. Subcontractors shall name the Contractor, the District, their officers, employees, Construction Manager, Architect, and all other Agents and Representatives as additional insureds. The Additional Insured Endorsement included on all such insurance policies shall state that coverage is afforded the additional insured with respect to claims arising out of operations performed by or on behalf of the insured. If the additional insureds have other insurance that is applicable to the loss, such other insurance shall be on an excess or contingent basis. The insurance provided by the Contractor must be designated in the policy as primary to any insurance obtained by the District. The amount of the insurer's liability shall not be reduced by the existence of such other insurance.

9. Public Contract Code Section 22300 permits the substitution of securities for any retention monies withheld by the DISTRICT to ensure performance under this Agreement. At the request and expense of the CONTRACTOR, securities equivalent to the monies withheld shall be deposited with the DISTRICT, or with a state or federally chartered bank in California as the escrow agent, who shall then pay such monies to the CONTRACTOR. The DISTRICT retains the sole discretion to approve the bank selected by the CONTRACTOR to serve as escrow agent. Upon satisfactory completion of the Agreement, the securities shall be returned to the CONTRACTOR. Securities eligible for investment shall include those listed in Government Code Section 16430 or bank or savings and loan certificates of deposit. The CONTRACTOR shall be the beneficial owner of any securities substituted for monies withheld and shall receive any interest thereon.

In the alternative, under Section 22300, the CONTRACTOR may request DISTRICT to make payment of earned retention monies directly to the escrow agent at the expense of the CONTRACTOR. Also at the CONTRACTOR's expense, the CONTRACTOR may direct investment of the payments into securities, and the CONTRACTOR shall receive interest earned on such investment upon the same conditions as provided for securities deposited by CONTRACTOR. Upon satisfactory completion of the Agreement, CONTRACTOR shall receive from the escrow agent all securities, interest and payments received by escrow agent from DISTRICT pursuant to the terms of Section 22300.

10. If CONTRACTOR is a corporation, the undersigned hereby represents and warrants that the corporation is duly incorporated and in good standing in the State of_____, and that_____ _____. whose title is_____, is authorized to act for and bind the corporation.

11. Each and every provision of law and clause required by law to be inserted in this Agreement shall be deemed to be inserted herein and the Agreement shall be read and enforced as though it were included herein, and

if through mistake or otherwise any such provision is not inserted, or is not currently inserted, then upon application of either party the Agreement shall forthwith be physically amended to make such insertion or correction.

12. This Agreement constitutes the entire agreement of the parties. No other agreements, oral or written, pertaining to the work to be performed, exists between the parties. This Agreement can be modified only by an amendment in writing, signed by both parties and pursuant to action of the Governing Board of the District. This Agreement shall be governed by the laws of the State of California.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed.

DISTRICT

By:_____
Signature

_____
Print Name

_____
Title

CONTRACTOR

By: _____
Signature

_____
Print Name

_____
Title

_____
Contractor's License No.

_____
Tax ID/Social Security No.

(CORPORATE SEAL OF CONTRACTOR,
if corporation)

ESCROW AGREEMENT FOR SECURITY DEPOSITS IN LIEU OF RETENTION

This Escrow Agreement is made and entered into, as of_____, 20_____, by and between South Orange County Community College District, whose address is 28000 Marguerite Parkway, Mission Viejo, CA 92692 hereinafter called "DISTRICT;"_____, whose address is_____ _____, hereinafter called "Contractor;" and, _____, whose address is_____ _____, hereinafter called "Escrow Agent."

For the consideration hereinafter set forth, the DISTRICT, Contractor, and Escrow Agent agree as follows:

(1) Pursuant to Section 22300 of the Public Contract Code of the State of California, Contractor has the option to deposit securities with Escrow Agent as a substitute for retention earnings required to be withheld by DISTRICT pursuant to the Agreement entered into between the DISTRICT and Contractor for _____ in the amount of_____ _____,dated _____ (hereinafter referred to as the "Agreement"). Alternatively, on written request of the Contractor, the DISTRICT shall make payments of the retention earnings directly to the Escrow Agent. When the Contractor deposits the securities as a substitute for retention earnings, the Escrow Agent shall notify the DISTRICT within ten (10) days of the deposit. The market value of the securities at the time of the substitution shall be at least equal to the cash amount then required to be withheld as retention under the terms of the Agreement between the DISTRICT and Contractor. Securities shall be held in the name of DISTRICT, and shall designate the Contractor as the beneficial owner.

(2) The DISTRICT shall make progress payments to the Contractor for those funds which otherwise would be withheld from progress payments, provided that the Escrow Agent holds securities in the form and amount specified above.

(3) When the DISTRICT makes payment of retentions earned directly to the Escrow Agent, the Escrow Agent shall hold them for the benefit of the Contractor until the time the escrow created under this Escrow Agreement is terminated. The Contractor may direct the investment of the payments into securities. All terms and conditions of this Escrow Agreement and the rights and responsibilities of the parties shall be equally applicable and binding when the DISTRICT pays the Escrow Agent directly.

(4) Contractor shall be responsible for paying all fees for the expenses incurred by Escrow Agent in administering the Escrow Account and all expenses of the DISTRICT. These expenses and payment terms shall be determined by the DISTRICT, Contractor and Escrow Agent.

(5) The interest earned on the securities or the money market accounts held in escrow and all interest earned on that interest shall be for the sole account of Contractor and shall be subject to withdrawal by Contractor at any time and from time to time without notice to the DISTRICT.

(6) Contractor shall have the right to withdraw all or any part of the principal in the Escrow Account only by written notice to Escrow Agent accompanied by written authorization from the DISTRICT to the Escrow Agent that DISTRICT consents to the withdrawal of the amount sought to be withdrawn by Contractor.

(7) The DISTRICT shall have a right to draw upon the securities in the event of default by the Contractor. Upon seven (7) days' written notice to the Escrow Agent from the DISTRICT of the default, the Escrow Agent shall immediately convert the securities to cash and shall distribute the cash as instructed by the DISTRICT.

(8) Upon receipt of written notification from the DISTRICT certifying that the Agreement is final and complete, and that the Contractor has complied with all requirements and procedures applicable to the Agreement, Escrow Agent shall release to Contractor all securities and interest on deposit less escrow fees and charges of the Escrow Account. The escrow shall be closed immediately upon disbursement of all monies and securities on deposit and payments of fees and charges.

(9) Escrow Agent shall rely on the written notifications from the DISTRICT and the Contractor pursuant to Sections (5) to (8), inclusive, of this Escrow Agreement and the DISTRICT and Contractor shall hold Escrow Agent harmless from Escrow Agent's release and disbursement of the securities and interest as set forth above.

(10) The names of the persons who are authorized to give written notice or to receive written notice on behalf of the DISTRICT and on behalf of Contractor in connection with the foregoing, and exemplars of their respective signatures are as follows:

On behalf of DISTRICT:	On behalf of Contractor:
_____	_____
Title	Title
_____	_____
Name	Name
_____	_____
Signature	Signature
_____	_____
Address	Address

On behalf of Escrow Agent:

_____
Title

_____
Name

_____
Signature

_____
Address

At the time the Escrow Account is opened, the DISTRICT and Contractor shall deliver to the Escrow Agent a fully executed counterpart of this Escrow Agreement.

IN WITNESS WHEREOF, the parties have executed this Escrow Agreement by their proper officers on the date first set forth above.

DISTRICT	CONTRACTOR
_____	_____
Title	Title
_____	_____
Name	Name
_____	_____
Signature	Signature

Escrow Agent

_____
Title

_____
Name

_____
Signature

GUARANTEE

Guarantee for_____. We hereby guarantee that the_____, which we have installed in _____, has been done in accordance with the Project Documents and that the work as installed will fulfill the requirements included in the Project Documents. The undersigned agrees to repair or replace any or all of such work, together with any other adjacent work which may be displaced in connection with such repair or replacement, that may prove to be defective in workmanship or material within a period of one (1) year from the date of completion of the Project, ordinary wear and tear and unusual abuse or neglect excepted.

In the event of the undersigned's or undersigned surety's failure to commence and pursue with diligence said repairs or replacements within ten (10) calendar days after being notified in writing by the DISTRICT, the undersigned authorizes the DISTRICT to proceed to have said defects repaired or replaced and made good at the expense of the undersigned and surety who hereby agree to pay the costs and charges therefore immediately upon demand. (General Conditions Article 47(d))

_____

Name of Contractor

By: _____

Signature of Contractor

_____

Print Name

_____

Title

Contractor shall provide copy of this Guarantee to Contractor's surety.

Guarantee (continued)

_____
Name of Subcontractor
(if work performed by
subcontractor)

By: _____
Signature of Subcontractor

_____
Print Name

_____
Title

Representatives to be contacted for service:

Name: _____

Address: _____

_____

Telephone: _____

SHOP DRAWING TRANSMITTAL

The procedure governing shop drawing submittals is contained in the General Conditions. In addition, all Supplemental Conditions, Special Conditions and Specifications must be followed by the CONTRACTOR.

Failure to comply with all requirements will constitute grounds for return of the shop drawing for proper resubmittal. CONTRACTOR shall sequentially number each submittal.

Date:_____ Submittal No.: _____

From: _____ To: _____

Project Name: _____

This is a(n): Original _____
Submittal _____
2nd Submittal _____
[ ] Submittal _____

Subject of Submittal: Equipment Designation: Specification Section(s):

Complete either (a) or (b) Check One:

(a) We have verified that the material or equipment contained in this submittal meets all the requirements specified or shown and exceptions:

(b) We have verified that the material or equipment contained in this submittal meets all the requirements specified or shown, except for the following deviations or modifications on attached data:

(continued on next page)

The CONTRACTOR has reviewed and approved not only the field dimensions but the construction criteria and has also made written notation regarding any information in the shop drawings that does not conform to the Project Documents. This shop drawing has been coordinated with all other shop drawings received to date by CONTRACTOR and this duty of coordination has not been delegated to subcontractors, material suppliers, the ARCHITECT, or the engineers on this Project.

_____

Signature of Contractor or
Supplier

DRUG-FREE WORKPLACE CERTIFICATION

This Drug-Free Workplace Certification is required pursuant to Government Code Sections 8350, et seq., the Drug-Free Workplace Act of 1990. The Drug-Free Workplace Act of 1990 requires that every person or organization awarded a contract for the procurement of any property or services from any State agency must certify that it will provide a drug-free workplace by doing certain specified acts. In addition, the Act provides that each contract awarded by a State agency may be subject to suspension of payments or termination of the contract and the contractor may be subject to debarment from future contracting, if the state agency determines that specified acts have occurred.

Pursuant to Government Code Section 8355, every person or organization awarded a contract from a State agency shall certify that it will provide a drug-free workplace by doing all of the following:

a) publishing a statement notifying employees that the unlawful manufacture, distribution, dispensation, possession or use of a controlled substance is prohibited in the person's or organization's workplace and specifying actions which will be taken against employees for violations of the prohibition;

b) establishing a drug-free awareness program to inform employees about all of the following:

1) the dangers of drug abuse in the workplace;

2) the person's or organization's policy of maintaining a drug-free workplace;

3) the availability of drug counseling, rehabilitation and employee-assistance programs;

4) the penalties that may be imposed upon employees for drug abuse violations;

c) requiring that each employee engaged in the performance of the contract be given a copy of the statement required by subdivision (a) and that, as a condition of employment on the contract, the employee agrees to abide by the terms of the statement.

I, the undersigned, agree to fulfill the terms and requirements of Government Code Section 8355 listed above and will publish a statement notifying employees concerning (a) the prohibition of controlled substance at the workplace, (b) establishing a drug-free awareness program, and (c) requiring that each employee engaged in the performance of the contract be given a copy of the statement required by Section 8355(a) and requiring that the employee agree to abide by the terms of that statement.

I also understand that if the DISTRICT determines that I have either (a) made a false certification herein, or (b) violated this certification by failing to carry out the requirements of Section 8355, that the contract awarded herein is subject to suspension of payments, termination, or both. I further understand that, should I violate the terms of the Drug-Free Workplace Act of 1990, I may be subject to debarment in accordance with the requirements of Section 8350, et seq.

I acknowledge that I am aware of the provisions of Government Code Section 8350, et seq. and hereby certify that I will adhere to the requirements of the Drug-Free Workplace Act of 1990.

_____
NAME OF CONTRACTOR

_____
Signature

_____
Print Name

_____
Title

_____
Date

CHANGE ORDER NO._____ (ADDITIVE)

PROJECT: _____

TO: _____

You are hereby directed to provide the extra work necessary to comply with this Change Order.

DESCRIPTION OF CHANGE: _____

_____

COST (This cost shall not be exceeded.):

Original contract price: $ _____

Change Order amount: $ _____

New contract price: $ _____

TIME FOR COMPLETION:

Original completion date: _____

Time for completion of

Change Order: _____

New completion date: _____

Contractor agrees to perform the above-described work in accordance with the above terms and in compliance with applicable sections of the Project Documents. The amount of the charges under this Change Order is limited to the charges allowed under Article 60 of the General Conditions. The adjustment in the contract sum, if any, and the adjustment in the contract time, if any, set out in this Change Order shall constitute the entire compensation and/or adjustment in the contract time due Contractor arising out of the change in the work covered by this Change Order, unless otherwise provided in this Change Order.

No additions or deletions to this Change Order shall be allowed, except with written permission of District. Contractor accepts the terms and conditions stated above as full and final settlement of any and all claims arising from this Change Order.

(continued on next page)

This Change Order is hereby agreed to, accepted and approved.

CONTRACTOR

By:_____
Signature

_____
Print Name

_____
Title

_____
Date

DISTRICT

By: _____
Signature

_____
Print Name

_____
Title

_____
Date

ARCHITECT

By: _____
Signature

_____
Print Name

_____
Title

_____
Date

CHANGE ORDER NO. _____ (DEDUCTIVE)

PROJECT: _____

TO: _____

You are hereby directed to comply with this Change Order.

DESCRIPTION OF CHANGE: _____

_____

_____

COST (This cost shall be deleted.):

Original contract price: $ _____

Change Order amount: $ _____

New contract price: $ _____

TIME FOR COMPLETION:

Original completion date: _____

Time for completion of

Change Order: _____

New completion date: _____

Contractor agrees to deduct the above-described work in accordance with the above terms and in compliance with applicable sections of the Project Documents. Contractor agrees to the adjustment in the contract sum, if any, and the adjustment in the contract time, if any, set out in this Change Order.

No additions or deletions to this Change Order shall be allowed, except with written permission of District. Contractor accepts the terms and conditions stated above as full and final settlement of any and all claims arising from this Change Order.

(continued on next page)

This Change Order is hereby agreed to, accepted and approved.

CONTRACTOR

By:_____

_____
Print Name

_____
Title

_____
Date

DISTRICT

By: _____

_____
Print Name

_____
Title

_____
Date

ARCHITECT

By: _____
Signature

_____
Print Name

_____
Title

_____
Date

CONTRACTOR'S CERTIFICATE REGARDING NON-ASBESTOS CONTAINING MATERIALS

Per Article 70 of the General Conditions.

Certification for_____. We hereby certify that no Asbestos, or Asbestos Containing Materials shall be used in this Project or in any tools, devices, clothing, or equipment used to affect the _____ _____

which we have installed in the South Orange County Community College District under Project/Bid No.____ _____.

(a) The Contractor further certifies that he/she has instructed his/her employees with respect to the above mentioned standards, hazards, risks and liabilities.

(b) Asbestos and/or asbestos containing material shall be defined as all items containing but not limited to chrysotile, corcidolite, amosite, anthopyllite, tremolite and actinolite.

(c) Any or all material containing greater than one-tenth of one percent (.1%) asbestos shall be defined as asbestos containing material.

(d) Any disputes involving the question of whether or not material contains asbestos shall be settled by electron microscopy. The costs of any such tests shall be paid by the Contractor if the material is found to contain asbestos.

(e) All work or materials found to contain asbestos or work or material installed with asbestos containing equipment will be immediately rejected and this work will be removed at no additional cost to the District.

_____
Date

_____
Name of Contractor

By: _____
Signature

_____
Print Name

_____
Title

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ARTICLE 1. DEFINITIONS

(a) Action of the Governing Board is a vote of a majority of the members in a lawful meeting.

(b) Addenda are the changes in plans, specifications, drawings, and/or Project Documents which have been authorized in writing by the DISTRICT or ARCHITECT, and which alter, explain, or clarify the Project Documents prior to the bid deadline.

(c) Agents & Representatives includes all project participants holding contract with the DISTRICT other than the CONTRACTOR.

(d) Agreement includes collectively all Project Documents.

(e) Approval means written authorization by ARCHITECT or DISTRICT.

(f) CONTRACTOR or DISTRICT are those mentioned as such in the Agreement. They are treated throughout the Project Documents as if they are of singular number and neuter gender.

(g) DISTRICT is the Governing Board or its duly authorized representative.

(h) Locality in which the work is performed means the county and city in which the work is done.

(i) Project is the planned undertaking as provided for in the Project Documents by DISTRICT and CONTRACTOR.

(j) Project Documents includes collectively, to wit: Notice Calling for Bids, Information for Bidders, Bid Form, Bid Security, Designation of Subcontractor form, Information Required of Bidder, all prequalification forms submitted pursuant to Public Contract Code Section 20111.5, if any, Noncollusion Affidavit, Workers' Compensation Certificate, Faithful Performance Bond, Payment Bond, Agreement, Escrow Agreement, Drug-Free Workplace Certification, Change Order forms, Shop Drawing Transmittals form, Insurance Certificates and Endorsements, Guarantee form, Contractor's Certificate Regarding Non-Asbestos Containing Materials, General Conditions, Supplemental Conditions, if any, Special Conditions, if any, Drawings, Specifications, and all modifications, addenda and amendments thereto. The Project Documents are complementary, and what is called for by any one shall be as binding as if called for by all.

(k) Provide shall include "provide complete in place," that is, "furnish and install."

(l) Safety Orders are those issued by the Division of Industrial Safety and OSHA safety and health standards for construction.

(m) Standards, Rules, and Regulations referred to are recognized printed standards and shall be considered as one and a part of these specifications within limits specified.

(n) Subcontractor, as used herein, includes those having a direct contractual relationship with CONTRACTOR and one who furnishes material worked to a special design according to plans, drawings, and specifications, but does not include one who merely furnishes material not so worked.

(o) Surety is the person, firm, or corporation that executes as a California admitted surety insurer, the CONTRACTOR's Bid Security, faithful performance bond and payment bond.

(p) Work of the CONTRACTOR or subcontractor includes labor or materials (including, without limitation, equipment and appliances) or both, incorporated in, or to be incorporated in the Project.

(q) Workers includes laborer, worker, or mechanic.

ARTICLE 2. STATUS OF CONTRACTOR

(a) CONTRACTOR is and shall at all times be deemed to be an independent contractor and shall be wholly responsible for the manner in which it performs the services required of it by the terms of the Project Documents. Nothing herein contained shall be construed as creating the relationship of employer and employee, or principal and agent, between the DISTRICT and CONTRACTOR or any of CONTRACTOR's agents or employees. CONTRACTOR assumes exclusively the responsibility for the acts of its employees as they relate to the services to be provided during the course and scope of their employment. CONTRACTOR, its agents and employees shall not be entitled to any rights or privileges of DISTRICT employees and shall not be considered in any manner to be DISTRICT employees. DISTRICT shall be permitted to monitor the activities of the CONTRACTOR to determine compliance with the terms of the Project Documents.

(b) Contractors are required by law to be licensed and regulated by the Contractors' State License Board. Any CONTRACTOR not so licensed is subject to penalties under the law, and the contract will be considered void pursuant to Section 7028.7 of the Business and Professions Code. Any questions concerning a contractor may be referred to the Registrar, Contractors' State License Board, 9821 Business Park Drive, P. O. Box 26000, Sacramento, CA 95826.

ARTICLE 3. CHANGE IN NAME AND NATURE OF CONTRACTOR'S LEGAL ENTITY

Before CONTRACTOR makes any change in the name or legal nature of the CONTRACTOR's entity, CONTRACTOR shall first notify the DISTRICT in writing and cooperate with DISTRICT in making such changes as the DISTRICT may request in the Project Documents.

ARTICLE 4. CONTRACTOR'S SUPERVISION, PROSECUTION AND PROGRESS

(a) During progress of the work, CONTRACTOR shall keep on the work site a competent superintendent satisfactory to DISTRICT. Before commencing the work herein, CONTRACTOR shall give written notice to DISTRICT and ARCHITECT of the name, qualifications and experience of such superintendent. If Superintendent is found unsatisfactory by DISTRICT, CONTRACTOR shall replace the Superintendent with one acceptable to the DISTRICT. Superintendent shall not be changed except with written consent of DISTRICT, unless a superintendent proves to be unsatisfactory to CONTRACTOR and ceases to be in its employ, in which case, CONTRACTOR shall notify DISTRICT and ARCHITECT in writing and replace said Superintendent with one acceptable to the DISTRICT. Superintendent shall represent CONTRACTOR and all directions given to Superintendent shall be as binding as if given to CONTRACTOR.

(b) CONTRACTOR shall supervise and direct the work competently and efficiently, devoting such attention thereto and applying such skills as may be necessary to perform the work in accordance with the Project Documents. CONTRACTOR shall carefully study and compare all plans, drawings, specifications, and other instructions and shall at once report to ARCHITECT any error, inconsistency or omission which CONTRACTOR or its employees may discover. The CONTRACTOR represents itself to DISTRICT as a skilled, knowledgeable, and experienced CONTRACTOR. The CONTRACTOR shall carefully study and compare the Project Documents with each other, and shall at once report to the ARCHITECT any errors, inconsistencies, or omissions discovered. The CONTRACTOR shall be liable to the DISTRICT for damage resulting from errors, inconsistencies, or omissions in the Project Documents that the CONTRACTOR recognized and which CONTRACTOR knowingly failed to report and which a similarly skilled, knowledgeable, and experienced contractor would have discovered.

(c) The CONTRACTOR shall verify all indicated dimensions before ordering materials or equipment, or before performing work. The CONTRACTOR shall take field measurements, verify field conditions, and shall carefully compare such field measurements and conditions and other information known to the CONTRACTOR with the Project Documents before commencing work. Errors, inconsistencies or omissions discovered shall be reported to the DISTRICT at once. Upon commencement of any item of work, the CONTRACTOR shall be responsible for dimensions related to such item of work and shall make any corrections necessary to make work properly fit at no additional cost to DISTRICT. This responsibility for verification of dimensions is a non-delegable duty and may not be delegated to subcontractors or agents.

(d) Omissions from the plans, drawings or specifications, or the misdescription of details of work which are manifestly necessary to carry out the intent of the plans, drawings and specifications, or which are customarily performed, shall not relieve the CONTRACTOR from performing such omitted or misdescribed work, but they shall be performed as if fully and correctly set forth and described in the plans, drawings and specifications.

(e) The CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. The CONTRACTOR shall be responsible to see that the finished work complies accurately with the Project Documents.

ARTICLE 5. SUBCONTRACTORS

(a) CONTRACTOR agrees to bind every subcontractor by terms of the Project Documents as far as such terms are applicable to subcontractor's work. If CONTRACTOR shall subcontract any part of the work, CONTRACTOR shall be as fully responsible to DISTRICT for acts and omissions of any subcontractor and of

persons either directly or indirectly employed by any subcontractor, as it is for acts and omissions of persons directly employed by CONTRACTOR. Nothing contained in Project Documents shall create any contractual relation between any subcontractor and DISTRICT, nor shall the contract documents be construed to be for the benefit of any subcontractor.

(b) DISTRICT's consent to any subcontractor shall not in any way relieve CONTRACTOR of any obligations under the Project Documents and no such consent shall be deemed to waive any provision of any Project Document.

(c) CONTRACTOR must submit with its bid, a Designation of Subcontractors pursuant to the Subletting and Subcontracting Fair Practices Act. If CONTRACTOR specifies more than one subcontractor for the same portion of work or fails to specify a subcontractor, and such portion of the work exceeds one-half of one percent of the total bid, CONTRACTOR agrees that it is fully qualified to perform and shall perform such work itself, unless CONTRACTOR provides for substitution or addition of subcontractors. Substitution or addition of subcontractors shall be permitted only as authorized under the Subletting and Subcontracting Fair Practices Act, Public Contract Code Section 4100, et. seq.

(d) In accordance with Business and Professions Code Section 7059, if CONTRACTOR is designated as a "specialty contractor" (as defined in Section 7058 of the Public Contract Code), all of the work to be performed outside of the CONTRACTOR's license specialty shall be performed by a licensed subcontractor in compliance with the Subletting and Subcontracting Fair Practices Act, Public Contract Code Section 4100, et seq.

(e) A copy of each subcontract, if in writing, or, if not in writing, then a written statement signed by the CONTRACTOR giving the name of the subcontractor and the terms and conditions of such subcontract. shall be filed with the DISTRICT before the subcontractor begins work. Each subcontract shall contain a reference to the Agreement between the DISTRICT and the CONTRACTOR and the terms of that Agreement and all parts of the Project Documents shall be made a part of such subcontract insofar as applicable to the work covered thereby. Each subcontract will provide for termination in accordance with Article 13 of these General Conditions. Each subcontract shall provide for its annulment by the CONTRACTOR at the order of the ARCHITECT if in the ARCHITECT'S opinion the subcontractor fails to comply with the requirements of the Project Documents insofar as the same may be applicable to this work. Nothing herein contained shall relieve the CONTRACTOR of any liability or obligation hereunder.

ARTICLE 6. PROHIBITED INTERESTS

No official of DISTRICT who is authorized in such capacity and on behalf of DISTRICT to negotiate, make, accept, or approve, or to take part in negotiating, making, accepting or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with construction of the Project, shall become directly or indirectly interested financially in this Project or in any part thereof. No officer, employee, architect, attorney, engineer or inspector of or for DISTRICT who is authorized in such capacity and on behalf of DISTRICT to exercise any executive, supervisory or other similar functions in connection with construction of Project shall become directly or indirectly interested financially in this Project or in any part thereof. CONTRACTOR shall receive no compensation and shall repay DISTRICT for any compensation received by CONTRACTOR hereunder, should CONTRACTOR aid, abet or knowingly participate in violation of this Article 6.

ARTICLE 7. DISTRICT'S INSPECTOR

(a) One or more Inspector(s), including special inspectors, as required, will be employed by DISTRICT and will be assigned to the Project.

(b) No work shall be performed by the CONTRACTOR solely upon the instructions or comments by the Inspector. The Inspector has no authority to interpret the Project Documents or order extra work and any extra work performed without the written instruction of the DISTRICT shall be at CONTRACTOR's sole cost and expense and there will be no delay damages incurred by DISTRICT for such work.

(c) No work shall be carried on except with the knowledge and under the inspection of said Inspector(s). He/she shall have free access to any or all parts of work at any time. CONTRACTOR shall furnish Inspector reasonable opportunities for obtaining such information as may be necessary to keep Inspector fully informed respecting progress and manner of work and character of materials. Inspection of work shall not relieve CONTRACTOR from any obligation to fulfill the Project Documents. Inspector or ARCHITECT shall have authority to stop work whenever provisions of Project Documents are not being complied with and such noncompliance is discovered. CONTRACTOR shall instruct its employees accordingly.

(d) CONTRACTOR understands and agrees that the Inspector for the Project may also serve concurrently as inspector for other DISTRICT projects and may not therefore be available on site during the entire work day. It shall be the responsibility of CONTRACTOR to notify the Inspector not less than twenty-four (24) hours in advance of materials and equipment deliveries and required inspections.

ARTICLE 8. ARCHITECT'S STATUS

(a) The ARCHITECT shall be the DISTRICT's representative during construction and shall observe the progress and quality of the work on behalf of the DISTRICT. ARCHITECT shall have the authority to act on behalf of DISTRICT only to the extent expressly provided in the Project Documents. ARCHITECT shall have authority to stop work whenever such stoppage may be necessary in ARCHITECT'S reasonable opinion to ensure the proper execution of the Project Documents.

(b) The ARCHITECT shall be, in the first instance, the judge of the performance of the work. ARCHITECT shall exercise authority under the Project Documents to enforce CONTRACTOR's faithful performance.

(c) The ARCHITECT shall have all authority and responsibility established by law. The ARCHITECT has the authority to enforce compliance with the Project Documents and the CONTRACTOR shall promptly comply with instructions from the ARCHITECT or an authorized representative of the ARCHITECT.

(d) On all questions related to the quantities, the acceptability of material, equipment or workmanship, the execution, progress or sequence of work, the interpretation of plans, specifications or drawings, and the acceptable performance of the CONTRACTOR pursuant to the decision of the ARCHITECT shall govern and shall be precedent to any payment unless otherwise ordered by the Governing Board. The progress and completion of the work shall not be impaired or delayed by virtue of any question or dispute arising out of or related to the foregoing matters and the instructions of the ARCHITECT relating thereto.

(e) General supervision and direction of the work by the ARCHITECT shall in no way imply that the ARCHITECT or his or her representatives are in any way responsible for the safety of the CONTRACTOR or its employees or that the ARCHITECT or his or her representatives will maintain supervision over the CONTRACTOR's construction methods or personnel other than to ensure that the quality of the finished work is in accordance with the Project Documents.

ARTICLE 9. NOTICE OF TAXABLE POSSESSORY INTEREST

The terms of the Agreement may result in the creation of a possessory interest. If such a possessory interest is vested in a private party to the Agreement, the private party may be subjected to the payment of property taxes levied on such interest.

ARTICLE 10. ASSIGNMENT OF ANTITRUST ACTIONS

Public Contract Code Section 7103.5 provides:

> In entering into a public works contract or a subcontract to supply goods, services, or materials pursuant to a public works contract, the contractor or subcontractor offers and agrees to assign to the awarding body (DISTRICT) all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Section 15) or under the Cartwright Act (Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, services, or materials pursuant to the public works contract or the subcontract. This assignment shall be made and become effective at the time the awarding body tenders final payment to the contractor, without further acknowledgment by the parties.

CONTRACTOR, for itself and all subcontractors, agrees to assign to DISTRICT all rights, title, and interest in and to all such causes of action CONTRACTOR and all subcontractors may have under the Agreement. This assignment shall become effective at the time DISTRICT tenders final payment to the CONTRACTOR and CONTRACTOR shall require assignments from all subcontractors to comply herewith.

ARTICLE 11. OTHER CONTRACTS

(a) DISTRICT reserves the right to let other contracts in connection with this work. CONTRACTOR shall afford other contractors reasonable opportunity for introduction and storage of their materials and execution of their work and shall properly connect and coordinate its work with such other contractors.

(b) If any part of CONTRACTOR's work depends for proper execution or results upon work of any other contractor, the CONTRACTOR shall inspect and promptly report to ARCHITECT in writing any defects in such work that render it unsuitable for such proper execution and results. CONTRACTOR will be held accountable for damages to DISTRICT for that work which it failed to inspect or should have inspected. CONTRACTOR's failure to inspect and report shall constitute its acceptance of other contractor's work as fit and proper for reception of its work, except as to defects which may develop in other contractors' work after execution of CONTRACTOR's work.

(c) To ensure proper execution of its subsequent work, CONTRACTOR shall measure and inspect work already in place and shall at once report to the ARCHITECT in writing any discrepancy between executed work and Project Documents.

(d) CONTRACTOR shall ascertain to its own satisfaction the scope of the Project and nature of any other contracts that have been or may be awarded by DISTRICT in prosecution of the Project to the end that CONTRACTOR may perform this Agreement in the light of such other contracts, if any.

(e) Nothing herein contained shall be interpreted as granting to CONTRACTOR exclusive occupancy at site of Project. CONTRACTOR shall not cause any unnecessary hindrance or delay to any other contractor working on Project. If simultaneous execution of any contract for Project is likely to cause interference with performance of some other contract or contracts, DISTRICT shall decide which contractor shall cease work temporarily and which contractor shall continue or whether work can be coordinated so that contractors may proceed simultaneously.

(f) DISTRICT shall not be responsible for any damages suffered or extra costs incurred by CONTRACTOR resulting directly or indirectly from award or performance or attempted performance of any other contract or contracts on Project, or caused by any decision or omission of DISTRICT respecting the order of precedence in performance of contracts.

ARTICLE 12. OCCUPANCY

DISTRICT reserves the right to occupy buildings and/or portions of the site at any time before completion, and such occupancy shall not constitute final acceptance of any part of work covered by this Agreement, nor shall such occupancy extend the date specified for completion of the work. Beneficial occupancy of building(s) does not commence any warranty period nor shall it entitle CONTRACTOR to any additional compensation due to such occupancy.

ARTICLE 13. DISTRICT'S RIGHT TO TERMINATE AGREEMENT

(a) Termination for Cause. If the CONTRACTOR refuses or fails to complete the work or any separable part thereof with such diligence as will insure its completion within the time specified or any extension thereof, or fails to complete said work within such time, or if the CONTRACTOR should file a petition for relief as a debtor, or should relief be ordered against CONTRACTOR as a debtor under Title 11 of the United States Code, or if CONTRACTOR should make a general assignment for the benefit of its creditors, or if a receiver should be appointed on account of its insolvency, or if it should refuse or should fail to supply enough properly skilled workers or proper equipment, tools, and materials in the necessary quantity and quality to complete the work in the time specified, or if CONTRACTOR should fail to make prompt payment to subcontractors for materials or labor, or disregard laws or ordinances or instructions of DISTRICT, or if CONTRACTOR or its subcontractors should otherwise be guilty of a violation of any provision of this Agreement, then CONTRACTOR shall be deemed to be in default of the Agreement and DISTRICT may, without prejudice to any other right or remedy, serve written notice upon CONTRACTOR and its surety of DISTRICT's intention to terminate this Agreement, such notice to contain the reasons for such intention to terminate, and unless within ten (10) calendar days after the service of such notice such condition shall cease or such violation shall cease, or arrangements satisfactory to DISTRICT for the correction thereof be made and corrective action commenced in a diligent and workmanlike manner and pursued to satisfactory completion, this Agreement shall upon the

expiration of said ten (10) calendar days, cease and terminate. In such case, CONTRACTOR shall be excluded from the worksite and not be entitled to receive any further payment until work is finished to DISTRICT's satisfaction.

(b) In the event of any such termination, surety shall have the right to take over and perform this Agreement, provided, however, that if surety within five (5) calendar days after service upon it of said notice of termination does not give DISTRICT written notice of its intention to take over and perform this Agreement or does not commence performance thereof within ten (10) calendar days after date of serving such notice of termination by DISTRICT on surety, DISTRICT may take over the work and prosecute same to completion by any means determined by DISTRICT including hiring another contractor for the account and at the expense of CONTRACTOR, and CONTRACTOR and its surety shall be liable to DISTRICT for any excess cost or other damages occasioned by the DISTRICT thereby. Time is of the essence in this Agreement. If the DISTRICT takes over the work as hereinabove provided, the DISTRICT may, without liability for so doing, take possession of and utilize in completing the work such materials, supplies, equipment and other property belonging to the CONTRACTOR as may be on the site of the work and necessary therefore.

(c) The expense of finishing the work, including compensation for additional architectural, managerial, and administrative services, shall be a charge against CONTRACTOR and CONTRACTOR agrees that the charge may be deducted from any money due or becoming due to CONTRACTOR from DISTRICT or CONTRACTOR shall pay the charge to the DISTRICT. Expense incurred by DISTRICT as herein provided, and damage incurred through CONTRACTOR's default, shall be certified to DISTRICT by ARCHITECT. The surety shall become liable for payment should CONTRACTOR fail to pay in full any cost incurred by the DISTRICT.

(d) Nonappropriation of Funds/Insufficient Funds. In the event that sufficient funds are not appropriated to complete the Project or the DISTRICT determines that sufficient funds are not available to complete the Project, DISTRICT may terminate or suspend the completion of the Project at any time by giving written notice to the CONTRACTOR. In the event that the DISTRICT exercises this option, the DISTRICT shall pay for any and all work and materials completed or delivered onto the site, and the value of any and all work then in progress and orders actually placed which cannot be canceled up to the date of notice of termination. The value of work and materials paid for shall include a factor of fifteen percent (15%) for the CONTRACTOR's overhead and profit and there shall be no other costs or expenses paid to CONTRACTOR. All work, materials and orders paid for pursuant to this provision shall become the property of the DISTRICT. DISTRICT may, without cause, order CONTRACTOR in writing to suspend, delay or interrupt the Project in whole or in part for such period of time as DISTRICT may determine. Adjustment shall be made for increases in the cost of performance of the Agreement caused by suspense, delay or interruption.

(e) The foregoing provisions are in addition to and not a limitation of any other rights or remedies available to the DISTRICT.

ARTICLE 14. BONDS

Unless otherwise specified in Special Conditions, CONTRACTOR shall furnish a surety bond in an amount equal to one hundred percent (100%) of contract price as security for faithful performance of this Agreement and shall furnish a separate bond in an amount of one hundred percent (100%) of the contract price as security

for payment to persons performing labor and furnishing materials in connection with this Project. Bonds shall be in the form set forth in these Project Documents.

ARTICLE 15. SUBSTITUTION OF SECURITIES

(a) Pursuant to the requirements of Public Contract Code Section 22300, upon CONTRACTOR's request, DISTRICT will make payment to CONTRACTOR of any earned retention funds withheld from payments under this Agreement if CONTRACTOR deposits with the DISTRICT or in escrow with a California or federally chartered bank acceptable to DISTRICT, securities eligible for the investment pursuant to Government Code Section 16430 or bank or savings and loan certificates of deposit, upon the following conditions:

(1) CONTRACTOR shall be the beneficial owner of any securities substituted for retention funds withheld and shall receive any interest thereon.

(2) All expenses relating to the substitution of securities under said Section 22300 and under this Article 15 , including, but not limited to DISTRICT's overhead and administrative expenses, and expenses of escrow agent shall be the responsibility of the CONTRACTOR.

(3) If CONTRACTOR shall choose to enter into an escrow agreement, such agreement shall be in the form as set forth in Public Contract Code section 22300(f) attached hereto as part of the Project Documents and which shall allow for the conversion to cash to provide funds to meet defaults by the CONTRACTOR including, but not limited to, termination of the CONTRACTOR's control over the work, stop notices filed pursuant to law, assessment of liquidated damages or amount to be kept or retained under the provisions of the Project Documents.

(4) Securities, if any, shall be returned to CONTRACTOR only upon satisfactory completion of the Agreement.

(b) To minimize the expense caused by such substitution of securities, CONTRACTOR shall, prior to or at the time CONTRACTOR requests to substitute security, deposit sufficient security to cover the entire amount to be then withheld and to be withheld under the General Conditions of this Agreement . Should the value of such substituted security at any time fall below the amount for which it was substituted, or any other amount which the DISTRICT determines to withhold, CONTRACTOR shall immediately, and at CONTRACTOR's expense, deposit additional security qualifying under said Section 22300 until the total security deposited is no less than equivalent to the amount subject to withholding under the Agreement.

(c) In the alternative, under Section 22300, CONTRACTOR, at its own expense, may request DISTRICT to make payment of earned retention funds directly to the escrow agent. Also at the expense of CONTRACTOR, CONTRACTOR may direct investment of the payments into securities, and CONTRACTOR shall receive the interest earned on the investment upon the same conditions as shown in paragraph (a) for securities deposited by CONTRACTOR. Upon satisfactory completion of the Agreement, CONTRACTOR shall receive from the escrow agent all securities, interest and payments received by the escrow agent from DISTRICT, pursuant to the terms of Section 22300.

(d) If any provision of this Article 15 shall be found to be illegal or unenforceable, then, notwithstanding, this Article 15 shall remain in full force and effect, and such provision shall be deemed stricken.

ARTICLE 16. FIRE INSURANCE

CONTRACTOR will procure at CONTRACTOR's own expense, and before commencement of any work under this Agreement, fire insurance on the Project. Amount of fire insurance shall be sufficient to protect against loss or damage in full until work is accepted by DISTRICT. CONTRACTOR shall submit proof of insurance and shall provide endorsements on forms provided by the DISTRICT or on forms approved by the DISTRICT.

ARTICLE 17. PUBLIC LIABILITY AND PROPERTY DAMAGE INSURANCE

(a) CONTRACTOR shall take out and maintain during the life of this Agreement such public liability and property damage insurance as shall protect CONTRACTOR and DISTRICT from all claims for personal injury, including accidental death, to any person (including, as to DISTRICT, injury or death to CONTRACTOR's or subcontractor's employees), as well as from all claims for property damage arising from operations under this Agreement, in amounts as set forth in the Agreement.

(b) CONTRACTOR shall require its subcontractors, if any, to take out and maintain similar public liability and property damage insurance in like amounts or insure the activities of its subcontractors in CONTRACTOR's own policy.

(c) CONTRACTOR, during the progress of the work and until final acceptance of the work by DISTRICT upon completion of the entire Agreement, shall maintain Builder's Risk/ "All Risk," course-of-construction insurance in an amount not less than as set forth in the Agreement. Coverage is to provide extended coverage and insurance against vandalism, malicious mischief, perils of fire, sprinkler leakage, civil authority, sonic boom, earthquake, collapse, flood, wind, lightning, smoke, riot, debris removal (including demolition), and reasonable compensation for ARCHITECT's services and expenses required as a result of such insured loss upon the entire work which is the subject of the Project Documents, including completed work, work in progress to the full insurable amount thereof, and temporary field offices placed at the project site by the Contractor or District Consultants in conjunction with the Project. The risk of damage to the work due to the perils covered by the Builder's Risk/"All Risk" Insurance, as well as any other hazards which might result in damage to the work, is that of CONTRACTOR and the surety, and no claims for such loss or damage shall be recognized by DISTRICT nor will such loss or damage excuse the complete and satisfactory performance of the Agreement by CONTRACTOR.

(d) CONTRACTOR shall submit proof of insurance and shall provide endorsements on the forms provided by the DISTRICT or on forms approved by the DISTRICT. Such insurance shall be issued by admitted surety insurers under the same conditions as required for bonds on the Project.

ARTICLE 18. WORKERS' COMPENSATION INSURANCE

(a) In accordance with the provisions of Section 3700 of the Labor Code, the CONTRACTOR and every subcontractor shall be required to secure the payment of compensation to its employees.

(b) The CONTRACTOR shall provide, during the life of the Agreement, workers' compensation insurance for all of its employees engaged in work under this Agreement, on or at the site of the Project, and, in case any of its work is sublet, the CONTRACTOR shall require the subcontractor similarly to provide workers' compensation insurance for all the latter's employees. Any class of employee or employees not covered by a subcontractor's insurance shall be covered by the CONTRACTOR's insurance. In case any class of employees engaged in work under this Agreement, on or at the site of the Project, is not protected under the workers' compensation statute, the CONTRACTOR shall provide or shall cause a subcontractor to provide, adequate insurance coverage for the protection of such employees not otherwise protected before subcontractor commences work. The CONTRACTOR shall file with the DISTRICT certificates of its insurance protecting workers and a thirty (30) day notice shall be provided to DISTRICT before the cancellation or reduction of any policy of CONTRACTOR or subcontractor. CONTRACTOR shall submit proof of insurance and shall provide endorsements on the forms provided by the DISTRICT or on forms approved by the DISTRICT. Such endorsements shall be submitted concurrently with the Project Documents.

ARTICLE 19. PROOF OF CARRIAGE OF INSURANCE

(a) CONTRACTOR shall not commence work nor shall it allow any subcontractor to commence work under this Agreement until all required insurance certificates and endorsements from admitted surety insurers have been obtained and delivered in duplicate to and approved by DISTRICT. Such insurance shall be issued by admitted surety insurers under the same conditions as required for bonds on the Project. CONTRACTOR shall provide proof of insurance on DISTRICT approved forms without revisions.

(b) Certificates and insurance policies shall include the following:

(1) A clause stating:

"This policy shall not be canceled or reduced in required limits of liability or amount of insurance until notice has been mailed to DISTRICT stating date of cancellation or reduction. Date of cancellation or reduction may not be less than thirty (30) days after date of mailing notice."

(2) Language stating in particular those insured, extent of insurance, location and operation to which insurance applies, expiration date, to whom cancellation and reduction notice will be sent, and length of notice period.

(3) Statement that the DISTRICT is an additional insured under the policy described and that such insurance policy shall be primary to any insurance or self-insurance maintained by the DISTRICT.

(c) In case of CONTRACTOR's failure to provide insurance as required by the Agreement, the DISTRICT may, at DISTRICT's option, take out and maintain at the expense of the CONTRACTOR, such insurance in the name of CONTRACTOR, or subcontractor, as the DISTRICT may deem proper and may deduct the cost of taking out and maintaining such insurance from any sums which are due or to become due to the CONTRACTOR under this Agreement.

ARTICLE 20. DRAWINGS AND SPECIFICATIONS

(a) Drawings and Specifications are intended to delineate and describe the Project and its component parts to such a degree as will enable skilled and competent contractors to intelligently bid upon the work, and to carry said work to a successful conclusion.

(b) Drawings and Specifications are intended to comply with all laws, ordinances, rules and regulations of constituted authorities having jurisdiction, and where referred to in the Project Documents, said laws, ordinances, rules and regulations shall be considered as a part of the Agreement within the limits specified. The CONTRACTOR shall bear all expenses of correcting work done contrary to said laws, ordinances, rules and regulations and if the CONTRACTOR performed same (1) without first consulting the ARCHITECT for further instructions regarding said work, or (2) disregarded the ARCHITECT'S instructions regarding said work.

(c) Questions regarding interpretation of drawings and specifications shall be clarified by the ARCHITECT. Before commencing any portion of the work, CONTRACTOR shall carefully examine all drawings and specifications and other information given to CONTRACTOR. CONTRACTOR shall immediately notify ARCHITECT and DISTRICT in writing of any perceived or alleged error, inconsistency, ambiguity, or lack of detail or explanation in the drawings and specifications. If CONTRACTOR or its subcontractors, material or equipment suppliers, or any of their officers, agents, and employees performs, permits, or causes the performance of any work under the Project Documents, which it knows or should have known to be in error, inconsistent, or ambiguous, or not sufficiently detailed or explained, CONTRACTOR shall bear any and all costs arising therefrom including, without limitation, the cost of correction thereof. In the event ARCHITECT determines that CONTRACTOR's requests for clarification or interpretation are not justified or do not reflect adequate competent supervision or knowledge by the CONTRACTOR or his/her subcontractors, CONTRACTOR shall be required to pay ARCHITECT's reasonable and customary fees in processing and responding to such requests. Should the CONTRACTOR commence work or any part thereof without seeking clarification, CONTRACTOR waives any claim for extra work or damages as a result of any ambiguity, conflict or lack of information.

(d) Figured dimensions on drawings shall govern, but work not dimensioned shall be as directed. Work not particularly shown or specified shall be the same as similar parts that are shown or specified. Large-scale drawings shall take precedence over smaller scale drawings as to shape and details of construction. Specifications shall govern as to materials, workmanship, and installation procedures. Drawings and specifications are intended to be fully cooperative and to agree. If CONTRACTOR observes that drawings and specifications are in conflict, CONTRACTOR shall promptly notify the ARCHITECT in writing, and any necessary changes shall be adjusted as provided in the Article entitled "Changes and Extra Work;" provided, however, that the specification calling for the higher quality material or workmanship shall prevail without additional cost to DISTRICT.

(e) Materials or work described in words which so applied has a well-known technical or trade meaning shall be deemed to refer to such recognized standards.

(f) It is not the intention of the Agreement to go into detailed descriptions of any materials and/or methods commonly known to the trade under "trade name" or "trade term." The mere mention or notation of such "trade name" or "trade term" shall be considered a sufficient notice to CONTRACTOR that it will be required to

complete the work so named with all its incidental and accessory items according to the best practices of the trade.

(g) The naming of any material and/or equipment shall mean furnishing and installing of same, including all incidental and accessory items thereto and/or labor necessary to achieve full and complete functioning of the material and/or equipment as per best practices of the trade(s) involved, unless specifically noted otherwise.

(h) ARCHITECT will furnish to CONTRACTOR one (1) complete set of blue-line prints for posting of changes. Additional blue-line prints shall be provided by ARCHITECT upon payment by CONTRACTOR. During the construction period, CONTRACTOR shall maintain the set of blue-line prints in a satisfactory record condition, and shall thoroughly and neatly post, as they occur, all additions, deletions, corrections and/or revisions in the actual construction of the Project. The record drawings must be posted monthly and be current prior to each submission of each certificate of payment.

ARTICLE 21. OWNERSHIP OF DRAWINGS

All plans, drawings, designs, specifications, and other incidental architectural and engineering work or materials and other Project Documents and copies thereof furnished by DISTRICT are DISTRICT's property. They are not to be used in other work and are to be returned to DISTRICT on request at completion of work, and may be used by DISTRICT as it may require, without any additional costs to DISTRICT.

ARTICLE 22. DETAIL DRAWINGS AND INSTRUCTIONS

(a) In case of ambiguity, conflict, or lack of information, ARCHITECT shall furnish additional instructions by means of drawings or otherwise, necessary for proper execution of work. All such drawings and instructions shall be consistent with Project Documents, true developments thereof, and reasonably inferable therefrom. Such additional instructions shall be furnished with reasonable promptness, provided that CONTRACTOR informs the ARCHITECT of the relationship of the request to the critical path of construction.

(b) Work shall be executed in conformity therewith and CONTRACTOR shall do no work without proper drawings and instructions.

(c) The ARCHITECT will furnish necessary additional details to more fully explain the work, which details shall be considered as part of the Project Documents.

(d) Should any details be more elaborate, in the opinion of the CONTRACTOR, than scale drawings and specifications warrant, CONTRACTOR shall give written notice thereof to the ARCHITECT within five (5) days of the receipt of same. In case no notice is given to the ARCHITECT within five (5) days, it will be assumed the details are reasonable development of the scale drawings. In case notice is given, then it will be considered, and if found justified, the ARCHITECT will either modify the drawings or shall recommend to DISTRICT a change order for the extra work involved.

(e) All parts of the described and shown construction shall be of the best quality of their respective kinds and the CONTRACTOR is hereby advised to use all diligence to become fully involved as to the required

construction and finish, and in no case to proceed with the different parts of the work without obtaining first from the ARCHITECT such directions and/or drawings as may be necessary for the proper performance of the work.

(f) If it is found at any time, before or after completion of the work, that the CONTRACTOR has varied from the drawings and/or specifications, in materials, quality, form or finish, or in the amount or value of the materials and labor used, the ARCHITECT shall make a recommendation: (1) that all such improper work should be removed, remade and replaced, and all work disturbed by these changes be made good at the CONTRACTOR's expense; or (2) that the DISTRICT deduct from any amount due CONTRACTOR, the sum of money equivalent to the difference in value between the work performed and that called for by the drawings and specifications. ARCHITECT shall determine such difference in value. The DISTRICT, at its option, may pursue either recommendation made by the ARCHITECT.

ARTICLE 23. SHOP DRAWINGS

(a) CONTRACTOR shall check and verify all field measurements and shall submit to ARCHITECT, with sufficient advance time, six (6) copies, checked and approved by CONTRACTOR, of all shop or setting list drawings, schedules, and materials list required for the work of various trades. ARCHITECT shall review such drawings, schedules and materials list only for conformance with design concept of Project and compliance with information given in Project Documents, and return as approved or disapproved with guidance as to required corrections within fourteen (14) calendar days (and more than 14 calendar days for complex reviews). CONTRACTOR shall make any corrections required by ARCHITECT, file three (3) corrected copies with ARCHITECT, and furnish such other copies as may be needed for construction within fourteen (14) calendar days. ARCHITECT'S approval of such drawings, schedules, or materials list shall not relieve CONTRACTOR from responsibility for deviations unless CONTRACTOR has in writing called ARCHITECT'S attention to such deviations at time of submission and secured ARCHITECT'S written approval, nor shall it relieve CONTRACTOR from responsibility for errors in shop drawings or schedules.

(b) All submittals of shop drawings, catalog cuts, data sheets, schedules and material lists shall be complete and shall conform to contract drawings and specifications.

(c) The term "shop drawing" as used herein shall be understood to include, but not be limited to, detail design calculations, fabrication and installation drawings, lists, graphs and operating instructions.

(d) Shop drawings shall be submitted at a time sufficiently early to allow review of same by the Division of State Architect (DSA) if required, and the ARCHITECT, and to accommodate the rate of construction progress required under the Project Documents. CONTRACTOR will be required to pay ARCHITECT's reasonable and customary fees in order to expedite review of shop drawings which are not submitted in a timely fashion.

(e) All shop drawing submittals shall be accompanied by an accurately completed transmittal form using the format bound herein. Any shop drawing submittal not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for resubmittal. The CONTRACTOR may authorize a material or equipment supplier to deal directly with the ARCHITECT with regard to shop drawings, however, ultimate responsibility for the accuracy and completeness of the information contained in the submittal shall remain with the CONTRACTOR.

(f) Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of shop drawings on various items using a single transmittal form will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. At its option, the CONTRACTOR or Supplier may obtain from the ARCHITECT quantities of the shop drawing transmittal form at reproduction cost.

(g) CONTRACTOR's review and approval of shop drawings shall include the following stamp:

> "The CONTRACTOR has reviewed and approved not only the field dimensions but the construction criteria and has also made written notation regarding any information in the shop drawings that does not conform to the Project Documents. This shop drawing has been coordinated with all other shop drawings received to date by CONTRACTOR and this duty of coordination has not been delegated to subcontractors, material suppliers, the ARCHITECT, or the engineers on this project.
>
> _____
>
> Signature of CONTRACTOR"

(h) Within fourteen (14) calendar days after receipt of shop drawings, the ARCHITECT will return one or more prints of each drawing to CONTRACTOR with his or her comments noted thereon. The CONTRACTOR shall make a complete and acceptable submittal to the ARCHITECT by the second submission of drawings. The DISTRICT shall withhold funds due the CONTRACTOR to cover additional costs of the ARCHITECT'S review beyond the second submission and any other costs incurred by DISTRICT.

(i) If prints of the shop drawing are returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision of said drawing will not be required. If prints of the drawing are returned to the CONTRACTOR marked "MAKE CORRECTIONS NOTED," formal resubmittal of said drawings will not be required. If prints of the drawing are returned to the CONTRACTOR marked "REVISE AND RESUBMIT," the CONTRACTOR shall revise said drawing and shall resubmit six (6) copies of the revised drawing to the ARCHITECT. If prints of the drawing are returned to the CONTRACTOR marked "REJECTED RESUBMIT," the CONTRACTOR shall resubmit six (6) new copies of the drawing to the ARCHITECT.

(j) Fabrication of an item shall not be commenced before the ARCHITECT has reviewed the pertinent shop drawings and returned copies to the CONTRACTOR marked with "NO EXCEPTIONS TAKEN," or "MAKE CORRECTIONS NOTED." Revisions indicated on shop drawings shall be considered as changes necessary to meet the requirements of the Project Documents and shall not be taken as the basis of claims for extra work. The review of such drawings by the ARCHITECT will be limited to checking for general agreement with the Project Documents, and shall in no way relieve the CONTRACTOR of responsibility for errors or omissions contained therein, nor shall such review operate to waive or modify any provision contained in the Project Documents. Fabricating dimensions, quantities of material, applicable code requirements, and other contract requirements shall be the CONTRACTOR's responsibility.

(k) No work represented by required shop drawings shall be purchased or commenced until the applicable submittal has been approved. The work shall conform to the approved shop drawings and all other requirements of the Project Documents. The CONTRACTOR shall not proceed with any related work which may be affected by the work covered under shop drawings until the applicable shop drawings have been approved, particularly where piping, machinery, and equipment and the required arrangements and clearances are involved.

(l) Except where the preparation of a shop drawing is dependent upon the approval of a prior shop drawing, all shop drawings pertaining to the same class or portion of the work shall be submitted simultaneously.

(m) Calculations of a structural nature must be approved by the Division of State Architect.

(n) THE CONTRACTOR SHALL HAVE NO CLAIM FOR DAMAGES OR EXTENSION OF TIME DUE TO ANY DELAY RESULTING FROM THE CONTRACTOR HAVING TO MAKE THE REQUIRED REVISIONS TO SHOP DRAWINGS UNLESS REVIEW BY THE ARCHITECT OF SAID DRAWINGS IS DELAYED BEYOND THE TIME PROVIDED HEREINBEFORE AND THE CONTRACTOR CAN ESTABLISH THAT THE ARCHITECT'S DELAY IN REVIEW ACTUALLY RESULTED IN A DELAY IN THE CONTRACTOR CONSTRUCTION SCHEDULE. CONTRACTOR SHALL NOT BE ENTITLED TO ANY CLAIM FOR DAMAGES RESULTING FROM DSA REVIEW EXTENDING BEYOND FIFTEEN (15) CALENDAR DAYS AFTER SUBMITTAL. HOWEVER, DISTRICT MAY CONSIDER AN EXTENSION OF TIME DUE TO ANY DELAY CAUSED BY DSA REVIEW.

ARTICLE 24. LAYOUT AND FIELD ENGINEERING

All field engineering if required for laying out of work and establishing grades for earthwork operations shall be furnished by CONTRACTOR at its expense. Such work shall be done by a qualified civil engineer approved by the DISTRICT.

ARTICLE 25. SOILS INVESTIGATION REPORT

(a) When a soils investigation report has been obtained from test holes at the site, such report is available for the CONTRACTOR'S use for work under this Agreement. Such report shall not be part of the Agreement. Any information obtained from such report or any information given on the project documents as to surface and subsurface soil condition or to elevations of existing grades or elevations of underlying rock is approximate only, is not guaranteed and does not form a part of the Agreement. CONTRACTOR is required to make a visual examination of site and must make whateer test CONTRACTOR deems appropriate to determine surface and subsurface soil conditions. If, during the course of work under this Agreement, CONTRACTOR encounters subsurface or latent conditions which differ materially from those indicated in the soils investigation report, then CONTRACTOR shall notify the DISTRICT within five (5) working days of discovery of the condition.

WARNING: DISTRICT does not warrant the soils at the project site nor any information contained in any soils report. Soils investigation report is provided for CONTRACTOR'S information only. CONTRACTOR must conduct an independent investigation of the project site and the soils conditions of the site. DISTRICT does not warrant the soils conditions of the site and CONTRACTOR is fully responsible to ascertain site conditions for the purposes of determining construction means and methods prior to commencing construction.

(b) CONTRACTOR agrees that no claim against DISTRICT will be made by CONTRACTOR for damages and hereby waives any rights to damages in the event that during progress of work CONTRACTOR encounters subsurface or latent conditions at the worksite materially different from those shown on project documents.

ARTICLE 26. TESTS AND INSPECTIONS

(a) Tests and inspections will comply with California Code of Regulations and with all other laws, ordinances, rules, regulations, or orders of public authorities having jurisdiction over the Project.

(b) If the Agreement, DISTRICT's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, CONTRACTOR shall give notice in accordance with such authority of its readiness for observation or inspection at least two (2) working days prior to being tested or covered up. If inspection is by authority other than DISTRICT, CONTRACTOR shall inform the DISTRICT's Inspector of the date fixed for such inspection. Required certificates of inspection shall be secured by CONTRACTOR. Observations by DISTRICT's Inspector shall be promptly made, and where practicable, at source of supply. If any work should be covered up without approval or consent of DISTRICT's Inspector, it must be uncovered for examination and satisfactorily reconstructured at CONTRACTOR's expense in compliance with the Agreement. Costs of tests, inspections and any materials found to be not in compliance with the Agreement shall be paid for by CONTRACTOR. Other costs for test and inspection shall be paid by the DISTRICT.

ARTICLE 27. TRENCHES

(a) CONTRACTOR shall provide adequate sheeting, shoring, and bracing, or equivalent method, for the protection of life and limb in trenches and open excavation, which conform to applicable safety standards.

(b) If this Agreement involves the excavation of any trench or trenches five (5) feet or more in depth, and the Project cost is in excess of $25,000, the CONTRACTOR shall, in advance of excavation, submit to the DISTRICT for acceptance or to whomever DISTRICT designates which may include a registered civil or structural engineer employed by the DISTRICT to whom authority to accept has been delegated, a detailed plan showing the design of shoring, bracing, sloping or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trench or trenches. If such plan varies from the Shoring System Standards established by the Construction Safety Orders of the Division of Industrial Safety, the plan shall be prepared by a registered civil or structural engineer employed by the CONTRACTOR, and all costs therefore shall be included in the price named in the Agreement for completion of the work as set forth in the Project Documents. In no case shall such plan be less effective than that required by the Construction Safety Orders. No excavation of such trench or trenches shall be commenced until said plan has been accepted by CAL-OSHA and a CAL-OSHA permit for such plan delivered to the DISTRICT. Labor Code Section 6500 and 6705; Health and Safety Code Section 17922.5)

(c) If this Agreement involves the digging of trenches or excavations that extend deeper than four feet below the surface, the following shall apply pursuant to Public Contract Code section 7104:

(1) The CONTRACTOR shall promptly, and before the following conditions are disturbed, notify the DISTRICT, in writing, of any:

(i) Material that the CONTRACTOR believes may be material that is hazardous waste, as defined in Section 25117 of the Health and Safety Code that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.

(ii) Subsurface or latent physical conditions at the site different from those indicated.

(iii) Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the contract.

(2) The DISTRICT shall promptly investigate the conditions, and if it finds that the conditions do materially so differ, or do involve hazardous waste, and cause a decrease or increase in the CONTRACTOR's cost of, or the time required for, performance of any part of the work shall issue a change order under the procedures described in the Project Documents.

(3) In the event a dispute arises between the DISTRICT and the CONTRACTOR, whether the conditions materially differ or involve hazardous waste, or cause a decrease or increase in the CONTRACTOR's cost of, or time required for, performance of any part of the work, the CONTRACTOR shall not be excused from any scheduled completion date provided for by the Project Documents, but shall proceed with all the work to be performed under the Project Documents. The CONTRACTOR shall retain any and all rights provided either by contract or by law which pertain to the resolution of disputes and protests between the contracting parties.

ARTICLE 28. DOCUMENTS ON WORK

CONTRACTOR shall keep on the job site at all times one legible copy of all Project Documents, including addenda and change orders, and all approved drawings, plans, schedules and specifications. Said Documents shall be kept in good order and available to ARCHITECT, ARCHITECT s representatives, and all authorities having jurisdiction. CONTRACTOR shall be acquainted with and comply with all California Code of Regulations provisions relating to conditions on this Project.

ARTICLE 29. STATE AUDIT

Pursuant to and in accordance with the provisions of Government Code Section 8546.7, or any amendments thereto, all books, records and files of the DISTRICT, the CONTRACTOR, or any subcontractor connected with the performance of this Agreement involving the expenditure of public funds in excess of Ten Thousand Dollars ($10,000.00), including, but not limited to, the costs of administration of the Agreement, shall be subject to the examination and audit of the State Auditor at the request of the DISTRICT or as part of any audit of the DISTRICT for a period of three (3) years after final payment is made under this Agreement .

ARTICLE 30. SUBSTITUTIONS

(a) Prior to Bid Opening. Should the bidder wish to request prior to bid opening, any substitution for the materials, process, service or equipment specified, the bidder shall submit a written request at least ten (10) working days before the bid opening date and hour. If the substituted item is acceptable, the DISTRICT will approve it in an Addendum issued to all bidders of record. Requests received less than ten (10) working days prior to bid opening will not be considered. DISTRICT shall only consider substitution requests from the bidder submitting the bid for the project.

(b) After Bid Opening and Prior to Award of Contract. If the bidder clearly indicates in its bid that it is proposing to use an "equal" product, the brand name or trade name, if any, of a proposed substitute item shall be inserted in the spaces provided on the *SUBSTITUTION REQUEST FORM*. **Any submittal provided after the aforementioned deadline will not be considered.** If the bidder fails to indicate an "equal" product, its bid shall be considered as offering the material, process, service or equipment referred to by the brand name or trade name specified. It is expressly understood and agreed to by the bidder that the DISTRICT reserves the right to reject any such proposed substituted item. It is further expressly understood and agreed by bidder that in the event the DISTRICT rejects a proposed "equal" item, the bidder will then supply the material; process, service or equipment designated by brand name or trade name or a substitute therefore which meets with the approval of the DISTRICT.

The *SUBSTITUTION REQUEST FORM:*. Requests for substitutions of products, materials, or processes in place of a Specified Item must in writing on the District's Substitution Request Form ("Request Form") at the time of submitting bids to the District. The *SUBSTITUTION REQUEST FORM* must be accompanied by evidence as to whether the proposed substitution:

1. Is equal in quality/service/ability to the Specified Item;
2. Will entail no changes in detail, construction, and scheduling of related work;
3. Will be acceptable in consideration of the required design and artistic effect;
4. Will provide no cost disadvantage to the District;
5. Will require no excessive or more expensive maintenance, including adequacy and availability of replacement parts; and
6. Will required no change of the construction schedule.

In completing the *SUBSTITUTION REQUEST FORM*, the bidder must state, with respect to each requested substitution, whether the bidder will agree to provide the Specified Item in the event that the District denies the bidder's request for such requested substitution. In the event that the bidder has agreed in the Request Form to provide the Specified Item and the District denies the bidder's requested substitution for a Specified Item, the bidder shall provide the Specified Item without any additional cost or charge to the District.

With respect to all proposed substitutions of "equal" items, the bidder shall submit all pertinent and appropriate data substantiating its request for substitutions within fifteen (15) days prior to the award of the contract. DISTRICT shall only consider substitution requests from the bidder submitting the bid for the Project. The DISTRICT is not responsible for locating or securing any information which is not included in such substantiating data. The burden of proof as to the quality or suitability of proposed substituted items shall be borne by the bidder. The DISTRICT shall be the sole judge as to the quality and suitability of proposed substituted items, and decisions of the DISTRICT shall be final and conclusive. Unless extended by the mutual agreement of the parties, the DISTRICT shall notify the successful bidder of the decision concerning the proposed substitution of "equal" items prior to the award of the contract. Also such decisions by the DISTRICT

shall be in writing, and no proposed substituted item shall be deemed approved unless the DISTRICT has so indicated in writing. These time limitations shall be complied with strictly, and in no case will an extension of time for completion be granted because of the bidder's failure to request the substitution of an item at the times and in the manner set forth herein.

(c) Whenever in specifications any materials, process, service or equipment is indicated or specified by brand name, trade name, proprietary name or by name of manufacturer, such specification shall be deemed to be used for the purpose of facilitating description of material, process, service or equipment desired and shall be deemed to be followed by the words "or equal," and CONTRACTOR may, unless otherwise stated, offer any material, process, service, or equipment which shall be substantially equal or better in every respect to that so indicated or specified subject to DISTRICT or ARCHITECT approval.

(d) If material, process, service, or equipment offered by CONTRACTOR is not, in opinion of ARCHITECT, or DISTRICT, substantially equal or better in every respect to that specified, then CONTRACTOR shall furnish the material, process, service, or equipment specified. Burden of proof as to equality of any material, process, service, or equipment shall rest with CONTRACTOR. Provision authorizing submission of "or equal" substantiating data shall not in any way authorize an extension of time for performance of this Agreement.

(e) In the event CONTRACTOR furnishes material, process, service or equipment other than what was specified by the DISTRICT and which has been accepted by the DISTRICT and which later is defective, then CONTRACTOR at its sole cost and expense shall furnish the DISTRICT specified material, process, service or equipment or fully replace with new the defective material process, service or equipment at DISTRICT's discretion.

(f) In the event CONTRACTOR furnishes material, process service, or equipment more expensive than that specified, difference in cost of such material, process, service, or equipment so furnished shall be borne by CONTRACTOR. Any engineering, design fees, or approval agencies' fees required to make adjustments in material or work of all trades directly or indirectly affected by the approved substituted items shall be borne entirely by CONTRACTOR. Any difference in cost between an approved substitution which is lower in cost than the originally specified item shall be refunded or credited by CONTRACTOR to DISTRICT.

(g) Price, fitness and quality being equal with regard to supplies, the District may prefer supplies grown, manufactured, or produced in California and next prefer supplies partially manufactured grown, or produced in California provided the bids of said suppliers or the prices quoted by them do not exceed by more than 5% of the lowest bids/prices quoted by out of state suppliers, the major portion of the manufacture of the supplies is not done outside of California and the public good will be served thereby. (Government Code section 4330-4334)

ARTICLE 31. SAMPLES

(a) CONTRACTOR shall furnish for approval, within thirty-five (35) calendar days following award of contract, all samples as required in specifications together with catalogs and supporting data required by ARCHITECT. This provision shall not authorize any extension of time for performance of the work. ARCHITECT shall review such samples, as to conformance with design concept of work and for compliance

with information given in Project Documents and approve or disapprove same within ten (10) working days from receipt of same.

(b) Unless specified otherwise, sampling, preparation of samples and tests shall be in accordance with the latest standards of the American Society for Testing and Materials.

(c) Samples shall, upon demand of ARCHITECT or DISTRICT, be submitted for tests or examinations and considered before incorporation of same into the work. CONTRACTOR shall be solely responsible for delays due to samples not being submitted in time to allow for tests. Acceptance or rejection will be expressed in writing. Work shall be equal to approved samples in every respect. Samples which are of value after testing will remain the property of the CONTRACTOR.

ARTICLE 32. PROGRESS SCHEDULE

(a) Within five (5) calendar days after Board approval of contract, CONTRACTOR shall submit a preliminary schedule that describes the work sequence planned in the first 30 days of construction. Within 21 calendar days following Board approval of contract, CONTRACTOR shall prepare and submit for DISTRICT's acceptance the Initial Construction Schedule. The schedule shall indicate the beginning and completion dates of all phases of construction and shall use the "critical path method" (commonly called CPM) or equivalent scheduling methodology for the value reporting, planning and scheduling, of all work required under the Project Documents. The schedule will separately identify those milestones or events that must be completed before other portions of the work can be accomplished.

(b) The scheduling is necessary for the DISTRICT's adequate monitoring of the progress of the work and shall be prepared in accordance with the time frame described in Article 4 of the Agreement. The DISTRICT may reject such a schedule and require modification to it if, in the opinion of the ARCHITECT or DISTRICT, adherence to the progress schedule will cause the work not to be completed in accordance with the Agreement. CONTRACTOR shall adhere to any such modifications required by the DISTRICT.

(c) CONTRACTOR will exchange scheduling information with subcontractors and suppliers. CONTRACTOR will order work, equipment and materials with sufficient lead time to avoid interruption of the work.

(d) The CONTRACTOR shall submit to DISTRICT a monthly schedule to reflect the actual sequence of the work which shall be totally separate and apart from the original progress schedule.

(e) The CONTRACTOR shall also, if requested by the ARCHITECT or DISTRICT, provide revised schedules within ten (10) calendar days if, at any time, the ARCHITECT or DISTRICT, consider the completion date to be in jeopardy. The revised schedule shall be designed to show how the CONTRACTOR intends to accomplish the work to meet the original completion date. The form and method employed by the CONTRACTOR shall be the same as for the original progress schedule. The CONTRACTOR shall modify any portions of the schedule that become infeasible because of "activities behind schedule" or for any other valid reason. CONTRACTOR will provide documents and justification for any schedule changes. An activity that cannot be completed by its original completion date shall be deemed to be behind schedule.

(f) CONTRACTOR shall submit a revised schedule within ten (10) consecutive calendar days of CONTRACTOR's request for any extension of time. Failure to submit such schedule will result in CONTRACTOR waiving his/her right to obtain any extension of time.

(g) IT IS AGREED THAT THE DISTRICT OWNS THE "FLOAT" ON THIS PROJECT. IF CONTRACTOR SUBMITS A REVISED SCHEDULE SHOWING AN EARLIER COMPLETION DATE FOR THE PROJECT, DISTRICT□s ACCEPTANCE OF THIS REVISED SCHEDULE SHALL NOT ENTITLE CONTRACTOR TO ANY DELAY CLAIM OR DISRUPTION DAMAGES OR ANY OTHER DAMAGES DUE TO ANY SUCH REVISED SCHEDULE. NOTHING PROVIDED HEREIN SHALL BE CONSTRUED AS A DIRECT, INDIRECT OR IMPLICIT ACCELERATION ORDER TO THE CONTRACTOR.

(h) CONTRACTOR agrees that failure to timely submit the progress schedule, the monthly schedule or any revised progress schedule requested by the ARCHITECT or the DISTRICT may result in delay in payment to CONTRACTOR.

(i) In addition to the requirement to update the baseline schedule, CONTRACTOR is responsible to provide a four week rolling schedule at each progress meeting. This Schedule will include activities that are 1 week behind the Data Date and 3 weeks ahead of the Data Date. The Data Date shall be the date of the progress meeting. Schedule shall include information for all trades on-site. Schedule will identify any work that is proposed outside the regular working hours.

ARTICLE 33. TIME ALLOWANCES

(a) DISTRICT will serve a Notice to Proceed upon Contractor by hand delivery, facsimile, email or delivery to Contractor at legal address.

(b) Start date for Contract Times shall be on the date indicated in the Notice to Proceed. If no date is indicated, then the start date for contract time shall be the 5th calendar day from date that Contractor receives DISTRICT's written Notice to Proceed, unless the Notice to Proceed is served by mail only, then the Start Date under the Contract shall be the tenth (10th) calendar day following the date of mailing. The Contractor shall commence work on such day, and shall prosecute the Work diligently to completion thereafter. No work shall commence before contract bonds and insurance certificates have been filed with the DISTRICT and the contract has been signed by the DISTRICT.

(c) CHANGE OF CONTRACT TIMES

(1) The contract times may only be changed by change order or written amendment and time is of this essence in this Agreement.

(2) The Contract Times will be adjusted in an amount equal to the time lost as shown on a critical path schedule due to the following:

(i) Changes in the Work ordered by DISTRICT;

(ii) Acts or neglect by DISTRICT's consultants, acts or neglect of utility districts, acts or neglect of other Contractors performing other Work, provided Contractor has fully and completely performed its responsibilities under the Contract Documents, including but not limited to, its cooperation and coordination responsibilities required by the Contract Documents;

Fires, floods, abnormal weather conditions, earthquakes, civil disturbances, or acts of God, provided damage resulting from same is not the result of Contractor's failure to properly protect the Work as required by the Contract Documents. Notwithstanding the foregoing, the contract times shall not be extended unless Contractor has actually been prevented from completing any part of the Work within the contract time due to delay which is (i) beyond the control of Contractor and (ii) due to reasons for which Contractor is not responsible and (iii) a claim for delay is made as provided for herein. Delays attributable to and within the control of a Subcontractor, or its subcontractors, or supplier shall be deemed to be delays within the control of Contractor.

Contractor shall have no right to an adjustment in the time of completion due to weather conditions which are normal for the locality of the site. The time period for completion of the project has been determined with consideration given to the average climatic range prevailing in the locality of the site.

(3) Where Contractor is prevented from completing any part of the Work within the contract due to delay beyond the control of both DISTRICT and Contractor, an extension of contract times in an amount equal to the time loss due to such delay shall be the Contractor's sole and exclusive remedy for such delay. DISTRICT shall not be liable to Contractor, any Subcontractor, any supplier, or any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from (i) delays caused by or within the control of Contractor, or (ii) delays beyond the control of both parties including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God or acts or neglect by utility districts.

(4) Delays due to adverse weather conditions will not be allowed for weather conditions which do not directly impact the performance of the critical path. Whenever the Contractor has undertaken an exterior critical path activity which is directly impacted by adverse weather conditions, the Contractor shall immediately notify the DISTRICT of the potential delay to such activity. The DISTRICT shall inspect the site, meet with the Contractor and confirm that the exterior critical path activity is impacted and grant an extension of the Contract Times sufficient to allow the Contractor to perform the impacted activity.

(5) If delays acceptable for evaluation occur concurrently, the maximum extension of the Contract time shall be the number of days from the commencement of the first delay to the cessation of the delay which ends last.

(6) Delay in completion of the Work beyond the expiration of the contract time resulting from causes other than those listed as acceptable for evaluation are considered inexcusable delays and shall not entitle the Contractor to an extension of the contract time or an adjustment of the Contract amount.

If an inexcusable delay occurs concurrently with acceptable delays for evaluation, the maximum extension of the Contract Time shall be the number of days, if any, by which the duration of a delay exceeds the inexcusable delay. The duration of concurrence is non-compensable.

(d) NOTICE OF DELAY

(1) Notice shall constitute application for extension of time only if notice requests extension and sets forth the impact of the delay on the critical path and Contractor's estimate of additional time required together with full recital of causes of unavoidable delays relied upon.

(2) After receipt of a request for a time extension, with verifiable documents and justifications included, DISTRICT will make decision thereon, and will advise Contractor in writing.

(3) No time extensions shall be considered without related documents and justifications necessary for DISTRICT to make determination.

(4) No time extensions shall be granted for delays for which Contractor fails to give timely notice and Contractor hereby waives any and all damages for delay for which timely notice is not given.

(5) Any request for extension of time shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant is entitled as a result of the occurrence of said event. All claims and adjustments in the contract times shall be determined by DISTRICT. No claim for an adjustment in the contract times will be valid and such claim will be waived if not submitted in accordance with the requirements of this paragraph.

(6) The Contractor's failure to perform in accordance with the construction schedule shall not be excused because the Contractor has submitted time extension requests, unless and until such requests are approved by DISTRICT.

(e) NO DAMAGE FOR CONTRACTOR CAUSED DELAY

Contractor shall not be entitled to any compensation, including but not limited to extended field or home office overhead, field supervision, costs of capital, interest, escalation charges, acceleration costs or other impacts for any delays caused in whole or in part by Contractor's failure to perform its obligations under this Contract, or during periods of delay concurrently caused by Contractor and either DISTRICT or others. Contractor may be compensated for delays caused directly and solely by DISTRICT except that Contractor shall not be entitled to damages for delay to the Work caused by the following reasons:

(1) DISTRICT's right to sequence Work in manner which would avoid disruption to the DISTRICT's tenants and their contractors or other prime contractors and their respective subcontractors, exercised as a result of Contractor's failure to perform its cooperation and coordination responsibilities required by this Contract;

(2) DISTRICT's enforcement of government act or regulation, or the provisions of the Contract Documents; and

(3) Extensive requests for clarifications to construction documents or modifications to contract, provided such clarifications or modifications are processed by DISTRICT or its consultants in a reasonable time commensurate with provisions of Contract requirements.

(f) EXTENSION OF TIME DOES NOT WAIVE DISTRICT'S RIGHTS

Granting of time extension for any reason shall in no way operate as waiver on part of DISTRICT, of right to collect liquidated damages for other delays or of right to collect other damages or other rights to which DISTRICT is entitled.

ARTICLE 34. MATERIALS AND WORK

(a) Except as otherwise specifically stated in this Agreement, CONTRACTOR shall provide and pay for all materials, supplies, tools, equipment, labor transportation, superintendence, temporary constructions of every nature, and all other services and facilities of every nature whatsoever necessary to execute and complete the Project within specified time.

(b) Unless otherwise specified, all materials shall be new and the best of their respective kinds and grades as noted or specified, and workmanship shall be of good quality.

(c) Materials shall be furnished in ample quantities and at such times as to insure uninterrupted progress of work and shall be stored properly and protected as required. DISTRICT has no obligation to pay for any prefabricated material stored offsite until delivered and installed to the jobsite and inspected and approved by the inspector of record.

(d) CONTRACTOR shall, after issuance of the Notice to Proceed by DISTRICT, place orders for materials and/or equipment as specified so that delivery of same may be made without delays to the work. CONTRACTOR shall, upon demand from the ARCHITECT, furnish to the ARCHITECT documentary evidence showing that orders have been placed.

(e) DISTRICT reserves the right, for any neglect in not complying with the above instructions, to place orders for such materials and/or equipment as it may deem advisable in order that the work may be completed at the date specified in the Agreement, and all expenses incidental to the procuring of said materials and/or equipment shall be paid for by the CONTRACTOR.

(f) No materials, supplies, or equipment for work under this Agreement shall be purchased subject to any chattel mortgage or under a conditional sale or other agreement by which an interest therein or in any part thereof is retained by seller or supplier. CONTRACTOR warrants good title to all material, supplies, and equipment installed or incorporated in work and agrees upon completion of all work to deliver premises, together with all improvements and appurtenances constructed or placed thereon by it, to DISTRICT free from any claims, liens, or charges. CONTRACTOR further agrees that neither it nor any person, firm, or corporation furnishing any materials or labor for any work covered by this Agreement shall have any right to lien upon premises or any improvement or appurtenance thereon, except that CONTRACTOR may install metering devices or other equipment of utility companies or of political subdivisions, title to which is commonly retained by utility company or political subdivision. In the event of installation of any such metering device or equipment, CONTRACTOR shall advise DISTRICT as to owner thereof.

(g) Nothing contained in this Article 33, however, shall defeat or impair the rights of persons furnishing material or labor under any bond given by CONTRACTOR for their protection or any rights under any law permitting such persons to look to funds due CONTRACTOR in hand of DISTRICT, and this provision shall be inserted in all subcontracts and material contracts and notice of its provisions shall be given to all persons furnishing materials or labor when no formal contract is entered into for such materials or labor.

(h) The title to new materials and/or equipment and attendant liability for its protection and safety, shall remain in the CONTRACTOR until incorporated in the work and accepted by the DISTRICT; no part of said materials and/or equipment shall be removed from its place of onsite/offsite storage except for immediate installation in the work; and CONTRACTOR shall keep an accurate inventory of all said materials and/or equipment in a manner satisfactory to the DISTRICT or its authorized representative.

ARTICLE 35. INTEGRATION OF WORK

(a) CONTRACTOR shall do all cutting, fitting, patching, and preparation of work as required to make its several parts come together properly, and fit it to receive or be received by work of other contractors or existing conditions showing upon, or reasonably implied by, the drawings and specifications, and shall follow all directions given by the Architect.

(b) All costs caused by defective or ill-timed work shall be borne by CONTRACTOR.

(c) CONTRACTOR shall not endanger any work by cutting, excavating, or otherwise altering work and shall not cut or alter work of any other contractor without the written consent of the ARCHITECT. CONTRACTOR shall be solely responsible for protecting existing work on adjacent properties and shall obtain all required permits for shoring and excavations near property lines.

(d) When modifying existing work or installing new work adjacent to existing work, CONTRACTOR shall match, as closely as conditions of site and materials will allow, the finishes, textures, and colors of the original work, refinishing existing work as required, at no additional cost to DISTRICT.

(e) CONTRACTOR is aware that this Project may be split into several phases. If the Project is split into phases then CONTRACTOR has made allowances for any delays or damages which may arise from coordination with contractors for other phases. If any delays should arise from a contractor working on a

different phase, CONTRACTOR's sole remedy for damages, including delay damages, shall be against the contractor who caused such damage and not the DISTRICT. CONTRACTOR shall provide access to contractors for other phases as necessary to prevent delays and damages to contractors working on other phases of construction.

ARTICLE 36. OBTAINING OF PERMITS, LICENSES AND EASEMENTS

(a) Permits, licenses, and certificates necessary for prosecution of work, shall be secured and paid for by CONTRACTOR, unless otherwise specified. All such permits, licenses, and certificates shall be delivered to the ARCHITECT before demand is made for the certificate of final payment. CONTRACTOR shall, and shall require subcontractors to, maintain contractors' licenses in effect as required by law.

(b) Easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by DISTRICT, unless otherwise specified.

(c) Permits and charges for installation, and inspection thereof, of utility services by serving utilities shall be secured and paid for by DISTRICT.

ARTICLE 37. SURVEYS

Surveys to determine location of property lines and corners will be supplied by DISTRICT. Surveys to determine locations of construction, grading, and site work, shall be provided by CONTRACTOR.

ARTICLE 38. EXISTING UTILITY LINES; REMOVAL, RESTORATION

(a) Pursuant to Government Code Section 4215, the DISTRICT assumes the responsibility for removal, relocation, and protection of utilities located on the construction site at the time of commencement of construction under this Agreement with respect to any such utility facilities which are not identified in the plans and specifications. The CONTRACTOR shall not be assessed for liquidated damages for delay in completion of the Project caused by failure of the DISTRICT to provide for removal or relocation of such utility facilities. If the CONTRACTOR, while performing work under this Agreement, discovers utility facilities not identified by the DISTRICT in the plans or specifications, CONTRACTOR shall immediately notify the DISTRICT and the utility in writing. CONTRACTOR shall be compensated according to the provisions governing changes in the work.

(b) This Article 37 shall not be construed to preclude assessment against the CONTRACTOR for any other delays in completion of the work. Nothing in this Article shall be deemed to require the DISTRICT to indicate the presence of existing service laterals or appurtenances whenever the presence of such utilities on the construction site can be inferred from the presence of other visible facilities, such as buildings, meter junction boxes, on or adjacent to the site of the construction.

(c) As part of the work to be performed, CONTRACTOR shall provide the notices and proceed in accordance with Government Code Sections 4216.2, 4216.3 and 4216.4, and pay all fees charged pursuant to Government Code Section 4216, et seq.

ARTICLE 39. WORK TO COMPLY WITH APPLICABLE LAWS AND REGULATIONS

(a) CONTRACTOR shall give all notices and comply with all laws, ordinances, rules, and regulations applicable to the work as indicated and specified.

(b) If CONTRACTOR observes that drawings or specifications are at variance therewith, CONTRACTOR shall promptly notify ARCHITECT in writing and any changes deemed necessary by the ARCHITECT shall be adjusted as provided for changes in work. If CONTRACTOR performs any work which it knew, or through exercise of reasonable care should have known, to be contrary to such laws, ordinances, rules or regulations, and without such notice to ARCHITECT, CONTRACTOR shall bear all costs arising therefrom. Where plans, drawings or specifications state that materials, processes, or procedures must be approved by the Division of State Architect, State Fire Marshall, or other body or agency, CONTRACTOR shall be responsible for satisfying requirements of such bodies or agencies.

ARTICLE 40. ACCESS TO WORK

DISTRICT and its representatives shall at all times have access to work wherever it is in preparation or progress. CONTRACTOR shall provide safe and proper facilities for such access so that DISTRICT's representatives may perform their functions.

ARTICLE 41. PAYMENTS BY CONTRACTOR

CONTRACTOR shall pay:

(1) For all transportation and utility services not later than the 20th day of the calendar month following that in which such services are rendered;

(2) For all materials, tools, and other expendable equipment to the extent of ninety percent (90%) of cost thereof, not later than the 20th day of the calendar month following that in which such materials, tools, and equipment are delivered at site of Project and balance of cost thereof not later than the 30th day following completion of that part of work in or on which such materials, tools, and equipment are incorporated or used; and

(3) To each of its subcontractors, not later than the 5th day following each payment to CONTRACTOR the respective amounts allowed CONTRACTOR on account of work performed by respective subcontractor to the extent of such subcontractor's interest therein.

(4) Within seven (7) days from the time that all or any portion of the retentions are received by CONTRACTOR from DISTRICT, to each of its subcontractors from whom retention has been withheld, each subcontractor's share of the retention received. However, if a retention payment received by CONTRACTOR is specifically designated for a particular subcontractor, payment of the retention shall be made to the designated subcontractor, if the payment is consistent with the terms of the subcontract. CONTRACTOR may withhold from a subcontractor its portion of the retentions if a bona fide dispute exists between the subcontractor and the CONTRACTOR. The amount withheld

from the retention shall not exceed one hundred fifty percent (150%) of the estimated value of the disputed amount.

ARTICLE 42. INSPECTOR'S FIELD OFFICE

CONTRACTOR shall provide for the exclusive use of Inspector a temporary field office to be located as directed by Inspector and to be maintained until removal is authorized by DISTRICT. Office shall be of substantial waterproof construction with adequate natural light and ventilation by means of stock design windows. Door shall have a key-type lock or padlock hasp. A table satisfactory for study of plans and two chairs shall be provided by CONTRACTOR. CONTRACTOR shall provide and pay for adequate electric lights, telephone service (not a pay phone), and adequate heat for the field office until authorized removal.

ARTICLE 43. UTILITIES

(a) All utilities, including but not limited to electricity, water, gas, and telephone used on work shall be furnished and paid for by CONTRACTOR. CONTRACTOR shall furnish and install necessary temporary distribution systems, including meters, if necessary, from distribution points to points on site where utility is necessary to carry on the work. When it is necessary to interrupt any existing utility service to make connections, a minimum of forty-eight (48) hours advance notice shall be given to the DISTRICT and ARCHITECT. Interruptions in utility services shall be of the shortest possible duration for the work at hand and shall be approved by the DISTRICT and the ARCHITECT. In the event any utility service is interrupted without the required forty-eight (48) hours notice, then CONTRACTOR shall be liable for all damage suffered by DISTRICT due to the interruption. Upon completion of work, CONTRACTOR shall remove all temporary distribution systems.

(b) CONTRACTOR may, with written permission of DISTRICT, use DISTRICT's existing utilities by making prearranged payments to DISTRICT for utilities used by CONTRACTOR for the Project.

ARTICLE 44. SANITARY FACILITIES

The CONTRACTOR shall provide sanitary temporary toilet and wash facilities in no fewer numbers than required by law and such additional facilities as may be directed by the Inspector for the use of all workers. The toilet facilities shall be maintained in a sanitary condition at all times and shall be left at the site until removal is directed by the Inspector. Use of toilet and wash facilities in the work under construction shall not be permitted.

ARTICLE 45. CLEANING UP

CONTRACTOR at all times shall keep work site free from debris such as waste, rubbish, and excess materials and equipment caused by this work. CONTRACTOR shall not leave debris under, in, or about the work site , but shall promptly remove same. Upon completion of work, CONTRACTOR shall clean interior and exterior of building, including fixtures, equipment, walls, floors, ceilings, roofs, window sills and ledges, horizontal projections, and any areas where debris has collected. CONTRACTOR shall clean and polish all glass, plumbing fixtures, and finish hardware and similar finish surfaces and equipment and remove temporary fencing, barricades, planking, sanitary facilities and similar temporary facilities from site. If CONTRACTOR

fails to clean up, the DISTRICT shall do so and the cost thereof shall be charged to the CONTRACTOR and deducted from any progress payment due.

ARTICLE 46. PATENTS, ROYALTIES, AND INDEMNITIES

The CONTRACTOR shall hold and save the DISTRICT and its governing board, officers, agents, and employees harmless from liability of any nature or kind, including cost and expense, for or on account of any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of this Agreement, including its use by the DISTRICT, unless otherwise specifically provided in the Project Documents, and unless such liability arises from the sole negligence, or active negligence, or willful misconduct of the DISTRICT.

ARTICLE 47. GUARANTEE

(a) CONTRACTOR warrants that the work (which includes any equipment furnished by CONTRACTOR as part of the materials) shall: (a) be free from defects in workmanship and material; (b) be free from defects in any design performed by CONTRACTOR; (c) be new, and conform and perform to the requirements stated in the specifications and where detail requirements are not so stated, shall conform to applicable industry standards; and (d) be suitable for the use stated in the specifications.

(b) The warranty period for discovery of defective work shall commence on the date stamped on the Notice of Completion verifying County recordation and continue for the period set forth in the specifications or for one year if not so specified. If, during the warranty period, the work is not available for use due to defective work, such time of unavailability shall not be counted as part of the warranty period. The warranty period for corrected defective work shall continue for a duration equivalent to the original warranty period.

(c) District shall give CONTRACTOR prompt written notice after discovery of any defective work. CONTRACTOR shall correct any such defective work, as well as any damage to any other part of the work resulting from such defective work, and provide repair, replacement, or reimbursement, at its sole expense, in a manner approved by the DISTRICT and with due diligence and dispatch as required to make the work ready for use by DISTRICT, ordinary wear and tear, unusual abuse or neglect excepted. Such corrections shall include, but not be limited to, any necessary adjustments, modifications, changes of design (unless of DISTRICT's design), removal, repair, replacement or reinstallation, and shall include all necessary parts, materials, tools, equipment, transportation charges and labor as may be necessary, and cost of removal and replacement of work shall be performed at a time and in such a manner so as to minimize the disruption to DISTRICT's use of the work.

(d) In the event of failure of CONTRACTOR or Surety to commence and pursue with diligence said repairs or replacements within ten (10) calendar days after being notified in writing, DISTRICT is hereby authorized to proceed to have defects repaired or replaced and made good at expense of CONTRACTOR and Surety who hereby agree to pay costs and charges therefore immediately on demand.

(e) If, in the opinion of the DISTRICT, defective work creates a dangerous condition or requires immediate correction or attention to prevent further loss to the DISTRICT or to prevent interruption of operations of the DISTRICT, the DISTRICT will attempt to give the written notice required by this Article. If

the CONTRACTOR or Surety cannot be contacted or neither complies with the DISTRICT's requirements for correction within a reasonable time as determined by the DISTRICT, the DISTRICT may, notwithstanding the provisions of this Article, proceed to make such correction or provide such attention and the costs of such correction or attention shall be charged against the CONTRACTOR and Surety. Such action by the DISTRICT will not relieve the CONTRACTOR and Surety of the guarantees provided in this Article or elsewhere in the Project Documents.

(f) This Article does not in any way limit the guarantees on any items for which a longer guarantee is specified or on any items for which a manufacturer gives a guarantee for a longer period. CONTRACTOR shall furnish to DISTRICT all appropriate guarantee or warranty certificates upon completion of the Project or upon request by DISTRICT.

(g) All guarantees required under this Article shall be in writing on the Guarantee form included in the Project Documents.

(h) CONTRACTOR shall provide to DISTRICT instruction manuals for all items which require same.

(i) Nothing herein shall limit any other rights or remedies available to DISTRICT.

(j) The DISTRICT may collect its reasonable costs and attorneys' fees in any action to enforce this Article.

ARTICLE 48. DUTY TO PROVIDE FIT WORKERS

(a) CONTRACTOR and subcontractors shall at all times enforce strict discipline and good order among their employees and shall not employ on work any unfit person or anyone not skilled in work assigned to such person. It shall be the responsibility of CONTRACTOR to ensure compliance with this Article.

(b) Any person in the employ of the CONTRACTOR or subcontractors whom DISTRICT or ARCHITECT may deem incompetent, unfit, troublesome or otherwise undesirable shall be excluded from the work site and shall not again be employed on it except with written consent of DISTRICT.

ARTICLE 49. WAGE RATES, TRAVEL AND SUBSISTENCE

(a) Pursuant to the provisions of Article 2 (commencing at Section 1770), Chapter 1, Part 7, Division 2 of the Labor Code, the governing board of DISTRICT has obtained the general prevailing rate of per diem wages and the general prevailing rate for holiday and overtime work in the locality in which this public work is to be performed for each craft, classification or type of worker needed for this Project from the Director of the Department of Industrial Relations ("Director.") These rates are on file with the Clerk of the DISTRICT's governing board and copies will be made available to any interested party on request. CONTRACTOR shall post a copy of such wage rates at the work site. Labor Code Section 1773.2. The rates are available on the Internet at www.dir.ca.gov "Statistics & Research."

(b) Holiday and overtime work, when permitted by law, shall be paid for at a rate of at least one and one-half times the above specified rate of per diem wages, unless otherwise specified. Holidays shall be defined in the Collective Bargaining Agreement applicable to each particular craft, classification or type of worker employed.

(c) CONTRACTOR shall pay and shall cause to be paid each worker engaged in work on the Project not less than the general prevailing rate of per diem wages determined by the Director, regardless of any contractual relationship which may be alleged to exist between the CONTRACTOR or any subcontractor and such workers.

(d) CONTRACTOR shall pay and shall cause to be paid to each worker needed to execute the work on the Project travel and subsistence payments, as such travel and subsistence payments are defined in the applicable collective bargaining agreements filed with the Department of Industrial Relations in accordance with Labor Code Section 1773.8.

(e) If during the period this bid is required to remain open, the Director of Industrial Relations determines that there has been a change in any prevailing rate of per diem wages in the locality in which this public work is to be performed, such change shall not alter the wage rates in the Notice Calling for Bids or the contract subsequently awarded.

(f) Pursuant to Labor Code Section 1775, CONTRACTOR shall as a penalty to the DISTRICT, forfeit fifty dollars ($50) for each calendar day, or portion thereof, for each worker paid less than the prevailing rate of per diem wages, determined by the Director, for such craft or classification in which such worker is employed for any public work done under the Agreement by CONTRACTOR or by any subcontractor under it. The amount of the penalty shall be determined by the Labor Commission and shall be based on consideration of the CONTRACTOR's mistake, inadvertence or neglect in failing to pay the correct prevailing rate of per diem wage, or the previous record of the CONTRACTOR in meeting his or her prevailing rate of per diem wage obligations, or the CONTRACTOR's willful failure to pay the correct prevailing rate of per diem wages. A mistake, inadvertence or neglect in failing to pay the correct prevailing rate of per diem wage is not excusable if the CONTRACTOR had knowledge of his or her obligations under this part. The difference between such prevailing rate of per diem wage and the amount paid to each worker for each calendar day or portion thereof for which each worker was paid less than the prevailing rate of per diem wage shall be paid to each worker by the CONTRACTOR.

(g) Any worker employed to perform work on the Project, which work is not covered by any craft or classification listed in the general prevailing rate of per diem wages determined by the Director shall be paid not less than the minimum rate of wages specified therein for the craft or classification which most nearly corresponds to work to be performed by them, and such minimum wage rate shall be retroactive to time of initial employment of such person in such craft or classification.

(h) Pursuant to Labor Code Section 1773.1, per diem wages are deemed to include employer payments for health and welfare, pension, vacation, travel time, and subsistence pay as provided for in Labor Code Section 1773.8.

(i) CONTRACTOR shall post at appropriate conspicuous points on the site of the Project, a schedule showing all determined minimum wage rates and all authorized deductions, if any, from unpaid wages actually earned.

ARTICLE 50. HOURS OF WORK

(a) As provided in Article 3, (commencing at Section 1810), Chapter 1, Part 7, Division 2 of the Labor Code, eight (8) hours of labor shall constitute a legal day's work. The time of service of any worker employed at any time by the CONTRACTOR or by any subcontractor on any subcontract under this Agreement upon the work or upon any part of the work contemplated by this Agreement shall be limited and restricted by the Agreement to eight (8) hours per day, and forty (40) hours during any one week, except as hereinafter provided. Notwithstanding the provisions hereinabove set forth, work performed by employees of CONTRACTOR in excess of eight (8) hours per day and forty (40) hours during any one week, shall be permitted upon this public work upon compensation for all hours worked in excess of eight (8) hours per day at not less than one and one-half times the basic rate of pay.

(b) The CONTRACTOR shall keep and shall cause each subcontractor to keep an accurate record showing the name of and actual hours worked each calendar day and each calendar week by each worker employed by CONTRACTOR in connection with the work or any part of the work contemplated by this Agreement. The record shall be kept open at all reasonable hours to the inspection of the DISTRICT and to the Division of Labor Standards Enforcement, Department of Industrial Relations.

(c) Pursuant to Labor Code Section 1813, the CONTRACTOR shall pay to the DISTRICT a penalty of Twenty-Five Dollars ($25) for each worker employed in the execution of this Contract by the CONTRACTOR or by any subcontractor for each calendar day during which such worker is required or permitted to work more than eight (8) hours in any one calendar day and 40 hours in any one calendar week in violation of the provisions of Article 3 (commencing at Section 1810), Chapter 1, Part 7, Division 2 of the Labor Code.

(d) Any work necessary to be performed after regular working hours, or on Sundays or other holidays shall be performed without additional expense to DISTRICT.

ARTICLE 51. PAYROLL RECORDS

(a) Pursuant to the provisions of Labor Code Section 1776, the CONTRACTOR shall keep and shall cause each subcontractor performing any portion of the work under this Agreement to keep an accurate payroll record, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by CONTRACTOR in connection with the work.

(b) The payroll records enumerated under subdivision (a) shall be certified and shall be available for inspection at all reasonable hours at the principal office of the CONTRACTOR on the following basis:

(1) A certified copy of an employee's payroll record shall be made available for inspection or furnished to the employee or his or her authorized representative on request.

(2) A certified copy of all payroll records enumerated in subdivision (a) shall be made available for inspection or furnished upon request to a representative of the DISTRICT, the Division of Labor Standards Enforcement, and the Division of Apprenticeship Standards of the Department of Industrial Relations.

(3) A certified copy of all payroll records enumerated in subdivision (a) shall be made available for inspection upon request by the public or copies thereof made; provided, however, that a request by the public shall be made through either the District, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement. If the requested payroll records have not been provided pursuant to paragraph (2), the requesting party shall, prior to being provided the records, reimburse the costs of preparation by the CONTRACTOR, subcontractors, and the entity through which the request was made. The public shall not be given access to the records at the principal office of the CONTRACTOR.

(4) The form of certification shall be as follows:

I, _____ (Name-print), the undersigned, am _____ (position in business) with the authority to act for and on behalf of

_____ (Name of business and/or CONTRACTOR), certify under penalty of perjury that the records or copies thereof submitted and consisting of _____

(description, number of pages) are the originals or true, full and correct copies of the originals which depict the payroll record(s) of the actual disbursements by way of cash, check, or whatever form to the individual or individuals named.

Dated: _____ Signature: _____

(c) Contractor shall file a certified copy of the payroll records enumerated in subdivision (a) with the entity that requested the records within ten (10) days after receipt of a written request. In the event that the CONTRACTOR fails to comply within the 10-day period, the CONTRACTOR shall, as a penalty to the DISTRICT, forfeit Twenty-Five Dollars ($25) for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement, these penalties shall be withheld from progress payments then due.

(d) Any copy of payroll records made available for inspection as copies and furnished upon request to the public by the DISTRICT, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement shall be marked or obliterated in such a manner as to prevent disclosure of an individual's name, address, and social security number. The name and address of the CONTRACTOR shall not be marked or obliterated.

(e) The CONTRACTOR shall inform the DISTRICT of the location of the payroll records enumerated under subdivision (a), including the street address, city and county, and shall, within five (5) working days, provide a written notice of a change of location and address.

(f) It shall be the responsibility of the CONTRACTOR to ensure compliance with the provisions of this Article 50 and the provisions of Labor Code Section 1776.

ARTICLE 52. APPRENTICES

(a) The CONTRACTOR acknowledges and agrees that, if this Agreement involves a dollar amount greater than or a number of working days greater than that specified in Labor Code Section 1777.5, this Agreement is governed by the provisions of Labor Code Section 1777.5. It shall be the responsibility of the CONTRACTOR to ensure compliance with this Article 51 and with Labor Code Section 1777.5 for all apprenticing occupations.

(b) Apprentices of any crafts or trades may be employed and, when required by Labor Code Section 1777.5, shall be employed provided they are properly registered in full compliance with the provisions of the Labor Code.

(c) Every such apprentice shall be paid the standard wage paid to apprentices under the regulations of the craft or trade at which he or she is employed, and shall be employed only at the work of the craft or trade to which he or she is registered.

(d) Only apprentices, as defined in Section 3077, who are in training under apprenticeship standards and written apprentice agreements under Chapter 4 (commencing at Section 3070), Division 3 of the Labor Code, are eligible to be employed on public works. The employment and training of each apprenticeship shall be in accordance with the provisions of the apprenticeship standards and apprentice agreements under which he or she is training.

(e) Pursuant to Labor Code Section 1777.5, the CONTRACTOR and any subcontractors employing workers in any apprenticeship craft or trade in performing any work under this Agreement shall employ apprentices in at least the ratio set forth in Section 1777.5 and apply to the applicable joint apprenticeship committee for a certificate approving the CONTRACTOR or subcontractor under the applicable apprenticeship standards for the employment and training of apprentices.

(f) Every contractor and subcontractor shall submit contract award information to the applicable joint apprenticeship committee which shall include an estimate of journeyman hours to be performed under the Agreement, the number of apprentices to be employed and the approximate dates the apprentices will be employed.

(g) If the CONTRACTOR or subcontractor willfully fails to comply with Labor Code Section 1777.5, then, upon a determination of noncompliance by the Chief of the Division of Apprenticeship Standards, the CONTRACTOR or subcontractor shall be subject to the penalties imposed under Labor Code Section 1777.7. Interpretation and enforcement of these provisions shall be in accordance with the rules and procedures of the California Apprenticeship Council.

(h) The CONTRACTOR and all subcontractors shall comply with Labor Code Section 1777.6, which section forbids certain discriminatory practices in the employment of apprentices.

(i) CONTRACTOR shall become fully acquainted with the law regarding apprentices prior to commencement of the work. Special attention is directed to Sections 1777.5, 1777.6, and 1777.7 of the Labor Code, and Title 8, California Code of Regulations, Section 200, et seq. Questions may be directed to the State Division of Apprenticeship Standards, 455 Golden Gate Avenue, 8th Floor, San Francisco, California 94102, (415) 703-4920.

ARTICLE 53. LABOR - FIRST AID

The CONTRACTOR shall maintain emergency first aid treatment for CONTRACTOR's workers on the Project which complies with the Federal Occupational Safety and Health Act of 1970 (29 U.S.C.A., Sec. 651, et seq.).

ARTICLE 54. PROTECTION OF PERSONS AND PROPERTY

(a) The CONTRACTOR shall be responsible for all damages to persons or property that occur as a result of its fault or negligence in connection with the prosecution of this Agreement and shall take all necessary measures and be responsible for the proper care and protection of all materials delivered and work performed until completion and final acceptance by the DISTRICT. CONTRACTOR shall provide such heat, covering, and enclosures as are necessary to protect all work, materials, equipment, appliances, and tools against damage by weather conditions. All work shall be solely at the CONTRACTOR's risk with the exception of damage to the work caused by "acts of God" as defined in Public Contract Code Section 7105.

(b) CONTRACTOR shall take, and require subcontractors to take, all necessary precautions for safety of workers and shall comply with all applicable federal, state, local and other safety laws, standards, orders, rules, regulations, and building codes to prevent accidents or injury to persons on, about, or adjacent to the work site and to provide a safe and healthful place of employment. CONTRACTOR shall furnish, erect and properly maintain at all times, as directed by DISTRICT or ARCHITECT or required by conditions and progress of work, all necessary safety devices, safeguards, construction canopies, signs audible devices for protection of the blind, safety rails, belts and nets, barriers, lights, and watchmen for protection of workers and the public and shall post danger signs warning against hazards created by such features in the course of construction. CONTRACTOR shall designate a responsible employee, whose duty shall be to post information regarding protection and obligations of workers and other notices required under occupational safety and health laws, to comply with reporting and other occupational safety requirements, and to protect the life, safety and health of workers. Name and position of person so designated shall be reported in writing to DISTRICT by CONTRACTOR. CONTRACTOR shall correct any violations of safety laws, standards, orders, rules, or regulations. Upon the issuance of a citation or notice of violation by the Division of Occupational Safety and Health, such violation shall be corrected immediately by the CONTRACTOR at CONTRACTOR's expense.

(c) In an emergency affecting safety of person or of work or of adjoining property, CONTRACTOR, without special instruction or authorization from ARCHITECT or DISTRICT, is hereby permitted to act, at its discretion, to prevent such threatened loss or injury; and CONTRACTOR shall so act if so authorized or instructed by Architect or DISTRICT. Any compensation claimed by CONTRACTOR on account of emergency work shall be determined by written agreement with the DISTRICT.

(d) CONTRACTOR shall take adequate precautions to protect existing roads, sidewalks, curbs, pavements, utilities, adjoining property and structures (including, without limitation, protection from settlement or loss of lateral support), and to avoid damage thereto, and repair any damage thereto caused by construction operations.

(e) CONTRACTOR shall (unless waived by the DISTRICT in writing):

(1) When performing new construction on existing sites, become informed and take into specific account the maturity of the students on the site; perform work which may interfere with school routine before or after school hours; enclose working area with a substantial barricade; not allow any unauthorized individuals on the site; require all workers on the Project to be conspicuously identified either by a firm logo on their clothing or prominent identification badge and arrange work to cause a minimum amount of inconvenience and danger to students and faculty in their regular school activities.

(2) Provide substantial barricades around any shrubs or trees indicated to be preserved.

(3) Deliver materials to building area over route designated by ARCHITECT.

(4) When directed by DISTRICT, take preventive measures to eliminate objectionable dust.

(5) Enforce all instructions of DISTRICT and ARCHITECT regarding signs, advertising, fires, and smoking and require that all workers comply with all regulations while on construction site.

(6) Take care to prevent disturbing or covering any survey markers, monuments, or other devices marking property boundaries or corners. If such markers are disturbed by accident, they shall be replaced by an approved civil engineer at no cost to the DISTRICT.

ARTICLE 55. NON-DISCRIMINATION

In the performance of the terms of this Agreement, CONTRACTOR agrees that it will not engage in nor permit such subcontractor as it may employ to engage in unlawful discrimination in employment of persons because of the race, religious creed, color, national origin, ancestry, physical handicap, medical condition, marital status, age or sex of such persons.

ARTICLE 56. SCHEDULE OF VALUES AND PERIODICAL ESTIMATES

(a) CONTRACTOR shall furnish on form(s) approved by DISTRICT:

(1) Within ten (10) calendar days of award of contract a detailed schedule of values giving complete breakdown of contract price for each component of the Project or site which shall include all subcontractor/supplier agreements showing dollar amounts of these agreements to justify the schedule of values; and

(2) A periodical itemized estimate of work done for purpose of making partial payments thereon. Change order work shall be clearly identified on a separate schedule of values.

(3) Within ten (10) calendar days of request of DISTRICT, a schedule of estimated monthly payments which shall be due CONTRACTOR under the Agreement.

(b) Values employed in making up any of these schedules are subject to the ARCHITECT's written approval and will be used only for determining basis of partial payments and will not be considered as fixing a basis for additions to or deductions from contract price.

ARTICLE 57. CONTRACTOR CLAIMS

If the CONTRACTOR shall claim compensation for any damage sustained by reason of the acts of the DISTRICT or its agents, CONTRACTOR shall, within five (5) calendar days after sustaining of such damage, make to the ARCHITECT a written statement of the damage sustained. On or before the 15th day of the month succeeding that in which such damage shall have been sustained the CONTRACTOR shall file with the DISTRICT an itemized statement of the details and amount of such damage, and unless such statement shall be made as thus required, CONTRACTOR's claims for compensation shall be forfeited and invalidated and it shall not be entitled to consideration for payment on account of any such damage.

ARTICLE 58. DISPUTES - ARCHITECT'S DECISIONS

(a) The ARCHITECT shall, within a reasonable time, make decisions on all matters relating to the CONTRACTOR's execution and progress of the work. The decisions of the ARCHITECT shall not be binding, but shall be advisory only on the CONTRACTOR for the purpose of CONTRACTOR's obligation to proceed with the work.

(b) Except for tort claims, all claims by the CONTRACTOR for a time extension, payment of money or damages arising from work done by, or on behalf of, the CONTRACTOR pursuant to the Agreement and payment of which is not otherwise expressly provided for or the claimant is not otherwise entitled to, or as to the amount of payment which is disputed by the DISTRICT of Three Hundred Seventy Five Thousand Dollars ($375,000) or less shall be subject to the settlement procedures set forth in Public Contract Code Section 20104, et seq. which provisions are incorporated herein by reference.

(c) In the event of a dispute between the parties as to performance of the work, the interpretation of this Agreement or payment or nonpayment for work performed or not performed, the parties shall attempt to resolve the dispute. Pending resolution of the dispute, CONTRACTOR agrees to continue the work diligently to completion. If the dispute is not resolved, CONTRACTOR agrees it will neither rescind the Agreement nor stop the progress of the work, but CONTRACTOR's sole remedy shall be to submit such controversy to determination by a court of the State of California, in Orange County, having competent jurisdiction of the dispute, after the Project has been completed, and not before.

ARTICLE 59. PAYMENTS

(a) Unless otherwise specified in writing, each month within thirty (30) days after receipt by the DISTRICT of the monthly progress schedule and an undisputed, properly submitted payment request from CONTRACTOR which has been certified for payment by the Architect, there shall be paid to CONTRACTOR a sum equal to ninety percent (90%) of value of work performed and of materials delivered to the jobsite and inspected and approved by the inspector of record and subject to or under the control of the DISTRICT and unused up to the last day of the previous month, less aggregate previous payments. Public Contract Code Section 20104.50 Monthly payments shall be made only on the basis of monthly estimates which shall be prepared by CONTRACTOR on a form approved by DISTRICT and filed before the fifth day of the month during which payment is to be made. Work completed as estimated shall be an estimate only and no inaccuracy or error in said estimate shall operate to release CONTRACTOR or Surety from any damages arising from such work or from enforcing each and every provision of this Agreement , and DISTRICT shall have the right subsequently to correct any error made in any estimate for payment. CONTRACTOR SHALL NOT BE ENTITLED TO HAVE ANY PAYMENT ESTIMATES PROCESSED OR BE ENTITLED TO HAVE ANY PAYMENT FOR WORK PERFORMED SO LONG AS ANY LAWFUL OR PROPER DIRECTION CONCERNING WORK, OR ANY PORTION THEREOF, GIVEN BY THE DISTRICT OR ARCHITECT SHALL REMAIN UNCOMPLIED WITH BY THE CONTRACTOR. CONTRACTOR AGREES TO THE TEN PERCENT (10%) RETENTION ON ALL PROGRESS PAYMENTS. Public Contract Code Section 9203.

(b) DISTRICT has discretion to require from the CONTRACTOR any of the following information with the application for payment: (i) certified payroll covering the period of the prior application for payment; (ii) unconditional waivers and releases from all subcontractors/suppliers for which payment was requested under the prior application for payment; and/or (iii) receipts or bills of sale for any items. CONTRACTOR agrees that payment may be contingent upon District receiving any one or more of these documents.

(c) Before payment is made hereunder, a certificate in writing shall be obtained from the ARCHITECT stating that the work for which the payment is demanded has been performed in accordance with the terms of the Project Documents and that the amount stated in the certificate is due under the terms of the Project Documents, which certificate shall be attached to and made a part of the claim made and filed with the DISTRICT, provided that if the ARCHITECT shall, within three (3) days after written demand therefore, fail to deliver such certificate to the DISTRICT, the CONTRACTOR may file its claim with the DISTRICT without said certificate, but together with such claim shall be filed a statement that demand was made for such certificate and that the same was refused. Thereupon, the DISTRICT will either allow said claim as presented or shall, by an order entered on the minutes of said DISTRICT state the reasons for refusing to allow said claim. It is understood, moreover, that the certificate of the ARCHITECT shall not be conclusive upon the DISTRICT, but advisory only.

(d) Upon receipt of CONTRACTOR's payment request, DISTRICT shall review the payment request as soon as practicable after receipt for the purpose of determining that the payment request is proper. Any payment request determined not to be proper shall be returned to the CONTRACTOR as soon as practicable but not later than seven (7) days after receipt and shall be accompanied by a document setting forth in writing the reasons(s) why the payment request was not proper. Public Contract Code Section 20104.50

(e) NO PAYMENT BY DISTRICT HEREUNDER SHALL BE INTERPRETED SO AS TO IMPLY THAT DISTRICT HAS INSPECTED, APPROVED, OR ACCEPTED ANY PART OF THE WORK.

(f) Unless otherwise provided, on or before making request for final payment of the undisputed amount due under the Agreement, CONTRACTOR shall submit to DISTRICT, in writing a summary of all claims for compensation under or arising out of this Agreement which were timely filed. The acceptance by CONTRACTOR of the payment of the final amount shall constitute a waiver of all claims against DISTRICT under or arising out of this Agreement, except those previously made, in a timely manner and in writing, and identified by CONTRACTOR as unsettled at the time of CONTRACTOR's final request for payment.

(g) CONTRACTOR shall pay each of its subcontractors from whom retention has been withheld each subcontractor's share of the retention received within seven (7) days from the time that all or any portion of the retention are received by the CONTRACTOR subject to any limitations set forth in Public Contract Code Section 7107(e).

(h) The final payment of the ten percent (10%) retention of the value of the work done under this Agreement, if unencumbered, shall be made thirty-five (35) days after recording by the DISTRICT of the Notice of Completion at the County Recorder's Office. APPROVAL OF COMPLETION OF THE PROJECT WILL BE MADE ONLY BY ACTION OF THE GOVERNING BOARD OF DISTRICT. Public Contract Code Section 7107.

ARTICLE 60. CHANGES AND EXTRA WORK

(a) DISTRICT may, as provided by law and without affecting the validity of this Agreement, order changes, modifications, deletions and extra work by issuance of written change orders from time to time during the progress of the Project, contract sum being adjusted accordingly. All such work shall be executed under conditions of the original Agreement except that any extension of time caused thereby shall be adjusted at time of ordering such change. DISTRICT has discretion to order changes on a "time and material" basis with adjustments to time made after CONTRACTOR has justified through documentation the impact on the critical path of the Project.

(b) Notwithstanding any other provision in the Project Documents, the adjustment in the contract sum, if any, and the adjustment in the contract time, if any, set out in a change order shall constitute the entire compensation and/or adjustment in the contract time due CONTRACTOR arising out of the change in the work covered by the change order unless otherwise provided in the change order. The amount of the compensation due CONTRACTOR shall be calculated pursuant to subparagraph (e) of this Article 59. The entire compensation shall not include any additional charges not set forth in subparagraph (e) and shall not include delay damages (due to processing of a change order, refusal to sign a change order) indirect, consequential, and incidental costs including any project management costs, extended home office and field office overhead, administrative costs and profit other than those amounts authorized under subparagraph (e) of this Article 59.

(c) In giving instructions, ARCHITECT shall have authority to make minor changes in work, not involving change in cost, and not inconsistent with purposes of the Project. Otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless in pursuance of a written order from DISTRICT, authorized by action of the governing board, and no claim for addition to contract sum shall be valid unless so ordered.

(d) If the ARCHITECT determines that work required to be done constitutes extra work outside the scope of the Agreement, the ARCHITECT shall send a request for a detailed proposal to the CONTRACTOR.

CONTRACTOR will respond with a detailed proposal within five (5) calendar days of receipt of the Request for Proposal which shall include a complete itemized cost breakdown of all labor and materials showing actual quantities, hours, unit prices, and the wage rates required for the change. If the change order involves a change in construction time, a request for the time change shall accompany the change order cost breakdown. All such requests for time shall be specified by CONTRACTOR as either "work days" or "calendar days." Any request for time received with only the designation of "days" shall be considered calendar days. The term "work days" as used in this paragraph shall mean Monday through Friday, excluding Saturdays, Sundays and federal/State of California observed holidays. If the work is to be performed by a subcontractor, CONTRACTOR must include a bid from the subcontractor containing the same detailed information as required for CONTRACTOR. No extensions of time will be granted for change orders that, in the opinion of the ARCHITECT, do not affect the critical path of the Project.

(e) Value of any such extra work, change, or deduction shall be determined at the discretion of DISTRICT in one or more of the following ways:

(1) By mutual written acceptance of a lump sum proposal from CONTRACTOR properly itemized and supported by sufficient substantiating data to permit evaluation by DISTRICT and ARCHITECT.

(2) By unit prices contained in CONTRACTOR's original bid and incorporated in the Project Documents or fixed by subsequent agreement between DISTRICT and CONTRACTOR.

(3) By cost of material and labor and percentage for overhead and profit ("time and material"). If the value is determined by this method the following requirements shall apply:

(A) Daily Reports by Contractor.

(i) General. At the close of each working day, the CONTRACTOR shall submit a daily report to the ARCHITECT and the Inspector, on forms approved by the DISTRICT, together with applicable delivery tickets, listing all labor, materials, and equipment involved for that day, and for other services and expenditures when authorized concerning extra work items. An attempt shall be made to reconcile the report daily, and it shall be signed by the ARCHITECT and the CONTRACTOR. In the event of disagreement, pertinent notes shall be entered by each party to explain points which cannot be resolved immediately. Each party shall retain a signed copy of the report. Reports by Subcontractors or others shall be submitted through the CONTRACTOR.

(ii) Labor. The report shall show names of workers, classifications, and hours worked and hourly rate. Project Superintendent expenses are not allowed.

(iii) Materials. The report shall describe and list quantities of materials used and unit cost.

(iv) Equipment. The report shall show type of equipment, size, identification number, and hours of operation, including loading and transportation, if applicable, and hourly/daily cost.

(v) Other Services and Expenditures. Other services and expenditures shall be described in such detail as the DISTRICT may require.

(B) Basis for Establishing Costs

(i) Labor. The costs of labor will be the actual cost for wages prevailing locally for each craft classification or type of workers at the time the extra work is done, plus employer payments of payroll taxes and insurance, health and welfare, pension, vacation, apprenticeship funds, and other direct costs resulting from federal, state or local laws, as well as assessments or benefits required by lawful collective bargaining agreements. The use of labor classification which would increase the extra work cost will not be permitted unless the CONTRACTOR establishes the necessity for such additional costs. Labor costs for equipment operators and helpers shall be reported only when such costs are not included in the invoice for equipment rental.

(ii) Materials. The cost of materials reported shall be at invoice or lowest current price at which such materials are locally available and delivered to the work site in the quantifies involved, plus sales tax, freight and delivery. The DISTRICT reserves the right to approve materials and sources of supply, or to supply materials to the CONTRACTOR if necessary for the progress of the work. No markup shall be applied to any material provided by the DISTRICT.

(iii) Tool and Equipment Rental. No payment will be made for the use of tools which have a replacement value of $500 or less or where an invoice is not provided.

Regardless of ownership, the rates to be used in determining equipment rental costs shall not exceed listed rates prevailing locally at equipment rental source, or distributors, at the time the work is performed. The rental rates paid shall include the cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, and all incidentals. Necessary loading and transportation costs for equipment used on the extra work shall be included.

If equipment is used intermittently and, when not in use, could be returned to its rental source at less expense to the DISTRICT than holding it at the work site, it shall be returned, unless the CONTRACTOR elects to keep it at the work site at no expense to the DISTRICT.

All equipment shall be acceptable to the ARCHITECT, in good working condition, and suitable for the purpose for which it is to be used. Manufacturer's ratings and manufacturer's approved modifications shall be used to classify equipment and it shall be powered by a unit of at least the minimum rating recommended by the manufacturer.

(iv) Other Items. The DISTRICT may authorize other items which may be required on the extra work. Such items include labor, services, material and equipment which are different in their nature from those required by the work and which are of a type not ordinarily available from the CONTRACTOR or any of the subcontractors. Invoices covering all such items in detail shall be submitted with the request for payment.

(v) Invoices. Vendors' invoices for material, equipment rental, and other expenditures, shall be submitted with the request for payment. If the request for payment is not substantiated by invoices or other documentation, the DISTRICT may establish the cost of the item involved at the lowest price which was current at the time of the report.

(C) The following form shall be used as applicable by the DISTRICT and CONTRACTOR to communicate proposed additions and deductions to the Agreement.

		EXTRA CREDIT
i.	Material/Equipment (attach itemized quantity and unit cost plus sales tax)	_____
ii.	Labor (attach itemized hours and rates)	_____
iii.	Subtotal	_____
iv.	If subcontractor performed work, add Subcontractor's overhead and profit to portions performed by it, not to exceed 15% of Item iii. above	_____
v.	Subtotal	_____
vi.	General Contractor's Overhead and Profit, not to exceed 15% of Item v if Contractor performed the work. If subcontractor performed the work, not to exceed 5% of Item v. Of portions performed by Contractor and subcontractors, portions performed by Contractor shall not exceed 15% of Item V, and portions performed by Subcontractor shall not exceed 5% of Item v.	_____
vii.	Subtotal	_____
viii.	Bond and Liability Insurance Premium, if in fact additional	

bonds or insurance were actually purchased, not to exceed 1% of Item vii. _____

ix. Total _____

(4) IT IS EXPRESSLY UNDERSTOOD THAT THE VALUE OF SUCH EXTRA WORK OR CHANGES, AS DETERMINED BY ANY OF THE AFOREMENTIONED METHODS, EXPRESSLY INCLUDES ANY AND ALL OF CONTRACTOR's COSTS AND EXPENSES, BOTH DIRECT AND INDIRECT, RESULTING FROM ADDITIONAL TIME REQUIRED ON THE PROJECT, OR RESULTING FROM DELAYS TO THE PROJECT. ANY COSTS OR EXPENSES NOT INCLUDED ARE DEEMED WAIVED. FOR PURPOSES OF DETERMINING THE COST, IF ANY, OF ANY EXTRA WORK, CHANGE, ADDITION OR OMISSION HEREUNDER, ALL TRADE DISCOUNTS, REBATES, REFUNDS, AND ALL RETURNS FROM THE SALE OF SURPLUS MATERIALS AND EQUIPMENT SHALL ACCRUE AND BE CREDITED TO CONTRACTOR, AND CONTRACTOR SHALL ENSURE THAT SUCH DISCOUNTS, REBATES, REFUNDS, AND RETURNS MAY BE SECURED, AND THE AMOUNT THEREOF SHALL BE ALLOWED AS A REDUCTION OF CONTRACTOR'S COST IN DETERMINING THE ACTUAL COST OF CONSTRUCTION FOR PURPOSES OF ANY EXTRA WORK, CHANGE, ADDITION OR OMISSIONS IN THE WORK AS PROVIDED HEREIN.

(f) If the CONTRACTOR should claim that any instruction, request, drawing, specification, action, condition, omission, default, or other situation obligates the DISTRICT to pay additional compensation to CONTRACTOR or to grant an extension of time, or constitutes a waiver of any provision in the Agreement, CONTRACTOR shall notify the DISTRICT, in writing, of such claim within five (5) calendar days from the date CONTRACTOR has actual or constructive notice of the factual basis supporting the claim. The notice shall state the factual bases for the claim and cite in detail the Project Documents (including plans and specifications) upon which the claim is based. The CONTRACTOR's failure to notify the DISTRICT within such five (5) day period shall be deemed a waiver and relinquishment of such a claim. If such notice be given within the specified time, the procedure for its consideration shall be as stated above in these General Conditions.

(g) "PROHIBITED USAGE OF CONTRACTOR QUALIFYING LANGUAGE STAMPS ON DISTRICT DRAWINGS OR CONTRACT FORMS." Contractor shall not countersign or endorse any form, drawing, change order, contract or other documents with any conditions not mutually agreed to in advance by the DISTRICT and the CONTRACTOR. Endorsement of a contract, change order, specification, drawing or form with the following: "This change order is being executed without waiver of the right to seek additional compensation for such services," shall be of no legal force or effect.

ARTICLE 61. COMPLETION

(a) The DISTRICT shall accept completion of the Project and have the Notice of Completion recorded within ten (10) days of acceptance of completion of the Project when the entire work including punch list items shall have been completed to the satisfaction of the DISTRICT. Civil Code Section 3093. The work may only be accepted as complete by action of the DISTRICT s Governing Board.

(b) However, the DISTRICT, at its sole option, may accept completion of the Project and have the Notice of Completion recorded when the entire work including individual portions of the work shall have been completed to the satisfaction of the DISTRICT, except for minor corrective items, as distinguished from incomplete items.

(c) A final walk through of the Project to determine completion and to record the Notice of Completion shall occur only upon a valid claim by CONTRACTOR that the Project is complete except for minor corrective items. Any erroneous claims of completion by CONTRACTOR resulting in a premature walk through shall be at CONTRACTOR□s sole cost and expense and DISTRICT shall make adjustments to the contract price by reducing the amount thereof to pay for any costs incurred by the DISTRICT due to the erroneous claims by the CONTRACTOR that the Project is complete. Minor corrective items shall be identified in the final walk through of the Project.

(d) If the CONTRACTOR fails to complete the minor corrective items prior to the expiration of the thirty-five (35) day period immediately following recording of the Notice of Completion, the DISTRICT shall withhold from the final payment an amount equal to one hundred fifty percent (150%), as determined by the DISTRICT, of the amount of each item until such time as the item is completed. Public Contract Code Section 7107. At the end of such 35-day period, if there are items remaining to be corrected, the DISTRICT may elect to proceed as provided in Article 61(b) entitled "Adjustments to Contract Price."

ARTICLE 62. ADJUSTMENTS TO CONTRACT PRICE

(a) If CONTRACTOR defaults or neglects to carry out the work in accordance with the Project Documents or fails to perform any provision thereof, DISTRICT may, after ten (10) days written notice to the CONTRACTOR and without prejudice to any other remedy it may have, make good such deficiencies.

(b) The DISTRICT shall adjust the total contract price by reducing the amount thereof by the cost of making good such deficiencies. If DISTRICT deems it inexpedient to correct work not done in accordance with the Project Documents, an equitable reduction in the contract price shall be made therefore.

ARTICLE 63. CORRECTION OF WORK

(a) CONTRACTOR shall promptly remove all work identified by DISTRICT as failing to conform to the Project Documents, whether incorporated or not. CONTRACTOR shall promptly replace and re-execute its own work to comply with Project Documents without additional expense to DISTRICT and shall bear the expense of making good all work of other contractors destroyed or damaged by such removal or replacement.

(b) If CONTRACTOR does not remove such work within a reasonable time, fixed by written notice, DISTRICT may remove it and may store the material at CONTRACTOR's expense. If CONTRACTOR does not pay expenses of such removal within ten (10) days' time thereafter, DISTRICT may, upon ten (10) days written notice, sell such materials at auction or at private sale and shall account for net proceeds thereof, after deducting all costs and expenses that should have been borne by CONTRACTOR.

ARTICLE 64. EXTENSION OF TIME - LIQUIDATED DAMAGES

(a) The CONTRACTOR and DISTRICT hereby agree that the exact amount of damages for failure to complete the work within the time specified is extremely difficult or impossible to determine. CONTRACTOR shall be assessed liquidated damages for each and every day the work required under the Project Documents remains unfinished past the time for completion, as set forth in the Agreement, and any extensions of time granted by the DISTRICT to the CONTRACTOR under the terms of the Project Documents. The CONTRACTOR will pay to the DISTRICT or DISTRICT may retain from amounts otherwise payable to the CONTRACTOR, said amount for each day after failure to meet the requirements of the contract completion as scheduled in the Agreement. Government Code Section 53069.85 For purposes of this article, the work shall be considered "complete" in accordance with the provisions of Article 60, "COMPLETION", except that the work may be considered complete without formal acceptance by the DISTRICT Governing Board so long as the Governing Board, at its next regularly scheduled meeting, accepts the work.

(b) CONTRACTOR shall not be charged for liquidated damages, as set forth above, because of any delays in completion of work which are not the fault or negligence of CONTRACTOR, including but not restricted to acts of God. CONTRACTOR shall within ten (10) days of beginning of any such delay, notify DISTRICT in writing of causes of delay. CONTRACTOR shall provide documentation and justification to substantiate the delay and its relation to the Project's critical path. DISTRICT shall ascertain the facts and extent of delay and grant extension of time for completing work when, in its judgment, the findings of fact justify such an extension. The DISTRICT's finding of fact thereon shall be final and conclusive on the parties hereto. Extension of time shall apply only to that portion of work affected by the delay, and shall not apply to other portions of work not so affected.

ARTICLE 65. PAYMENTS WITHHELD

(a) In addition to amount which DISTRICT may retain under Article entitled "COMPLETION" and Article entitled "PAYMENTS," DISTRICT may withhold a sufficient amount or amounts of any payment or payments otherwise due to CONTRACTOR, as in its judgment may be necessary to cover:

(1) Payments which may be past due and payable for just claims against CONTRACTOR or any subcontractors, or against and about the performance of work on the Project, including, without limitation, payments made pursuant to the Article entitled "PAYMENTS BY CONTRACTOR."

(2) The cost of defective work which CONTRACTOR has not remedied.

(3) Liquidated damages assessed against CONTRACTOR.

(4) Penalties for violation of labor laws.

(5) The cost of materials ordered by the DISTRICT pursuant to Article 33 entitled "MATERIALS AND WORK."

(6) The cost of completion of this Agreement if there exists a reasonable doubt that this Agreement can be completed for the balance then unpaid to CONTRACTOR.

(7) Damage to DISTRICT, another contractor, or subcontractor.

(8) Site clean-up as provided in Article 44 entitled "CLEANING UP."

(9) Payments to indemnify, defend, or hold harmless the DISTRICT.

(10) Any payments due to the District including but not limited to payments for failed tests, utilities or imperfections.

(11) Extra services for ARCHITECT.

(12) Extra services for the INSPECTOR including but not limited to reinspection required due to CONTRACTOR's failed tests or installation of unapproved or defective materials and CONTRACTOR's requests for inspection and CONTRACTOR's failure to attend the inspection.

(13) Failure of CONTRACTOR to submit on a timely basis, proper and sufficient documentation required by the Project Documents, including without limitation, monthly progress schedules, shop drawings, submittal schedules, schedule of values, product data and samples, proposed product lists, executed change orders and verified reports.

(14) Any other obligation(s) of the DISTRICT which the DISTRICT is authorized and/or compelled by law to perform.

(b) If the above grounds are in the opinion of the DISTRICT removed by or at the expense of CONTRACTOR, payment shall be made for amounts withheld because of them.

(c) DISTRICT may apply such withheld amount or amounts to payment of such claims or obligations at its discretion. In so doing, DISTRICT shall make such payments on behalf of CONTRACTOR. If any payment is so made by DISTRICT, then such amount shall be considered as a payment made under contract by DISTRICT to CONTRACTOR and DISTRICT shall not be liable to CONTRACTOR for such payments made in good faith. Such payments may be made without prior judicial determination of claim or obligations. DISTRICT will render CONTRACTOR an accounting of such funds disbursed on behalf of CONTRACTOR.

(d) As an alternative to payment of such claims or obligations, DISTRICT, in its sole discretion, may reduce the total contract price as provided in Article 61 entitled "ADJUSTMENTS TO CONTRACT PRICE."

ARTICLE 66. TAXES

(a) CONTRACTOR will pay all applicable federal, state and local taxes on all materials, labor, or services furnished by it, and all taxes arising out of its operations under the Project Documents.

(b) If under federal excise tax law any transaction hereunder constitutes a sale on which a federal excise tax is imposed and the sale is exempt from such excise tax because it is a sale to a state or local government for

its exclusive use, the DISTRICT, upon request, will execute documents necessary to show (1) that the DISTRICT is a political subdivision of the State for the purposes of such exemption and (2) that the sale is for the exclusive use of the DISTRICT. No excise tax for such materials shall be included in any bid price.

ARTICLE 67. NO ASSIGNMENT

The CONTRACTOR shall not assign, transfer, convey, sublet or otherwise dispose of this Agreement or of its rights, title or interest in or to the same or any part thereof. If the CONTRACTOR shall assign, transfer, convey, sublet or otherwise dispose of the Agreement or its right, title or interest therein, or any part thereof, such attempted or purported assignment, transfer, conveyance, sublease or other disposition shall be null, void and of no legal effect whatsoever; and the Agreement may, at the option of the DISTRICT, be terminated, revoked and annulled, and the DISTRICT shall thereupon be relieved and discharged from any and all liability and obligations growing out of the same to the CONTRACTOR, and to its purported assignee or transferee.

ARTICLE 68. NOTICE

Any notice from one party to the other or otherwise under the Agreement shall be in writing and shall be dated and signed by party giving such notice or by a duly authorized representative of such party. Any such notice shall not be effective for any purpose whatsoever unless served in one of the following manners:

(1) If notice is given to DISTRICT, by personal delivery thereof to DISTRICT, or by depositing same in United States mail, enclosed in a sealed envelope addressed to DISTRICT, and sent by registered or certified mail with postage prepaid;

(2) If notice is given to CONTRACTOR, by personal delivery thereof to said CONTRACTOR, or to CONTRACTOR's superintendent at site of Project, or by depositing same in United States mail, enclosed in a sealed envelope addressed to said CONTRACTOR at its regular place of business or at such address as may have been established for the conduct of work under this Agreement, and sent by registered or certified mail with postage prepaid;

(3) If notice is given to surety or other persons, by personal delivery to such surety or other person, or by depositing same in United States mail, enclosed in a sealed envelope, addressed to such surety or person at the address of such surety or person last communicated by surety or other person to party giving notice, and sent by registered or certified mail with postage prepaid.

ARTICLE 69. NO WAIVER

The failure of the DISTRICT in any one or more instances to insist upon strict performance of any of the terms of this Agreement or to exercise any option herein conferred shall not be construed as a waiver or relinquishment to any extent of the right to assert or rely upon any such terms or option on any future occasion.

ARTICLE 70. NON-UTILIZATION OF ASBESTOS MATERIAL

(a) The CONTRACTOR will be required to execute and submit the Certificate Regarding Non-Asbestos Containing Materials.

(b) Should asbestos containing materials be installed by the CONTRACTOR in violation of this certification, or if removal of asbestos containing materials is part of the Project, decontaminations and removals will meet the following criteria:

(1) Decontamination and removal of work found to contain asbestos or work installed with asbestos containing equipment shall be done only under the supervision of a qualified consultant, knowledgeable in the field of asbestos abatement and accredited by the Environmental Protection Agency (EPA).

(2) The asbestos removal contractor shall be an EPA accredited contractor qualified in the removal of asbestos and shall be chosen and approved by the asbestos consultant who shall have sole discretion and final determination in this matter.

(3) The asbestos consultant shall be chosen and approved by the DISTRICT who shall have sole discretion and final determination in this matter.

(4) The work will not be accepted until asbestos contamination is reduced to levels deemed acceptable by the asbestos consultant.

(c) Cost of all asbestos removal, including, but not necessarily limited to the cost of the asbestos removal contractor, the cost of the asbestos consultant, analytical and laboratory fees, time delays and additional costs as may be incurred by the DISTRICT shall be borne entirely by the CONTRACTOR.

(d) Hold Harmless: Interface of work for the Project with work containing asbestos shall be executed by the CONTRACTOR at his/her risk and at his/her discretion with full knowledge of the currently accepted standards, hazards, risks and liabilities associated with asbestos work and asbestos containing products. By execution of the Agreement, the CONTRACTOR acknowledges the above and agrees to hold harmless the DISTRICT, its Governing Board, employees, agents, and ARCHITECT and assigns for all asbestos liability which may be associated with this work. The CONTRACTOR further agrees to instruct his/her employees with respect to the above mentioned standards, hazards, risks and liabilities.

ARTICLE 71. LEAD

Pursuant to the Lead-Safe Schools Protection Act (Education Code Sections 32240, et seq.) and other applicable law, the CONTRACTOR shall not use lead-based paint, lead plumbing and solders, or other potential sources of lead contamination in the construction of any new school facility or the modernization or renovation of any existing school facility.

ARTICLE 72. GOVERNING LAW

The laws of the State of California shall govern the Project and the Agreement.

SUPPLEMENTAL CONDITIONS

1 **Application of Supplemental Conditions.** These Supplemental Conditions are a part of the Contract Documents for the Project generally described as **"Bid #1094 - Saddleback College James B. Utt Memorial Learning Resource Center Renovation".**

2 **Construction Manager**. The Construction Manager for the Bid Package is McCarthy Building Companies, Inc. The Construction Manager is authorized to act on behalf of the District as set forth in the agreement between the Construction Manager and the District in the administration of the Contract Documents, in conjunction with the Architect, except that the observation of the Work shall be under the general responsible charge of the Architect. **Notwithstanding any other provision of the Contract Documents and unless directed otherwise by the Construction Manager, all written and electronic communications required or permitted by the Contract Documents from Contractor to the District and/or the Architect shall be directed to the Construction Manager**, as follows:

McCarthy Building Companies, Inc.
20401 S.W. Birch St., Suite 300
Newport Beach, California 92660
Attn: Steve Baker
Phone: (949) 851-8383
Fax: (949) 756-6843
Email: sbaker@mccarthy.com

3 **Contract Time.** The Commencement Date for the Work shall be the date set forth in the Notice to Proceed issued by or on behalf of the District for the Bid Package. Subject to approval of the District's Board of Trustees. The failure of a Contractor to achieve Substantial Completion as set forth below will subject the Contractor to Liquidated Damages as set forth in these Special Conditions.

Description	No. of Cal. Days
LRCR Renovation	387 (Phased) *
CC Building Demolition, Removal & Restoration	47 (Phased)**

* Calculated from 5/10/10 thru 5/31/11
** Calculated from 6/27/11 thru 8/12/11

(The above time includes weather delay time allowance as stipulated herein)

END OF PAGE

4 **Liquidated Damages.**

4.1 The Contractor shall be subject to assessment and withholding of Liquidated Damages for Work that is not Substantially Complete within the phased completion timelines as indicated in Contract Time. The delayed Substantial Completion of the Work will result in the assessment and withholding of Liquidated Damages for each day of delayed Substantial Completion beyond the Contract Time for each phase of the project in the following amount per day (The assessment of liquidated damages are cumulative and may be assessed for multiple phases concurrently in the event of simultaneous delay to multiple phases). Furthermore, where so indicated, the commencement of the Work in any single phase will not be allowed to commence until the previous phase has been completed, and a delayed commencement due to a Contractor's failure to complete the previous phase shall not extend the completion date required for the subsequent phase):

Description	Daily Amount
LRC Renovation	Two Thousand Dollars ($2,000.00)/Cal. Day)
CC Building Demolition	Two Thousand Dollars ($2,000.00/Cal. Day)

5 **Site Verification.**

5.1 Within fourteen (14) days after the date for commencement of the Work as set forth in the Notice to Proceed, the Contractor shall complete a review at the Site under the direction of the Construction Manager, District, and Architect to verify that the Construction Documents are adequate, feasible and complete for providing, performing and constructing the Work in a sound and suitable manner for the use specified and intended by the Contract Documents.

5.2 In the course of conducting the review provided for in this Paragraph, the Contractor shall maintain a written log or other documentation of comments, recommendations or other notations generated in the course of its review, and all such materials with a copy provided to the District for review.

5.3 Upon completion of the review set forth in this Paragraph, Contractor shall execute and deliver to the Construction Manager the Site Verification Certification, included with the Contract Documents.

5.4 The failure of the Contractor to execute and deliver the Site Verification Certification to the Construction Manager no later than fourteen (14) calendar days after the date for commencement of the Work as set forth in the Notice to Proceed may be deemed acceptance of the site and contract documents as being adequate, feasible, and complete as defined in Article 5.1 above.

6 **Construction And Progress Schedule**

6.1 **Progress Schedule requirements shall be provided as stipulated in the Agreement and the General Conditions, Article 32.**

6.2 The schedule and all associated updates for all categories of work shall be prepared and updated on a monthly basis by the Contractor. The baseline contract schedule shall comply with the timelines indicated in the bid documents and the phasing commencement and completion dates indicated in the "Contract Schedule / Phasing Requirements" attached hereto, as **Exhibit 1** and as the attached **Milestones Schedule**, hereto known as **Exhibit #6**.

6.3 Contractor shall not delay the Work of any of the other Contractors. The failure of a Contractor to comply with the preceding: (i) shall be deemed delayed Substantial Completion of the Work of that Contractor; (ii) shall subject that Contractor to assessment and deduction of Liquidated Damages from progress payment(s) and/or final payment, in the amount per day set forth above for each day Substantial Completion of the Work of any other Contractor is delayed thereby; and, (iii) may be deemed by the District to be Contractor's default of a material obligation hereunder.

7 **Unit Price Item(s).** If the Bid Proposal for the Work includes proposal(s) for Unit Price Item(s), during Contractor's performance of the Work, the District may elect to add or delete any such Unit Price Item(s). If the District elects to add or delete any such Unit Price Item(s) pursuant to the foregoing, the debit or credit for such Unit Price Item(s) shall be in accordance with the amount(s) set forth in the Contractor's Unit Price Item(s) Proposal.

8 **Rain Days.** For purposes of Article 32 of the General Conditions, **Fourteen (14) Rain Days** (calendar days) are expected during the Contract Time for the Work of this construction Agreement. The Contractor's Construction Schedules prepared pursuant to Article 32 of the General Conditions shall incorporate the Rain Days set forth above. There shall be no adjustment to the Contract on account of unusually severe weather conditions resulting from rainfall until the actual number of Rain Days exceeds the number of Rain Days set forth above.

9 **Standardized Forms.** Each and every document generated and/or submitted by the Contractor relating to cost breakdowns, applications for payment, change order requests, requests for information, submittals, verified reports, progress reports, and all other matters relating to the administration of the Work as set forth in the General Conditions, shall be prepared by the Contractor on such forms as may be directed by the Construction Manager. Unless otherwise expressly provided for in the Contract Documents, all such documents shall be submitted to the District with such frequency as the Construction Manager may require in its sole reasonable discretion.

10 **District Tests/Inspections.** Pursuant to Article 26 of the General Conditions, within twenty-one (21) calendar days after the date of award of the Contract, the Contractor, the District, Construction Manager, and the Architect shall meet and confer to establish, by mutual agreement, the specific tests/inspections to be conducted by or on behalf of the District and to establish limits on costs incurred by the District to complete such test/inspections. If mutual agreement is not reached as to tests/inspections to be completed by or on behalf of the District or the limitations on the District's costs to complete such tests/inspections, the Architect shall issue a final binding determination. The Contractor shall be responsible for all costs of tests/inspections exceeding those established pursuant to the forgoing.

11 **Mitigation Monitoring Program.** Contractor shall participate in a "Mitigation & Monitoring Program" for the Site by performing the following as part of the Work:

11.1 If active bird nests are identified, Contractor shall suspend Work in the affected area, and so notify the Construction Manager immediately; Contractor shall resume Work thereafter upon written notice from the District to do so.

11.2 If archaeological deposits, features, or human remains are encountered, and they cannot be avoided, Contractor shall suspend any Work which disturbs the ground in the affected area, and so notify the District immediately; Contractor shall resume Work thereafter upon written notice from the District to do so.

11.3 If underground tanks, obvious or suspected contamination, or other features or materials which could present a threat to human health or the environment are discovered during grading or excavation of the site, Contractor shall suspend Work in the affected and so notify the District immediately; Contractor shall resume Work thereafter upon written notice from the District to do so.

11.4 Contractor shall comply strictly with the erosion control plan set forth in the Contract Documents.

11.5 Contractor shall observe the following Site limitations, in addition to other Site limitations set forth elsewhere in the Contract Documents (pursuant to but not limited to Article 50 of the General Conditions):

11.5.1 Construction work on the Project shall be limited to the hours of 7:00 a.m. to 3:30 p.m. Monday through Friday, unless the written consent of the District is obtained to perform the Work on other days or at other times. Contractor is to provide a minimum of 48-hours notification to the District of intent to extend the standard hours of work. All overtime and/or extended hours inspection charges associated with the work will be the responsibility of the Contractor.

11.5.2 All construction equipment with a high noise generating potential, including all equipment powered by internal combustion engines, shall be muffled or controlled.

11.5.3 All stationary noise generating equipment, such as compressors, shall be located as far as possible from existing classroom buildings.

11.5.4 Machinery, including motors, shall be turned off when not in use; mobile equipment shall not be allowed to run idle near existing classroom buildings.

12 **Contractor Identification / Prohibited Activities.**

12.1 The Contractor is required to provide Employee Identification such as Shirts or Badges to clearly identify all employees of Contractor and subcontractor of each tier. Form of identification to be approved by the District.

12.2 No unlawful activity is permitted at the Site. The sale, use, or consumption of alcoholic beverages is not permitted at the Site. The identification badge of any person conducting himself in a manner inconsistent with this Paragraph shall be revoked.

12.3 The use of any tobacco products will be limited to designated areas of the site only and never inside any buildings.

13 **Site Maintenance.** Contractor shall at all times shall keep Site and Building free from debris such as waste, dust, excess water, storm water runoffs, rubbish, and excess materials and equipment. Contractor shall not leave debris under, in, or about the premises, but shall promptly remove same from the premises and dispose of same offsite in a lawful manner. As a minimum, site clean-up shall be done on a daily basis.

13.1 The Contractor is to provide vehicular and pedestrian traffic control as required to facilitate on-campus safety at all times. Roadways, sidewalks, etc. are to remain clear and unobstructed during the course of construction and during off-hours. Limited blockage will only be allowable with a 48-hour notification to the District and subsequent approval and then only with the proper and safe procedures in place and are followed.

13.2 Contractor to maintain appropriate, safe and adequate building access and egress of the building project area under construction as well as all surrounding buildings in and around the area of construction at all times except as otherwise allowed by the Agreement.

13.3 The Contractor shall provide site dust control at intervals sufficient to prevent contamination outside the Site and shall clean up all construction-related dirt and debris from pavement and sidewalks to and from the Site daily.

13.4 A street sweeper or equivalent shall be used as deemed necessary by the District and Construction Manager.

14 **Progress Clean-up.**

14.1 Progress clean-up shall be in accordance with the other Contract Documents (pursuant to but not limited to Article 45 of the General Conditions and Specification Section 01770).

14.2 The Contractor shall provide dumpsters as needed. At the completion of the Contractor's Work, the Contractor shall leave the project clean as defined by the project documents, all debris placed in dumpsters, all dumpster's lawfully removed offsite, and all storage bins/materials removed from the Project Site (see **Exhibit #7**).

15 **Drawings and Specifications.**

15.1 **Drawings and Specifications requirements shall be provided as stipulated in the Agreement and the General Conditions, Article 20.**

15.2 The number of sets of the Drawings and Specifications which the District will provide to the Contractor pursuant to Article 20 of the General Conditions will be two **(2)** additional sets. Additional sets of the Drawings and Specifications may be obtained by the Contractor from the District at the cost of reproduction.

16 **The Contractor shall be responsible for the following is it applies to the Contractor's Work:**

16.1 The Contractor shall employ and submit the name and summary of previous experience of a competent superintendent for the Work ("Superintendent"). The Superintendent shall have authority to act on behalf of the Contractor, shall have overall responsible charge of the Contractor's performance of the Work, and shall be in attendance at the Site at all times during performance of the Work. In accordance with Article 4 of the General Conditions, the Contractor also shall employ and submit the name and summary of previous experience of a competent project manger ("Project Manager") and all necessary assistants. If the Superintendent and/or Project Manager are deemed to be unsatisfactory to the District, the Contractor shall replace these personnel with someone acceptable by the District. The phone numbers of both the Superintendent and Project Manager are to be provided to the District so as to be able to be reached at any time.

16.2 In accordance with Article 24 of the General Conditions, the Contractor shall provide all surveying and building layout, by a surveyor duly licensed by the State of California, as necessary for the performance of the Work of its Bid Package, including bench mark elevations and grid-line off-sets for the layout of the Work.

16.3 The Contractor shall provide sanitary, temporary toilet and sanitary wash facilities, of a nature and in at least such number as required by law, and such additional like facilities as may be directed by the Construction Manager for the use of all Contractor's personnel and shall maintain same in a sanitary condition at all times, until removal is directed in writing by the Construction Manager. Use of restroom facilities in any District facility is prohibited without the prior written consent of the Construction Manager.

16.5 The District will provide to the Contractor temporary electrical and water services necessary for the performance of its Work as it relates to this Project only. The Contractor is responsible for connecting at the available point of connection for each service at the location approved by the District.

16.6 At completion of Work, the Contractor shall clean the interior and exterior of all structures at Site and Project in accordance with the Project Specifications.

16.7 Any damage to existing facilities and/or structure is to be repaired and restored to the original condition found prior to construction; including interior surfaces/finishes, exterior surfaces/finishes, utility systems, asphalt parking lots, curbs, gutters, driveways, signage, turf/irrigation, etc that has been damaged as a result of the Contractor's actions.

16.8 The Contractor shall provide within its construction trailer or separate facilities on site, a conference room, table, and chairs that will accommodate 12 persons, a telephone with speaker phone capabilities and an updated, current set of Contract Documents.

16.9 Pursuant to Article 42 of the General Conditions, the Contractor shall provide, for the use of the District Inspector, a temporary office of not less than 96 square feet of floor area (8' x 12'), at the Site, including connection of electrical power and telephone, to be located as directed by District and to be maintained until removal is authorized by District ("Inspector's Office"). As a minimum, the Contractor will provide rent for the Inspector's Office continuously until project substantial completion plus two additional months. The Contractor shall also pay the costs to dismantle, remove seismic restraints, and return shipping. The Contractor shall pay for the repair of the asphalt parking lot upon removal of all seismic tie down straps including the repair of the asphalt parking lot upon the removal of ten (10) seismic tie down straps removed from the Construction Manager's on-site field office trailer.

16.10 The Contractor shall provide the connection, rental, and removal of temporary electrical power equipment for the Construction Manager's 12' x 55' field office trailer.

16.11 The Contractor shall include the installation and removal of one 10 pair, outdoor rated telephone cable from the Construction Manager's field office to the D-Mark phone panel on the ground floor of the LCRC Building. The Contractor will perform the final termination of the telephone and fax lines at each end for the District's Inspector.

16.12 The Contractor shall be responsible for the preparation, implementation and monitoring of the Storm Water Pollution Prevention Plan ("SWPPP"), as further described in these Project Documents. The Contractor shall prepare and submit the NOI permit and pay all fees associated with the NOI Stormwater Permit.

17 **Labor Compliance Program**

17.1 The Labor Compliance documents shall be prepared and submitted in accordance with the District's "Labor and Compliance Program".

18 Refer to **Exhibits #7A & 7B** for acceptable delineation of project specific requirements as noted:

18.1.1 Proposed construction fencing layout.

18.1.2 Proposed Construction employee parking area.

18.1.3 Access and egress to the construction site.

18.1.4 Proposed office trailer, lay down and storage area.

EXHIBIT 1

CONTRACT SCHEDULE / PHASING REQUIREMENTS

PART 1: GENERAL

1.0 SHOP DRAWING, PRODUCT DATA, AND MOCK-UP REVIEWS (SUBMITTALS)

A. Make and prioritize submittals far enough in advance of scheduled installation dates to provide for timely reviews, for securing necessary approvals, for possible revision and re-submittal, and for placing orders, coordination and securing delivery so that the project may be completed in accordance with Article 60 of the General Conditions.

B. No later than ten (10) calendar days after the Notice to Proceed, the Contractor shall furnish a complete material and equipment product submittal schedule for District approval.

C. Submittal Schedule:

1. A schedule for submission of shop drawings, product data, and samples by the Contractor (the "Submittal Schedule"), and their processing and return by the Architect, shall be agreed upon by both parties in order that the items covered by these submittals will be available when needed by the construction process and so that each party can plan its workload in an orderly manner.

2. The Contractor shall prepare the Submittal Schedule in a form which is acceptable to the District and shall coordinate it with the Contract Schedule.

3. The approved Submittal Schedule shall be incorporated into and become part of the construction schedule.

4. The Submittal Schedule dates shall integrally link to the Contract Schedule. The Contractor shall identify on the Submittal Schedule all of the submittal items required by the Contract Documents listing shop drawings, product data, product literature, samples, reports, certifications, in-service training, and all other submittal items separately.

5. In preparing the Submittal Schedule, the Contractor shall first determine from the Contract Schedule the date the date of product delivery required to avoid delay to the Work. Working backwards, the Contractor shall add the required number of days for shipment, time for fabrication, time for review and acceptance by the Architect, time for re-submittals, and similar items to determine the date of the first submittal.

6. Provide the updated Submittal Schedules monthly or as necessary to conform with updated Contract Schedules. The Contractor shall indicate, as a minimum, for each submittal item on the Submittal Schedule start and finish dates for:

a. Preparation of the submittal.

b. Architect's review and acceptance.
c. Revisions to the submittal by the Contractor.
d. Re-review by the Architect.
e. Fabrication and delivery.
f. Earliest activity start date for respective submittal.

7. In preparing the Submittal Schedule, the Contractor shall consider the nature and complexity of each submittal item and shall allow ample time for review (more than 14 days for complex product information), revisions, or corrections. In preparing the Submittal Schedule, the Contractor shall coordinate and cooperate with the Architect to stagger the review of submittal review activities.

   a. First-time Submittals: The minimum time required by the Architect and the Architect's consultants to review and process shop drawings, product data, and samples and return the materials to the Contractor will be fourteen (14) calendar days from date of receipt by the District.

   b. Re-submittals: The minimum time required by the Architect and the Architect's consultants to review, process, and return re-submittals will be fourteen (14) calendar days from date of receipt by the Architect.

   c. Notwithstanding the review times stated above, the Contractor is responsible for the time associated with obtaining acceptances. Resubmitting beyond the times indicated above is not grounds for time extensions.

1.1 CONTRACTOR'S INITIAL CONSTRUCTION SCHEDULE

It is expressly understood and agreed that the time of beginning, the rate of progress, and the time of completion of the work are of the essence of this Contract. The work shall be prosecuted at such time, in such manner, and on such part or parts of the project as may be required to complete the project as contemplated in the Contract Documents and the Contractor's Construction Schedule.

A. The work specified in this Section shall be in addition to and in accordance with the requirements for the Contractor's Construction Schedule as specified in the General Conditions and shall be prepared, submitted and updated by the Contractor.

B. Form:

   1. The Schedule shall comply with the requirements of Article 32 of the General Conditions.

   2. The initial schedule prepared and pending approval is also referred to as the "Initial Construction Schedule". The schedule "accepted" by the District at the conclusion of the schedule submittal process will be referred to as the "Final Baseline Schedule".

   3. A tabular report shall accompany the network diagram and shall, at a minimum, include an activity number for each activity; the description and duration of each

activity; all predecessors to and successors from each activity; a responsibility code identifying the organization performing the activity; and the early start, early finish, late start, late finish, and total float for each activity. The report shall support the network diagram submitted.

4. The work activities comprising the Contractor's Initial Construction Schedule shall be in sufficient detail to assure that adequate planning has been done for proper execution of the work and such that the schedule provides an appropriate basis for monitoring and evaluating the progress of the work. A work activity is defined as an activity, which requires time and resources (including manpower, equipment, or materials) to complete. Exclusive of those activities for submittal review and material fabrication and delivery, activity duration shall not be more than fourteen (14) calendar days, unless otherwise approved by the Construction Manager. The work activities shall include submittals; Architect's review of submittals; procurement, material delivery, installation and testing/inspection of equipment or materials; subcontractor's items of work; and all major construction activities.

5. The Contractor's Initial Construction Schedule shall begin with the date of issuance of the Notice to Proceed and conclude with the Contract Completion Date. The Contractor may submit an Initial Construction Schedule which shows the work completed in less time than the specified Contract Time. However, the acknowledgement of such a schedule will not change the Contract Time. The Contract Time shall control in any determination of liquidated damages or extension of the Contract Time. The difference in time between the project's scheduled early completion date, as submitted, and the required contract completion date shall be considered as float, slack time or contingency.

6. Identify the work of separate phases, units, or other logically grouped activities to facilitate review of the Application for Payment with completed work. This shall include codes to organize using the CSI numbering format, work areas, etc.

7. The Initial Construction and Final Baseline Schedule submittals shall include all reports, plots, and the read only CD, with a properly compressed schedule back up file (.prx for P3 or .stx for Suretrak)

C. Milestones: Identify significant milestone events or contractual milestone events on the Contractor's Initial Construction Schedule.

D. It shall be the responsibility of the Contractor to verify with all authorities having jurisdiction all holidays for each calendar year. Identify all holidays and non-working days on the Contractor's Initial Construction Schedule.

E. Identify and include in the Construction Schedule normal weather conditions and its impact on the Project. This shall be clearly identified as an activity on the Construction Schedule. In order to receive credit against the weather delay time allowance or a schedule time extension, the Contractor shall be required to demonstrate that the requested weather delay causes a time impact to the critical path of the schedule.

F. The Initial Construction and Final Baseline Schedules shall not have status progress of any activity.

G. Activities:

1. Identify all work activities in correct sequence for the completion of the Work. Work activities shall also include, but not be limited to the following:

   a. Major Contractor-furnished equipment, materials, and building elements, and scheduled activities requiring submittal or District's prior approval.

      1) Show dates for the submission, review and acceptance of each submittal, shop drawing, sample, mock-up, etc.. Dates shall be shown for the procurement, fabrication, delivery, and installation of major equipment, materials, and building elements, and for scheduled activities designated by the District.

      2) A minimum of fourteen (14) calendar days shall be allotted for the Architect to review each submittal and fourteen (14) calendar days for each subsequent re-submittal(s).

      3) The actual review period by the Architect shall commence on the day following the day the submittal is received from the Construction Manager.

      4) If submittals are rejected by the Architect and/or Construction Manager, the Contractor shall be responsible for any resulting time delays without additional compensation or time extension from the District.

2. System test dates.

3. Scheduled overtime work or work outside established "regular work hours" (e.g. 7 am- 3:30 pm), if required by the Contract Documents.

4. Dates on which the Contractor requests designated working spaces, storage areas, access, and other facilities to be provided by the District, if any.

5. Dates on which the Contractor requests orders and decisions from the District on designated items.

6. Dates on which the Contractor requests District-furnished equipment.

7. Dates on which Contractor requests District-furnished utilities.

8. Connection, shut down, or relocation of existing utilities.

9. Connecting to or penetrating existing structures.

10. Scheduled inspections as required by Codes, or as otherwise specified.

H. Identify all work activities that constitute the critical path.

I. All activities shall have a successor activity except the final activity of the schedule.

J. Critical path work activities are defined as work activities which, if delayed or extended, will delay the scheduled completion of one or more of the milestones specified in this Section or the scheduled completion of the Work, or both. All other work activities are defined as non-critical path work activities and are considered to have float.

K. The Final Baseline Schedule and all schedule updates shall clearly identify the activities that comprise the critical path for the completion of the contract work. The proposed critical path shall be subject to District approval and agreement that it reflects an achievable and logical execution of the work within the contract time.

L. Float is defined as the time that a non-critical path work activity can be delayed or extended without delaying the scheduled completion of milestones or Contract Time specified in this Section and/or the scheduled completion of the Work.

M. Delays of any non-critical path work activity shall not be the basis for an extension of Contract Time until work activity becomes critical path work.

N. The Contractor shall not sequester float through such strategies as extending activity duration estimates or lags to consume available float, using preferential logic, using extensive crew/resource sequencing, etc. No time extensions will be granted nor delay damages paid until a delay occurs which extends the work beyond the Contract completion date. The Contractor shall not be entitled to receive a time extension or delay damages until the Contract completion date is exceeded.

O. The Construction Manager, within fourteen (14) calendar days after receipt of the Contractor's Initial Construction Schedule, shall meet with the Contractor and selected subcontractors requested by the Construction Manager, to review the Initial Construction Schedule comments. Within ten (10) calendar days after receipt of the Construction Manager's written review comments, the Contractor shall address and submit to Construction Manager a written response to each comment, and if necessary, revise and resubmit the Initial Construction Schedule. Within ten (10) days from receipt of this revised Initial Construction Schedule the Construction Manager shall return it for further corrections or indicate the construction schedule has been "Accepted". The "Accepted" schedule shall be deemed to be the Final Baseline Schedule.

P. District acceptance of the Final Baseline Schedule in no way binds or implies that the Construction Manager/District are agreeing or validating the contents of the Contract Schedule(s) and shall not be interpreted to establish or approve the means, methods, techniques, or sequences of construction.

Q. As determined and/or requested by the Construction Manager, the Contractor shall provide additional schedule information necessary to better articulate or demonstrate the Contractor's schedule(s).

1.2 CONTRACTOR'S INVOICE & SCHEDULE OF VALUES

A. The Schedule of Values shall be prepared and submitted in the same time frame as the detailed Initial Construction Schedule. The Construction Manager, within ten (10) calendar days after receipt of the Contractor's Schedule of Values, shall meet with the Contractor to review Construction Manager's comments to the Schedule of Values. Within ten (10) calendar days after receipt of the Construction Manager's written review comments, the Contractor shall address the Construction Manager's concerns with the Schedule of Values and submit a written response to Construction Manager's concerns, and if necessary, revise and resubmit the Schedule of Values. This process shall be repeated until such time as the Schedule of Values has been deemed as "Acceptable" by the Construction Manager and District representative.

B. The submittal of an acknowledge Contractor's Schedule of Values shall be a condition precedent to the processing of the Contractor's first payment application.

C. The submittal and "acceptance" of the Contractor's Final Baseline Construction Schedule shall be a condition precedent to the processing of the Contractor's <u>second</u> payment application.

1.3 UPDATING AND REVISIONS

A. The **Contractor** will include as part of the weekly construction meeting, a review of the Construction Schedule with the Construction Manager and District to update/confirm progress and incorporate in the Contract Schedule all other changes in logic sequence.

B. Five (5) calendar days prior to the submittal of the Contractor's monthly payment request, the **Contractor** shall submit an updated Construction Schedule reflecting progress to date, estimated start and completion dates for activities not yet begun, status of ongoing activities, approved changes to the work, and any schedule revisions.

1. The data date of each monthly update shall be the last working day of the month.

2. The updated Construction Schedule shall accurately represent the as-built condition of all completed and in-progress work activities as of the data date of the updated Construction Schedule. Updates shall continue until substantial completion.

3. An electronic schedule update shall be produced monthly and distributed in the approved format. Computer produced reports shall indicate actual activity start and/or complete dates, revised (current) remaining duration, and percent complete versus the planned accepted Baseline Schedule indicating activity start and finish to compare with current progress.

4. The updated Construction Schedule shall incorporate all changes mutually agreed upon by the Contractor and the District during preceding periodic reviews and all changes resulting from Change Orders and Field Orders.

5. If revision to the Construction Schedule is contemplated, the Contractor or District shall advise the other in writing at least fourteen (14) calendar days prior to the next schedule update meeting, describing the revision and setting forth the revisions thereof.

6. All reasonable requests by the District for revisions shall be implemented by the Contractor.

7. District directed revisions to the Construction schedule will not be incorporated into the construction schedule without written notice to the Contractor, who shall respond in writing within fourteen (14) calendar days, either agreeing with the District's proposed revision, or setting forth justification for not accomplishing the revision. The Contractor's failure to respond in writing within fourteen (14) calendar days, will be deemed to be an acceptance of the District directed revisions, and such revisions will be incorporated into the construction schedule.

8. The Contractor shall perform the work in accordance with the updated Construction Schedule. The Contractor may change the Construction Schedule to modify the order or method of accomplishing the work only with prior agreement by the District.

9. In the case of disagreement at the Schedule Update meeting concerning actual progress to date, the District's determination shall govern.

C. Predicated upon the results of the Construction Managers review of monthly schedule updates, or the joint Construction Manager/Contractor review in any given month, the Contractor may be required to revise the Contractor's Construction Schedule. Conditions under which a revision will be made include the following (but is not limited to):

1. When a delay in completion of any work activities or sequence of work activities results in an indicated extension of the project completion or interim milestone dates detailed herein by fourteen (14) or more calendar days.
2. When delays in material submittals, equipment or material deliveries, or work stoppages are encountered which make rescheduling of the work necessary.
3. When the schedule does not represent the actual prosecution and progress of the project.

D. All other updating and revisions shall be performed in accordance with Article 32 of the General Conditions.

1.4 REPORTS, PLOTS, AND ELECTRONIC ARCHIVES

A. As determined by the Construction Manager, the **Contractor** will submit of a minimum 3 sets of bound reports.

The bound report shall include the information described in the Contractor's Schedule Narrative Report outline listed below:

CONTRACTOR'S SCHEDULE NARRATIVE REPORT OUTLINE

- *Contractor's transmittal letter*
- *Description of problem areas (referenced to change order or claim numbers) as appropriate.*
- *Current and anticipated delays not resolved by approved change order, including:*
- *Cause of the delay*
- *Corrective action and schedule adjustments to correct the delay*
- *Known or potential impact of the delay on other activities, milestones, and project completion date.*
- *Revisions to the construction sequence including logic, activity durations, descriptions, start/finish constraints, etc. The Contractor shall use Digger Software to produce this report.*
- *Pending items and status thereof including but not limited to:*
- *Pending change orders*
- *Time extension requests*
- *Other items*
- *Contract completion date status:*
- *If ahead of the Approved Baseline Schedule, the number of calendar days ahead*
- *If behind Approved Baseline Schedule, the number of calendar days behind*

B. At weekly project meetings, Contractor shall present a 4- Week rolling schedule that looks ahead 3 weeks and back 1 week behind the data date. The data date of this schedule shall be no earlier than 2 days prior to the weekly progress meeting. This schedule shall be updated from the most recently approved monthly update schedule.

C. After Contractor's Application for Payment #1 is paid, no further applications for payment will be approved nor any payments become due until The Final Baseline Schedule and any required monthly construction schedule update has been submitted and "Accepted" by the District. The monthly updating of the Construction Schedule shall be an integral part and the basic element of the estimate upon which partial payments will be made. If in the judgment of the Construction Manager, the Contractor fails or refuses to provide information required to accomplish a complete Construction Schedule Update, the Contractor shall be deemed to have not provided the required estimate upon which partial payment may be made, and shall not be entitled to its monthly progress payment until it has furnished the information necessary for an accurate monthly Construction Schedule Update.

1.5 ADJUSTMENT OF TIMES FOR COMPLETION

A. In addition to the requirements of the General and Special Conditions, adjustment of the time for completion of the Work shall be in accordance with the following procedures:

1. When change orders or delays are experienced by the Contractor, and the Contractor requests an extension of time, the Contractor shall submit to the Construction Manager a written time impact analysis illustrating the influence of each item of change or delay on the current Construction Schedule completion date. Each time impact analysis shall include a "fragnet" demonstrating how the Contractor proposes to incorporate the change order or delay into the Construction Schedule. A "fragnet" is defined as a sequence of new activities and activity updates that are proposed to be added to the existing schedule to demonstrate the influence of delay and the method for incorporation delays and impacts into the schedule as they are encountered. Copies of the time impact analysis shall be submitted to the Construction Manager with the Contractor's request for an adjustment of the Contract Time no later than five (5) calendar days after notice of direction for proceeding with a change. In cases when the Contractor does not submit a time impact analysis for a specific change order or delay within the specified period of time, the Contractor shall be deemed to have agreed that there is no impact and that it has irrevocably waived its rights to any additional time and cost.

   a. Each time impact analysis shall demonstrate the estimated time impact based on the events of delay, the date the change was given to the Contractor, the date the changed work began or is scheduled to begin, the status of construction at that time, and all activities affected by the change or delay. The time impact analysis shall be based on the current update of the Construction Schedule. Each impact analysis will be evaluated using fundamentally sound, reasonable and responsible scheduling logistics and approach.

   b. The narrative Time Impact Analysis shall demonstrate the time impact based on the date the Scope Modification (including the proposed Scope modification), the date the delay occurred, the status of construction at that point in time, and the event time computation of all affected activities.

   c. Acceptance or rejection of each time impact analysis by the Construction Manager will be made within a reasonable time after receipt of each time impact analysis, unless subsequent meetings and negotiations are necessary in the sole judgment of the Construction Manager. Upon acceptance, the time impact analysis shall be incorporated into the Construction Schedule by the Contractor.

   d. Upon mutual agreement by both parties, "fragnets" illustrating the influence of change orders and delays shall be incorporated into the Construction Schedule during the first update after agreement is reached.

1.6 RESPONSIBILITY FOR COMPLETION

A. If at any time during the project, the Contractor fails to complete any activity by its latest scheduled completion date, which late completion will impact the end date of the work past the contract completion date, the Contractor shall, within ten (10) calendar days, submit to the Construction Manager a written recovery plan as to how and when the Contractor will reorganize his work force to return to the current Contractor's Construction Schedule. Whenever it becomes apparent from the current monthly progress evaluation and updated Construction Schedule data that any milestone date(s) or the Contract completion date will not be met, the Contractor shall take some or all necessary actions that may include:

1. Increase construction staffing in such quantities and crafts as shall substantially eliminate the backlog of work and meet the current Contract completion date.

2. Increase the number of working hours per shift, the number of shifts per day, the number of work days per week, or the amount of construction equipment, or any combination of the foregoing sufficient to substantially eliminate the backlog of work and meet the current Contract/Milestone Completion dates

3. Reschedule work items to achieve concurrent accomplishment of work activities.

Under no circumstances will the addition of equipment or construction forces, increasing the working hours, or any other method, manner, or procedure to return to the contractually required completion date be considered justification for a change order or treated as an acceleration.

B. Failure of the Contractor to comply with the requirements of this subsection shall be a basis for determination by the District that the Contractor is not executing the Work with such diligence as will ensure completion within the Contract Time. Upon such determination, the District may terminate the Contractor's right to proceed with the Work or any separable part thereof, in accordance with the Contract Documents, or may take other actions as may be deemed appropriate.

C. When change orders or delays are experienced by the Contractor, and the Contractor requests an extension of time, the Contractor shall submit to the Construction Manager a written time impact analysis illustrating the influence of each item of change or delay.

D. As a condition precedent to the release of retained funds, the Contractor shall, after substantial completion of the work has been achieved, submit a Final Contractor's Construction Schedule which accurately reflects the manner in which the project was constructed and includes actual start and completion dates for all work activities on the Construction Schedule.

PART 2: PRODUCTS

A. The schedule produced by the **Contractor**, will be produced utilizing the most current version of Primavera Project Planner (P3) software system, SureTrak, or similar as approved by the District.

B. Microsoft Project scheduler is not an acceptable product.

PART 3: EXECUTION (NOT USED)

END OF PAGE

Exhibit 2

Additional Project Safety Guidelines

OSHA required safety work orders are to be maintained at all times. In addition, the following site specific safety program shall be adhered to at all times. The Contractor shall include the below requirements as part of any and all subcontracts for work performed at the Site:

1. Personal Protective Equipment (PPE): The following shall be worn when on the Project site at all times until "Substantial Completion". Beyond the date of Substantial Completion, PPE shall be worn at any time the hazards of the work require such PPE.
    a. Hard hats
    b. Hard soled boots or work shoes
    c. Appropriate construction work clothing i.e. long pants (no shorts), shirts with appropriate coverage over shoulder (no sleeveless shirts)
    d. Safety glasses
    e. High visibility vest and/or shirt (orange, lime green, yellow are acceptable – red is not acceptable)
    f. Gloves (as needed)
2. Weekly Safety Meetings shall be held by each contractor and sub-tier contractor of every level; written record of the topic(s) discussed and attendees to be submitted to the Construction Manager within 3 business days of being held.
3. Mandatory monthly "All-Hands Safety Meeting" to be held and conducted jointly with the Contractor and Construction Manager. All employees on site on the day of the meeting are to attend. The Contractor will administer the worker sign-in sheet and distribute to the Construction Manager immediately following the meeting.
4. Safety will be a topic discussed at the weekly mandatory Foremen's Meeting; all Contractor's foremen to be in attendance
5. All Contractor equipment shall be in good working order including operable backup alarms
    a. All operators are to be qualified to operate the equipment
    b. Operators shall provide a copy of their written qualification to the Construction Manager.
6. The Contractor shall submit a monthly report to the Construction Manager indicating the total hours worked on the project by the Contractor and subcontractors of every tier. Reports shall be submitted no later than the 7th of the month following the reporting month. Reported hours should substantially match the certified payroll reports.
7. Contractor shall immediately report in writing, any injuries (recordable or otherwise), lost time accidents, accidents involving property damage other than that of the Contractor, and any near miss incidents.

END OF PAGE

EXHIBIT 3A

EXCLUDED SCOPE OF WORK

WORK PERFORMED BY OTHERS UNDER SEPARATE DISTRICT CONTRACT

The District has awarded a separate construction agreements for the following work. The Contractor shall review carefully this list of work and note this is part of the Work that shall be excluded from this Bid Package/Contract:

1. All Work to renovate repair the East Bridge to the LCRC Project.

END OF PAGE

EXHIBIT 3B

INCLUDED SCOPE OF WORK AND CONSTRUCTION PHASING

I. DRAWINGS AND SPECIFICATIONS

1.	Supplemental Conditions, dated 02/01/2010	Complete
2.	Project Manual prepared by gkkworks, Inc, (DSA approval date 5/7/08)	Complete
3.	Drawings prepared by gkkworks, Inc, (DSA approval date 5/7/08)	Complete
4.	Geotechnical Investigation , dated 11/27/06	Complete
5.	Environmental Removal Specifications (undated) and Asbestos and, Lead Survey #1034108 dated 2/19/08 for the LRCR Building both prepared by H2 Environmental	Complete
6.	Environmental Removal Specifications (undated), the Asbestos and Lead Survey #1282210 AS dated 1/21/10, prepared for the SA Building, and the Asbestos and Lead Survey #1282210 AS dated 1/28/10, Prepared for the CC Building all prepared by H2 Environmental.	Complete

II. EXPANDED DESCRIPTION

CLARIFICATIONS AND ADDITIONAL REQUIREMENTS:

The following are additional clarifications and requirements for the Contractor to include during the execution of the work shown in the Contract Documents. These include, but are not limited to:

1. The Contractor's Work includes the LRCR Main Building, all Site Improvements, and the Demolition/Removal/Site Restoration of Buildings CC and SA complete as shown in the Project Documents.

2. The Contractor shall not modify roofing, walls, or other equipment without taking proper precautions to prevent water damage to the building contents or other interior construction. Wall and roof penetrations, roofing, and roof demolition shall be scheduled and coordinated in a manner that minimizes the duration in which the building is not watertight. Refer to **Exhibit 4** regarding the District's Water Infiltration Prevention Plan (WIPP) and the Building Enclosure Control (BEC) Program.

3. The Contractor shall schedule a pre-installation conference with the Construction Manager and District to review the proposed method of executing the work and all proposed sound and/or odor mitigation measures.

4. Contractor shall locate and identify all underground utilities that connect to and/or interfere with the Work. Additional as-built drawings are available for Contractor review at the School Maintenance Office. The Contractor shall bring all unresolved interference issues to the attention of the Architect.

5. The Contractor is advised that the District will continue to occupy a portion of the building to maintain its data center operation. The Work shall be performed to keep the occupied portion of the building operational and safe for occupancy by District staff. Utility outages shall be planned as defined in the Project Documents.

6. Shutdown of any electrical, mechanical, and plumbing systems serving must be coordinated and scheduled with Saddleback College Maintenance and Operations staff. Provide 48-hrs. Minimum notice.

7. Temporary construction work shall include interior barricades, signage, finishes, lighting or other requirements to safely separate the students/staff from the construction work.

8. The Contractor shall conduct a pre-removal meeting to review all hazardous material removal procedures with the Construction Manager and the District's industrial hygienist prior to performing the work.

9. Contractor shall provide and coordinate all permits, inspections and fees with the AQMD as required.

10. All "Recycling Credits" obtained from the waste management company in compliance with the recycling of materials removed from the project are to be the property of the District. Supply the associated manifests indicating the recycled materials. Removal of rebar from demolished concrete as required to obtain the best price/credit for recycling shall be included in the bid

11. The Contractor shall mobilize within 5-days of receipt of the Notice to Proceed.

12. Due to the nature of this Project, unforeseen conditions may be encountered during construction. As such, an allowance in the amount indicated on the Bid Form is to be included as part of the base bid and is to be used for these unforeseen conditions. Application to draw from this allowance will require written approval by the Architect and the District. All unused portions of the allowance shall be credited back to the District at the Substantial Completion point of the construction through a deductive change order to the Contract.

13. The Contractor is advised that the submittal, DSA Deferred Approval, and overall procurement time of the Skylight Systems may extend beyond the critical dates to install moisture sensitive building finishes. Therefore, the Contractor is advised to be prepared to take temporary precautions to prohibit water intrusion at the skylight openings, either existing or remodeled so as not to delay the schedule. All measures shall be installed, maintained and removed at no additional cost to the District.

14. The Contractor is advised that the submittal, DSA Deferred Approval, and overall procurement time of the Exterior Window Systems may extend beyond the critical dates to install moisture sensitive building finishes. Therefore, the Contractor is advised to be prepared to take temporary precautions to prohibit water/moisture intrusion at the these openings, either existing or remodeled so as not to delay the schedule. All measures shall be installed, maintained and removed at no additional cost to the District.

15. The Contractor shall protect in place the existing AT&T cellular tower located on the Library roof until such time that AT&T can remove and relocate it. All precautions are to be taken so as not to impair the continuous service provided as such. Maintain/provide temporary measures to prohibit water intrusion in and around the Cell Tower equipment/structure.

16. Revise Resilient Floor Tile specification #09651: Add the following paragraph:

    3.2.B.4: After demolition and removal of the existing flooring, walls, furniture, casework, shelving etc. and prior to the installation of the new floor systems, all substrates are to be verified to be within a flatness tolerance not to exceed 1/8" variance over a ten foot distance in any direction. Use a 10' metal straight edge to determine extent of patching, fill, grinding and/or chipping to achieve the aforementioned tolerances. Use products specified in this section that are compatible with the proposed flooring product(s) adhesives. Work shall be done in a timely fashion so as not to impede the schedule including moisture tests, PH test and/or adhesive tests as required by the manufacturer prior to installation.

NOISE & ODOR MITIGATION MEASURES:

1. The Contractor is advised that on school days during school hours, the Contractor shall not make excessive noise that will disrupt the education process. Excessive noise is described as that noise similar to demolition, jackhammers, chipping guns, saws, drills, roto-hammers, equipment warning alarms, noise from the roof, noise transmitted to the floor below, and loud or annoying noise of any kind. The Construction Manager and District shall use reasonable interpretation to determine when noise is deemed "excessive".
    a. Work inside the Library Building will be partially occupied by the **District's Data Center Operation** during the construction and thus sound and odor mitigation measures will receive the highest scrutiny. The Contractor shall take precautions to mitigate the impact of hazardous or noxious odors of every kind from disrupting the data center occupants.
    b. Work inside the Library Building, the "CC" Building and the "SA" Building shall be performed in a manner to mitigate excessive sound transmission that is audible from the adjacent buildings (while school is in session).
    c. The Contractor is encouraged to erect sound partitions or other barriers as necessary that will reduce the transmission of noise to the occupied portion of the site.

WORK AREAS AND PARKING

1. The construction barricade/fence is meant to be a safety separation to prevent the students and general public from entering the work site. The Contractor is responsible to provide a barricade system that meets all required safety codes and regulations insofar as to ensure the safety of the students and general public.
2. All fences shall be a minimum of 6' high, properly secured in the ground to prevent falling over in all conditions, and covered with a screening material to obscure the construction activities. Existing fences may be used provided they are in good condition and capable of handling wind loading from the screening material. The Contractor is responsible to repair/replace damaged existing fences. Removable 6' fence panels may be used in designated areas with Construction Manager's approval. All holes, bolts, etc utilized to anchor the fence must be patched back to match the pre-existing conditions or better at no cost to the District.
3. The Contractor shall provide the fencing of its own storage and laydown areas. The designated laydown area shall be as indicated in the Laydown/Fencing Plan hereto referred to as "**Exhibits #7A and 7B**.

4. The Contractor shall submit for District and Construction Manager approval, a construction barricade and phasing drawing showing the Contractor's proposed location of all barricades, office trailers, storage, parking, etc.
5. In the event the Contractor desires to remove or relocate any or all of the fence prior to Final Completion, it shall not be done without prior approval of the District or the Construction Manager. The fencing may require re-installation in its original configuration at the conclusion of this work. Request for approval to relocate fence shall be accompanied by 3 copies of a plan showing the proposed revision. Approval may be granted for reasonable requests that address traffic, public safety, and accessibility concerns.
6. When deemed necessary by the Construction Manager/District, the Contractor shall provide a flagman or take appropriate measures to ensure public safety.
7. Where it should occur, a safe access path will be needed for students and/or faculty to walk around areas where construction areas and non-construction areas adjoin.
8. The work shall be contained within the boundaries established on the construction phasing plan. The Contractor shall secure the perimeter of the work site and lay-down area. Gates shall be locked when the Contractor is not working on the Site.
9. Emergency access to the work area shall be maintained **AT ALL TIMES**. The District will include its padlock on all chains securing the gates into and out of the work site.
10. Notification to and approval from the District is required three (3) working days prior to performing work outside the barricades. All trench excavations and other work performed outside the barricade shall be kept in a safe condition at all times and comply with CAL-OSHA regulations. No trench excavation shall be left open at the end of a work day.
11. At no time shall the Contractor hoist over or place any materials onto an existing school building (or over-head in an open area) while it is occupied by students, faculty, or other District personnel. This shall include partially occupied buildings.
12. All fire and service roads to the school shall be kept open and maintained at all times. In the event a fire access lane must be blocked, an alternative fire access lane including additional directional signage must be provided and approved in writing by the District and the local fire authority. Obtaining said approvals shall be at the effort and expense of the Contractor.
13. On-site construction parking will only be permitted inside the work area or lay-down area as noted on **Exhibit #7A**. Parking at any other areas on District property shall not be permitted without prior written approval from the District. All parking areas shall be kept broom clean and free from construction dirt, trash, and debris at all times. This designated parking area only may not be used for the staging of materials Or any other purpose other than construction employee parking.
14. Twenty-five (25) temporary "Construction Parking Only" permits will be issued to the Contractor at no cost to use for the duration of the Project. It is the Contractor's responsibility to maintain those (25) permits and will be financially responsible if replacement(s) are needed

TEMPORARY UTILITIES

1. The Contractor shall examine the site and make the necessary arrangements to obtain temporary water and power from existing on-site water and electrical utilities. The utilities must have the excess capacity for the construction work and the use at the source must not disrupt the operations of the District/College at any point in time.

2. The Contractor is responsible for the removal of all temporary conduits, pipes, wires, and any other facilities used for communication, water and power. All District facilities shall be restored to their pre-project condition.
3. There will be no charge to the Contractor for consumption of electricity and water. Electricity and water consumption shall only be permitted for activities involving the performance of the Work for this Project.
4. The Contractor is responsible for locating, providing and paying for its own communication facilities. Disruption to District phone system shall not be permitted. All proposed connections through a District owned telephone panel shall be coordinated and approved by the District prior to any work commencing.

PHASING, SCHOOL CLOSURE DAYS, AND START OF CONSTRUCTION

1. The Project Site will be available for construction beginning approximately 5/10/10 unless noted otherwise.
2. The Contractor is encouraged to use the District holiday periods as noted on the campus web site calendar at: www.socccd.org to accomplish work involving excessive noise or other interruptions:

Note that the Contractor may perform work on OVERTIME, SATURDAY, SUNDAY or LEGAL HOLIDAYS with District pre-approval and the Contractor's agreement to pay for additional inspection costs (unless noted otherwise).

SUBSTANTIAL COMPLETION

1. LRCR Main Building and Site Work Substantial Finish Milestone shall include the following:
    a. Substantial Completion of all work in accordance with Specification Section 01770.
    b. Substantial Completion of the Site Work Finish Milestone is extremely important. The Contractor must take this into account when developing its work plan and utilize overtime or weekend hours as needed to accomplish this milestone.
2. Building CC (Classroom Complex) and SA (Annex) Building Demolition and Site Restoration Substantial Finish Milestone shall include the following:
    a. Removal and haul off of all demolition debris and final site cleaning. Installation of irrigation, plant material and sod. Perimeter fencing may be left in place during sod establishment period.
    b. Perimeter fencing of this site location shall be removed and necessary repairs performed prior to requesting Final Inspection of the CC and SA Building project sites.

END OF PAGE

EXHIBIT 4

DISTRICT'S WATER INTRUSION PREVENTION PROGRAM (W.I.P.P.) & BUILDING ENCLOSURE CONTROL PROGRAM (B.E.C.P.) & THE ELIMINATION OF CONTAMINATES

The District desires a completed project that is free of moisture damaged finishes, contaminated surfaces including dust and mold, skylights, windows, doors, louvers, and roofs that do not leak, and workmanship of the best quality per the requirements of the Contract Documents.

During construction activities, the Contractor shall take all required precautions to prevent building water infiltration, moisture damage and contamination from deleterious materials. A program shall be developed and submitted to the Construction Manager and Architect for review at least fourteen (14) calendar days PRIOR to the commencement of any activity that exposes the Building to water intrusion from the roof, through windows or from relocation of utility piping or activities that expose finished products to dust, mold, and any other contaminates.

In order to complete the project within the stipulated duration, the Contractor may need to include in the cost of the work temporary water infiltration protective measures as noted below at the skylights, exterior windows, and during roof replacement.

The Contractor shall also take precautions to prevent any of the following from entering occupied portions of work not under construction.

These precautions include but may not be limited to:

1. Prevention of water infiltration through the open building enclosure such as doors, windows, skylights, open roofing during replacement operations and other moisture barriers. The Contractor shall outline specific procedures and submit for acceptance (note that not all of the below may be applicable to the Work):
    a. Use of moisture resistant materials
    b. Protecting open walls parapets covered by tarps
    c. Use of polyethylene sheeting on scaffolding
    d. Sealing floor penetrations at designated floor
    e. Furnishing Temporary heat to prevent material damage
    f. Temporary roof drains to channel water safely from the work
    g. Temporary roof coverings
    h. Install window-door opening shields to prevent entry of wind driven rain
    i. Store materials on dunnage
    j. Diversion ditches to channel water from the work area
    k. Install Silt fence to control erosion
    l. Keep sump pumps on site during the rainy season

m. Temporary grading of site to channel water to collection points

n. Temporary retention and settling ponds

o. Emergency drainage piping

p. Temporary equipment material stocking openings sealed during non use

q. Floor water sensors

r. Isolation valve maps

s. Lockout-tagout of piping

t. Water flow monitoring on pressurized water piping for notification of water line breach

u. System openings sealed as installed

2. Immediately remove moisture damaged drywall, insulation, wood, flooring, and any other damaged materials that may cause the growth of mold or mildew.

3. Protect all materials from dust, fugitive paint overspray and other contaminates. The Contractor shall initiate the use of walk-off mats, temporary poly dust walls, shrink wrapping, positive pressure systems, masking, and any other appropriate methods. When possible, retain original shipping protection. Materials to be protected include: Ductwork, millwork, flooring and carpet, wallcovering, ceiling tile, light fixtures, etc. Contaminated materials shall be properly cleaned to a "like new" condition.

4. The Contractor is encouraged to use visual and functional Mock-ups:

   a. Exterior paving - colored cement, exposed aggregates/special finishes, expansion joints.

   b. Metal wall panel system.

   c. Sample millwork - when repetitive units are involved.

   d. Masonry block sample - surface texture/mortar joints/control joints - block filler.

   e. Stucco - color/textures/special details/joints.

   f. Architectural coatings - color/texture.

   g. Millwork finishes.

   h. Individual window samples - full size.

   i. Roofing details, i.e., leaders, pitch pockets, flashing, etc.

   j. Typical ceramic installation.

   k. Painted walls and ceiling including texture.

   l. Vinyl fabric (including seams).

   m. Drywall construction above ceiling (including penetrations and detail at structure above).

   n. Fire Damper and Smoke Damper Installation.

   o. Typical clean-out and drain installation in ceramic tile, vinyl tile and concrete floors.

   p. Waterproofing and waterproof tests.

   q. Expansion joints and control joints, especially those which are to be watertight.

r. Wall and Deck Penetration Fireproofing.

s. Other "Mock-ups" or sample construction items as deemed applicable or required elsewhere in the contract documents.

5. Pre-Installation Meetings:

Pre-installation meetings are important to maintain quality as they provide clarity to the construction means and methods as well as what was approved in the submittals, mock-up/sample construction or shown in the construction documents. Contractors as noted will be required to attend a pre-installation meeting. As a minimum, the following list identifies the trades to be involved for the LRCR project:

Demolition / Hazardous Materials Removal	Flooring Systems	
Site Clearing/Grading/Earthwork	Plumbing	
Site Utilities	HVAC	
Site Concrete	Fire Sprinklers	
AC Paving/Markings	Electrical	
Landscape & Irrigation	Signage	
Reinforcing Steel and Structural Concrete		
CMU		
Doors, Frames and Hardware		
Miscellaneous Metal		
Waterproofing		
Drywall/Metal Studs/Plaster		
Roofing		
Sheet Metal and Expansion Joints		
Joint Sealants		
Ceramic Tile		
Doors, Frames and Hardware		
Curtain wall/Glazing		
Skylight Systems		
Casework/Millwork		

A typical pre-installation meeting will review the following information:

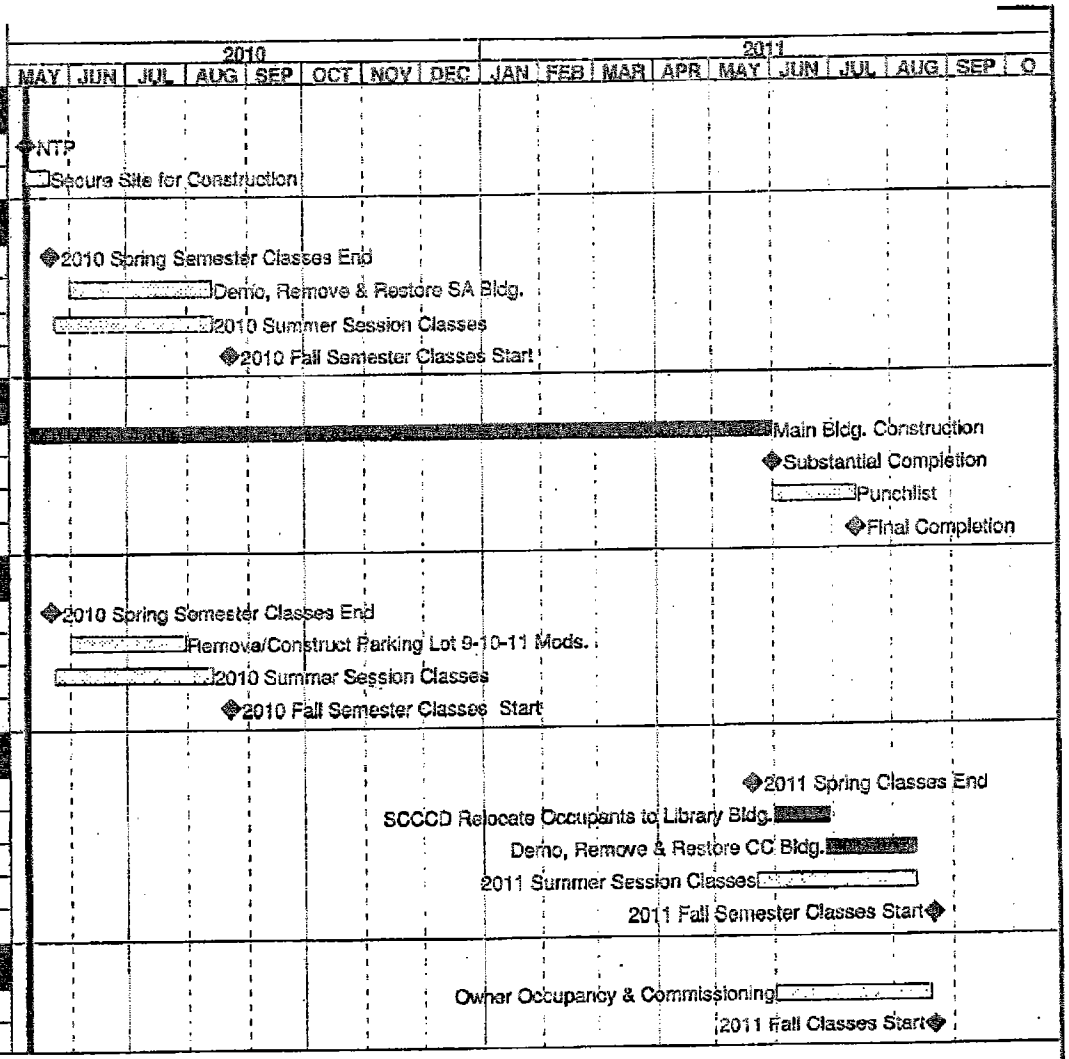
- Project and trade specific safety guidelines
- Review of Mock-up, Sample Construction, and/or Submittals
- Discussion of Contractor's means and methods for construction
- Tests and Inspections
- Review of construction sequencing/schedule
- Defining precedence and/or coordination of systems
- Review of the Contractor's QA/QC plan

These meetings are intended to be conducted 2-3 weeks prior to the Contractor commencing the work on site and will include as a minimum the following: Contractor's Superintendent/Foreman to be onsite; Contractor's Project Manager; Contractor's Safety Engineer (if applicable); Contractor's QA/QC Engineer (if applicable).

EXHIBIT 5

RESERVED FOR FUTURE USE

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
Mobilization				
500	NTP	0	10MAY10	
600	Secure Site for Construction	12	10MAY10	21MAY10
Phase 1 - SA Building				
1000	2010 Spring Semester Classes End	0		21MAY10*
1010	Demo, Remove & Restore SA Bldg.	74	01JUN10	13AUG10
1015	2010 Summer Session Classes	82	24MAY10	13AUG10
1020	2010 Fall Semester Classes Start	0	23AUG10*	
Phase 2 - Main Building				
2000	Main Bldg. Construction	387	10MAY10	31MAY11
2010	Substantial Completion	0		31MAY11
2015	Punchlist	42	01JUN11	12JUL11
2020	Final Completion	0		12JUL11
Phase 3 - Parking Lots 9-10-11				
3000	2010 Spring Semester Classes End	0		21MAY10
3010	Remove/Construct Parking Lot 9-10-11 Mods.	60	01JUN10	30JUL10
3015	2010 Summer Session Classes	82	24MAY10	13AUG10
3020	2010 Fall Semester Classes Start	0	23AUG10	
Phase 4 - CC Building				
4000	2011 Spring Classes End	0		20MAY11*
4010	SCCCD Relocate Occupants to Library Bldg.	28	01JUN11	28JUN11
4015	Demo, Remove & Restore CC Bldg.	47	27JUN11	12AUG11
4020	2011 Summer Session Classes	82	23MAY11	12AUG11
4025	2011 Fall Semester Classes Start	0	22AUG11*	
Owner Occupancy				
5000	Owner Occupancy & Commissioning	80	01JUN11	19AUG11
5010	2011 Fall Classes Start	0	22AUG11	



Start Date	10MAY10
Finish Date	21AUG11
Data Date	10MAY10
Run Date	28JAN10 09:50

Early Bar
Progress Bar
Critical Activity

LRMR

Sheet 1 of 1

McCarthy Building Companies, Inc.

James B Utt Memorial LRCR Milestones

Milestone Schedule

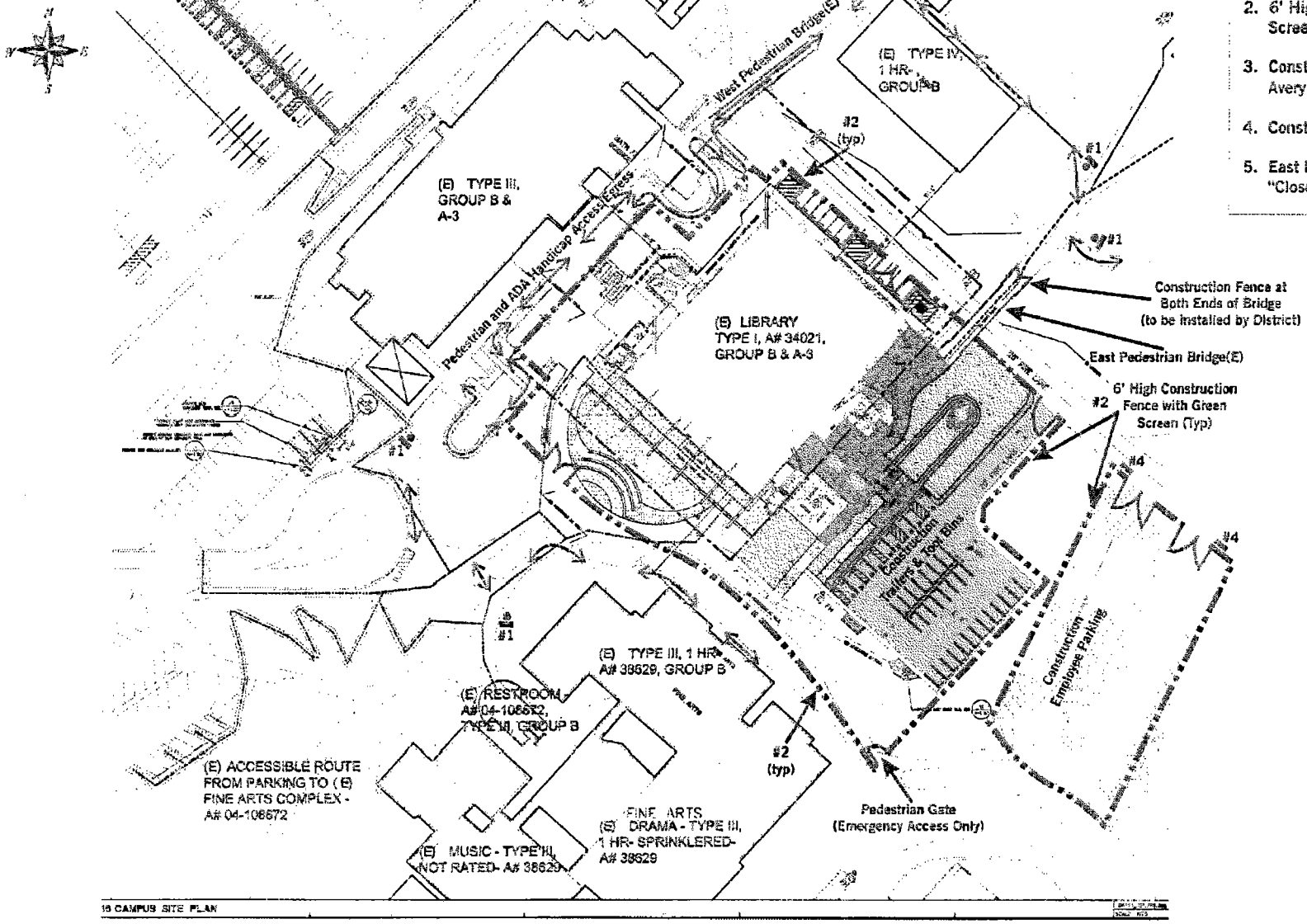
EXHIBIT "6"

McCARTHY BUILDING COMPANIES

Date	Revision	Checked	Approved

© Primavera Systems, Inc.

Saddleback College
James B. Utt Memorial Library
Learning Resource Center Renovation



LEGEND

1. Directional Signage to Use West Pedestrian Bridge(s) Ea.
2. 6' High Construction Fence with Green Screen.
3. Construction Access/Egress to be Via Avery and College Drive East.
4. Construction Parking Only Sign (2) Ea.
5. East Pedestrian Bridge will Remain "Closed" during Construction.

Exhibit 7A

McCARTHY Construction Management Services

Saddleback College
James B. Utt Memorial Library
Learning Resource Center Renovation

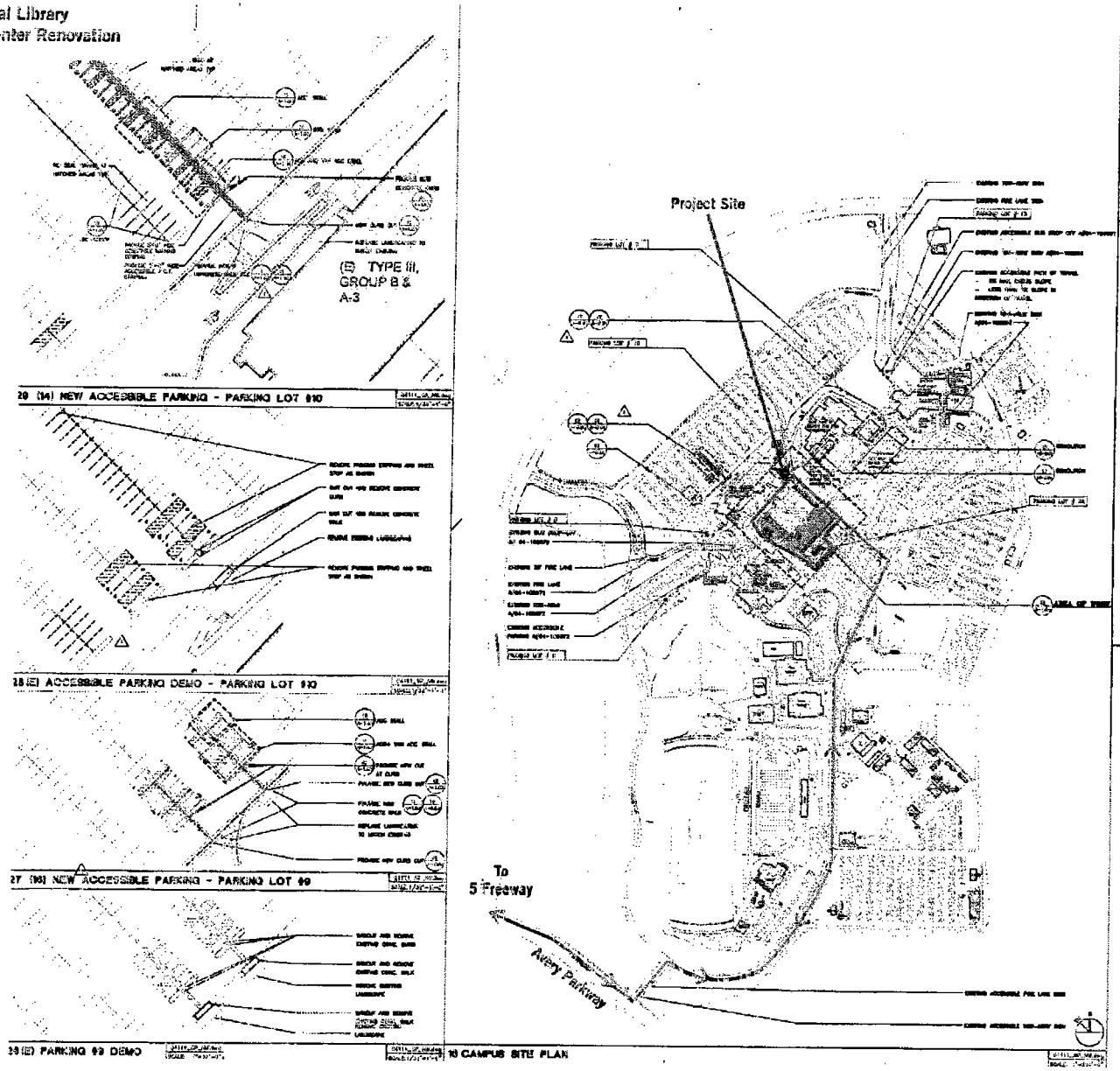


Exhibit 7B

McCarthy Construction Management Services

American Geotechnical, Inc.

Protecting Your Future

November 27, 2006 File No. 32180.02

South Orange County Community College District
28000 Marguerite Parkway
Mission Viejo, CA 92692-3635

Attention: Mr. Raul Villalba

Subject: **GEOTECHNICAL INVESTIGATION**
Apparent Slab Distress
Library Building
Mission Viejo, California

Dear Mr. Villalba:

Pursuant to your authorization for geotechnical consulting, the accompanying geotechnical report has been prepared for the purpose of providing conclusions and recommendations pertaining to the proposed remedial repairs to the Library Building.

Results of our investigation indicated that the slab-on-grade of the Library Building has been adversely impacted by the expansive soil activity of the underlying fill/bedrock. Additionally, it is our opinion that the negative impact of the site geotechnical conditions is generally limited to the front, eastern portion of the slab-on-grade. The manometer survey performed in the second-floor slab also indicated some tilting and doming. Some of this measured deflection may be due to structural sagging and/or other adjustments. We recommend that the project structural engineer review the manometer data and provide any remedial recommendations, if necessary.

This geotechnical report should be reviewed in detail prior to proceeding with the planned remedial repairs. Should you have any questions regarding the information herein, please contact us. When construction plans become available, they should be forwarded for review and comment.

Respectfully submitted,

AMERICAN GEOTECHNICAL

REGISTERED GEOLOGIST CRAIG CHASE No. C.E.G. 2225 Exp. 6-30-07 CERT. ENG. GEOLOGIST STATE OF CALIFORNIA

Craig C. Chase
Chief Engineering Geologist
C.E.G. 22225

REGISTERED PROFESSIONAL ENGINEER MOHAMMAD JOOLAZADEH No. GE 2199 Exp. 6/30/08 GEOTECHNICAL STATE OF CALIFORNIA

Mohammad Joolazadeh
Principal Engineer
G.E. 2199

REGISTERED PROFESSIONAL ENGINEER ARUMUGAM ALVAPPILLAI No. GE2504 Exp. 12-31-07 GEOTECHNICAL STATE OF CALIFORNIA

Arumugam Alvappillai, Ph.D.
Senior Engineer
G.E. 2504

Attachments: Plates 1-13
Appendix A - B
Distribution: 3 – Addressee

wpdata\oc\32180.02.mj.ak.nov.2006.Geo Investigation

22725 Old Canal Road, Yorba Linda, CA 92887 • (714) 685-3900 • FAX (714) 685-3909
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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this geotechnical investigation was to obtain geologic and engineering data to estimate on-site geotechnical conditions and to provide remedial repair recommendations for the apparent distress conditions in the Library Building of the Saddleback College campus.

1.2 BACKGROUND INFORMATION AND PROJECT DESCRIPTION

The investigation area consisted of the first floor (basement) of the Library Building within the Saddleback campus area in the city of Mission Viejo, California. Several investigations were previously performed by other consultants for the reported slab distress in the Library Building. These investigations generally concluded that the existing distress is the result of adverse expansive soil activity at the site. This supplemental investigation was performed to determine the extent of the existing distress and provide remedial repair recommendations.

The Library Building is a three-story, concrete-frame structure with a conventional shallow slab/foundation system founded in bedrock deposits. The site soils prior to development generally consisted of up to five feet of natural soils overlying sedimentary bedrock of the Niguel Formation. To achieve the desired finish grade elevation, excavations on the order of 40 to 60 feet were required. Due to the required excavation, the topsoil and the upper bedrock layers were removed. Construction of the Library Building was completed in 1971. It is our understanding that the distress to the building was first reported in 1984. Additionally, it our understanding that in recent years the footprint of the Library Building was extended easterly. This extension was accomplished by enclosing the patio slab between the main Library Building and the concrete architectural/structure columns located along the eastern side of the building.

1.3 SCOPE OF SERVICES

The scope of work performed during this investigation included the following:

* Gather and review of available published and unpublished reports and maps pertaining to geotechnical conditions at the site and surrounding areas;
* Manometer level survey of the entire slab-on-grade system as well as the 2nd floor slab of the Library Building;
* Concrete coring of the slab-on-grade at four locations;
* Subsurface exploration consisting of four small diameter borings;
* Logging of the borings using visual and tactile methods;
* Collection, during logging, of samples considered representative of materials encountered;
* Laboratory analysis of selected representative samples collected during the subsurface investigation;

* Geotechnical analysis;

* Preparation of this report summarizing our field and laboratory investigations, presenting our findings and conclusions, and providing remedial repair recommendations for the Library Building.

2.0 INVESTIGATION

2.1 SUBSURFACE INVESTIGATION

Subsurface conditions at the site were explored by excavating four borings in the interior of the building. Prior to excavation of the borings, four six-inch-diameter concrete cores were obtained from the slab-on-grade system. Borings were excavated to a maximum depth of 10 feet below grade utilizing hand-auger equipment. Our field personnel logged the test pits and borings using visual and tactile methods. Representative bulk and undisturbed soil and bedrock samples were also obtained for subsequent laboratory testing.

The approximate location of the borings performed for this investigation as well as borings by other consultants are shown on Plate 1. A detailed description of the materials encountered in our test borings and in the borings by others is given in the boring logs presented in Appendix A.

2.2 MANOMETER-LEVEL SURVEY

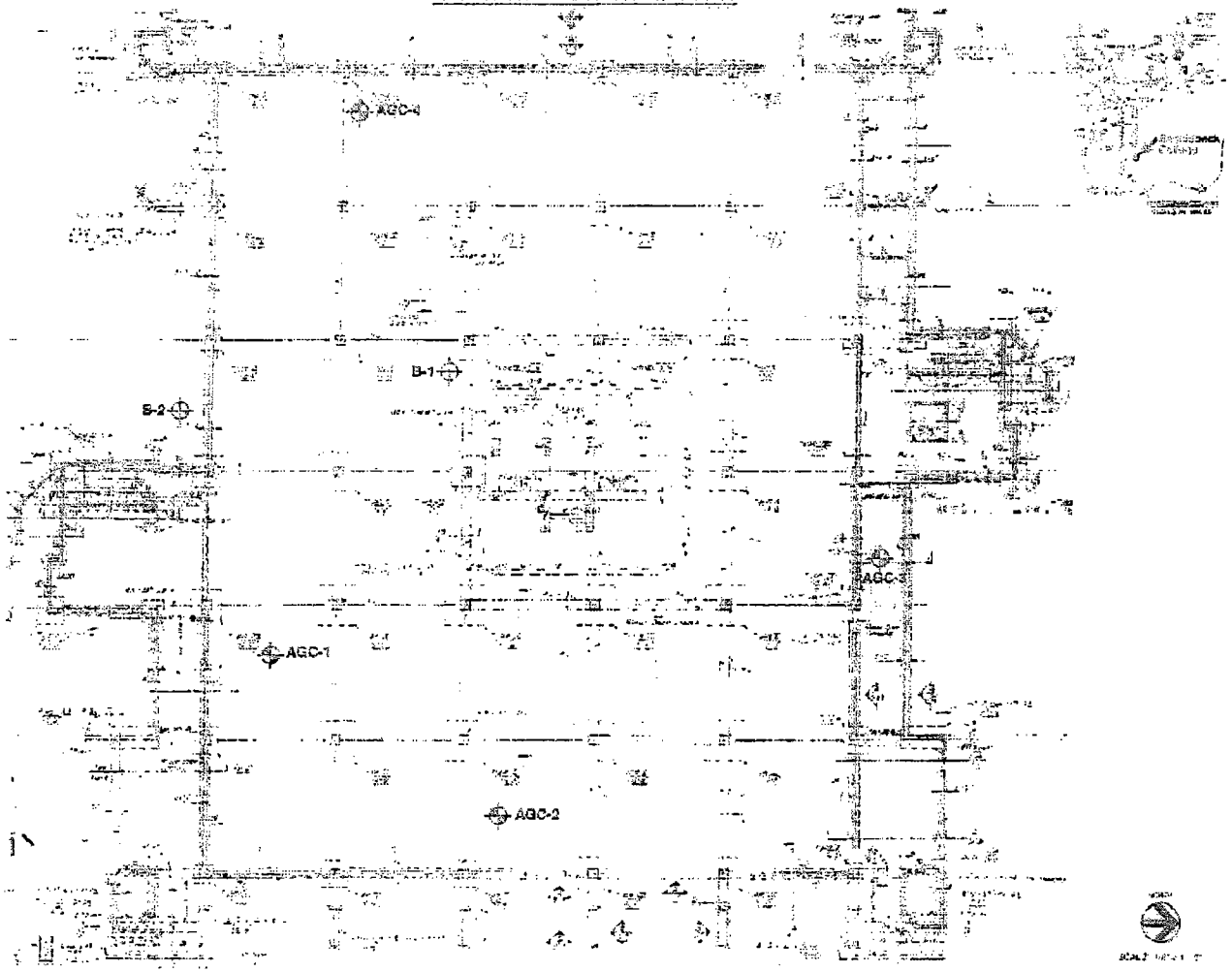
In addition to a visual review of the site conditions, a manometer survey was also conducted in the interior of the Library Building. The purpose of this survey was to evaluate the relative levelness of the slab-on-grade floor as well as the 2nd floor system. A manometer is a single-reservoir, direct-reading device commonly used for the purpose of measuring floor elevations. At the free end of the manometer device, water within the clear plastic tubing moves up and down with respect to an inverted scale to allow for the direct reading of elevation changes. The device has a sharp point fixed to the bottom of the scale, which can easily penetrate carpet without damage.

Measurements were taken at close intervals and corrected for varying floor heights and thickness of floor coverings. All point readings have been based on the same datum. By evaluation of the different readings, floor deformation can be easily determined by conventional contouring techniques.

The contoured manometer data shown on Plates 2 and 3 indicates that the maximum difference in elevation across the entire 1st and 2nd floors is on the order of 7.6 and 2.1 inches, respectively. A part of the observed elevation differential may be attributed to the finish of the slab during construction. Floor-level variations, due to construction, are difficult to quantify. Our experience with similar projects indicates that ordinary construction deviations may be as much as 3/8 to 1/2 inch. However, based on the magnitude of the floor deformation, it appears that the building was significantly affected by expansive soil-related earth movement.

Subdivision Drawings

BASEMENT FOUNDATION PLAN



Explanation

AGC-4 [illegible]

B-1 [illegible]

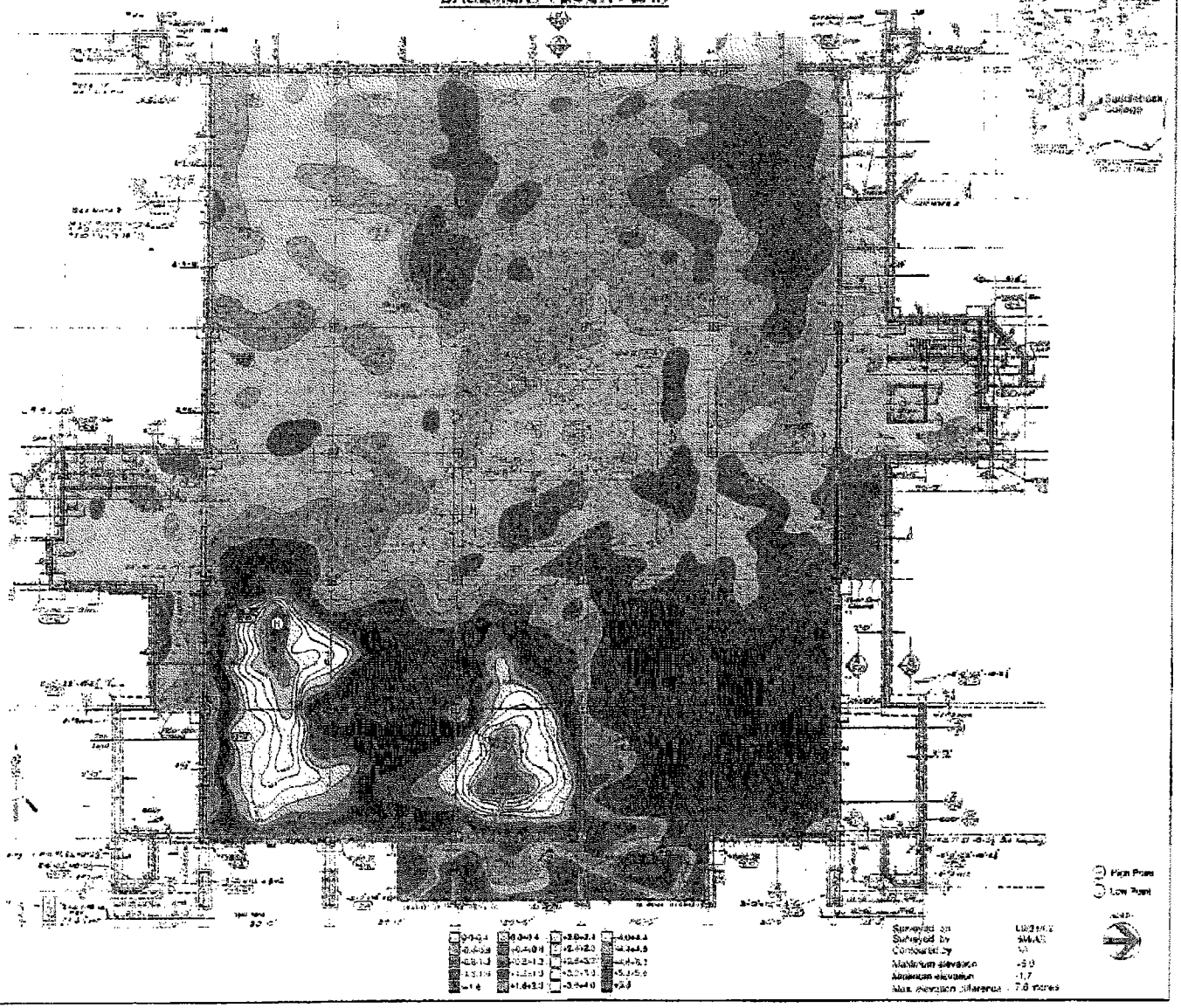
AMERICAN GEOTECHNICAL

BORING LOCATIONS

Plate 1

Southwest College

BASEMENT FLOOR PLAN



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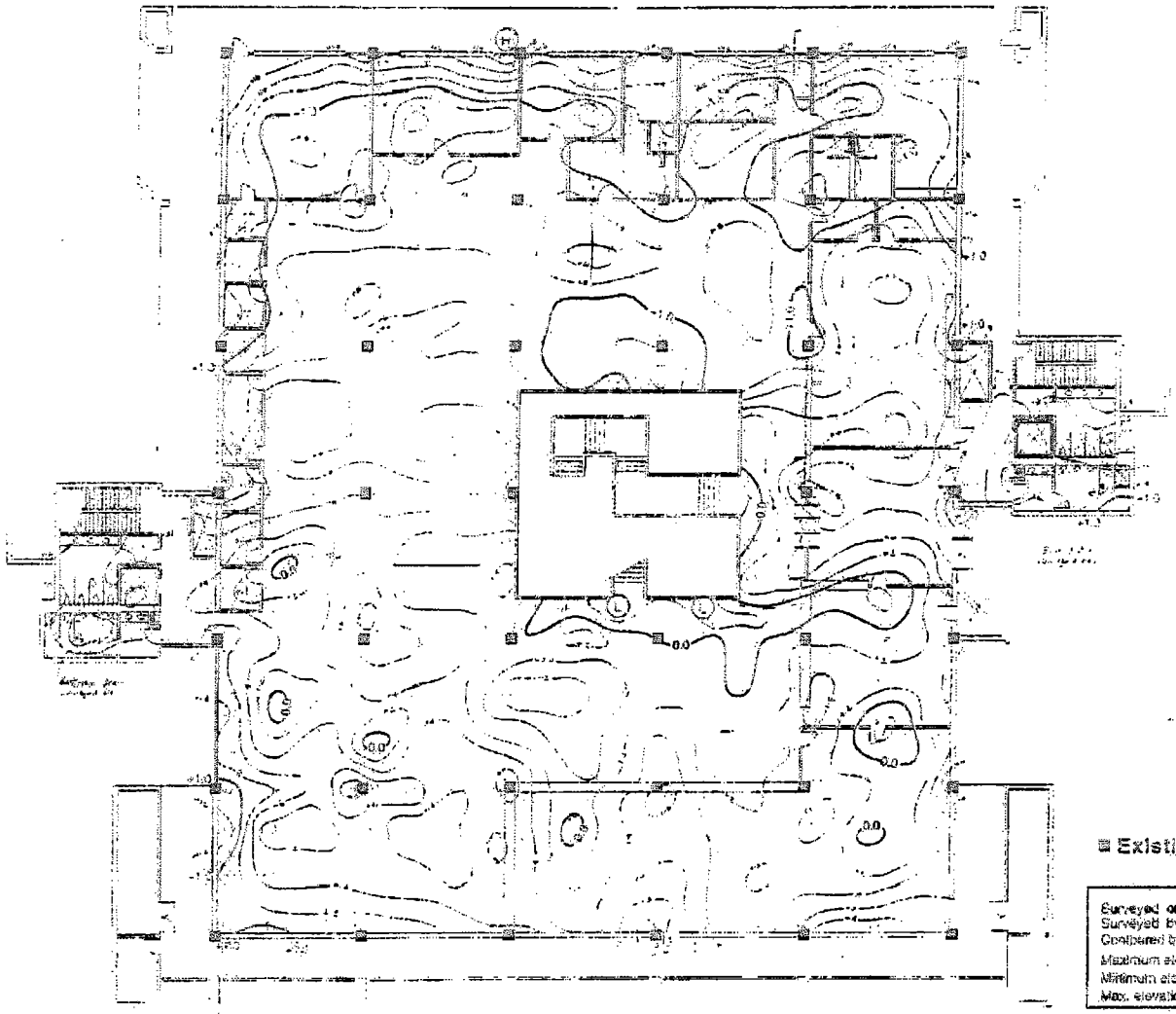
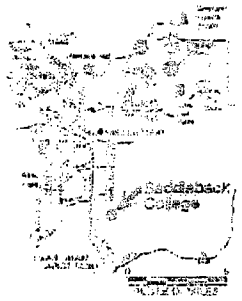
MONOMETER SURVEY

Page 1

Saddleback College

SECOND FLOOR LIBRARY BUILDING





NORTH

■ Existing Columns

Surveyed on	07/23/05	
Surveyed by	MD/GC	
Compiled by	AA	
Maximum elevation	+1.2	High Point
Minimum elevation	-2.3	Low Point
Max. elevation difference	2.1 inch	

REVISIONS

AMERICAN GEOTECHNICAL
32726 Old Canal Road, Yucaipa, California 92399
PHONE: (714) 795-3900, FAX: (714) 795-3910

MANOMETER SURVEY
SADDLEBACK COMMUNITY COLLEGE
LIBRARY CLASSROOM COMPLEX
MISSION VIEJO, CALIFORNIA

File No. 2318.03

Date 10/17/2005

Plate 3

2.3 LABORATORY TESTING

Samples collected in the field were examined in the laboratory to check the field classification and to assign laboratory testing. Selected samples were tested to determine soil properties for use in the subsequent engineering analyses. Laboratory tests included moisture-density, consolidation, expansion potential, and corrosion potential. The laboratory test results are presented in Appendix B.

3.0 GEOLOGY

3.1 SITE GEOLOGY

Information obtained from our subsurface investigation and previous investigations for the site as well as the existing reports for the surrounding buildings, indicated that the site is underlain by a variable thickness of fill soil and bedrock of the Niguel Formation.

3.1.1 Artificial Fill

Up to five feet of fill was encountered in the borings and the test pits excavated for this project. The fill that was observed was comprised of brown to gray, moist to wet, stiff, sandy to silty clay.

3.1.2 Niguel Formation

The bedrock encountered at the site was predominately brown to gray, moist, hard, interbedded sandstone, siltstone and claystone of Niguel Formation.

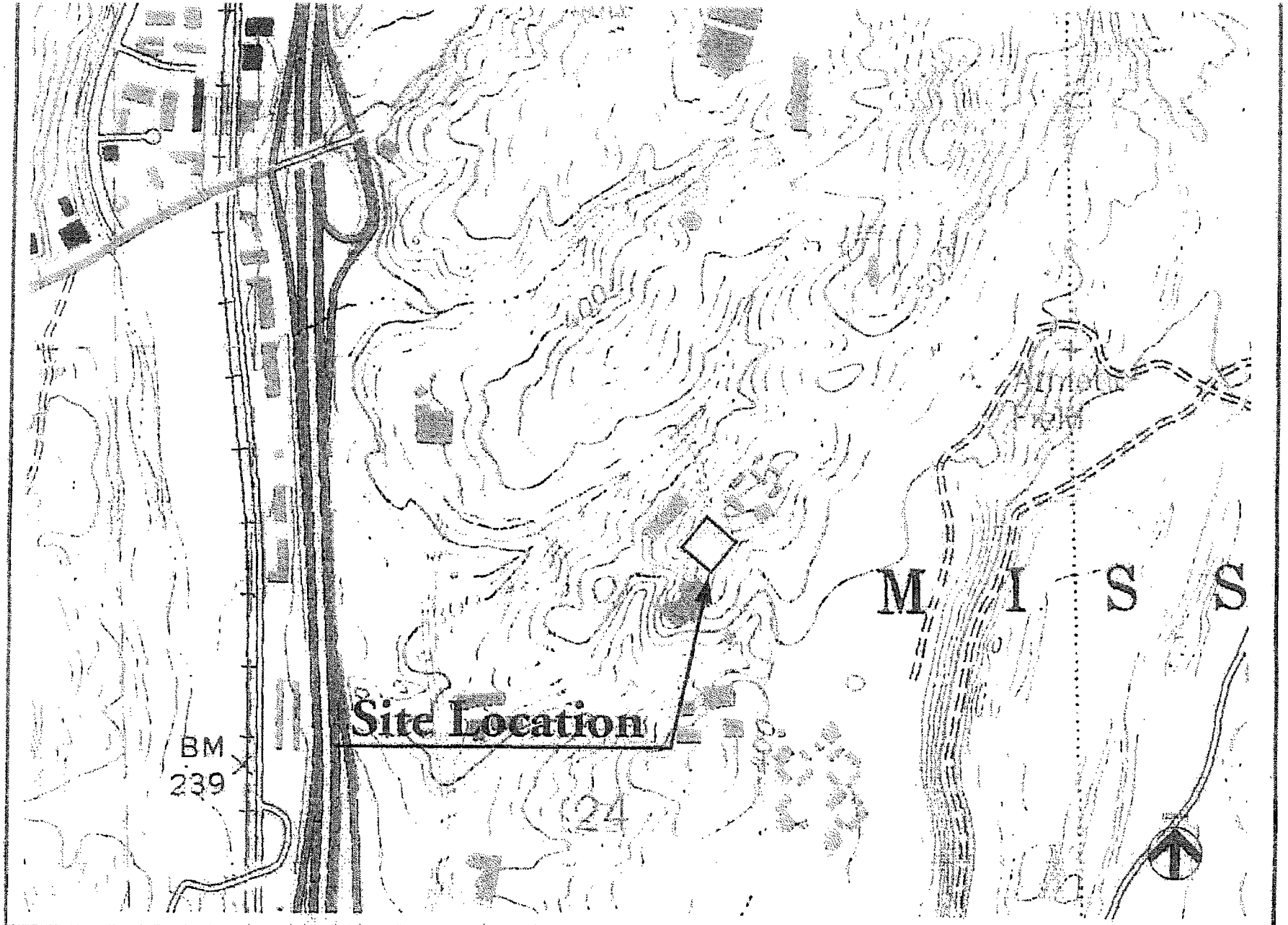
3.1.3 Groundwater

Groundwater was not encountered in any of the test excavations during our site investigation.

3.2 GEOLOGIC SETTING

The Library Building is located within the Saddleback College campus in the city of Mission Viejo. The approximate site coordinates are 33.5537 degrees north latitude and 117.6653 degrees west longitude. The campus is located within Section 24 of Township 7 South, Range 8 West as depicted on the San Juan Capistrano, CA 7.5-Minute Topographic Quad Map dated 1968, and photo revised 1981. A Site Location Map utilizing the 7.5-Minute Quad Map is attached as Plate 4.

Regionally, the subject site is located within the northern portion of the Peninsular Ranges Geomorphic Province of southern California. The Peninsular Ranges Geomorphic Province consists of a series of northwest-trending mountain ranges and valleys and similarly oriented faults. The province extends from the Transverse Ranges southward to the tip of the Baja California Peninsula. The width of the province in southern California extends from the Pacific Ocean on the west to the Colorado Desert in the east.



Site Topographic Map

AMERICAN GEOTECHNICAL	FN. 32180.02	NOV 2006	Plate 4

The Transverse Ranges Province is a seismically-active region characterized by structural blocks separated by a series of northwest-trending strike-slip faults. These faults are a part of or related to the San Andreas Fault System. The most prominent of these faults within the site area are the Whittier, Elsinore and Newport-Inglewood Fault Zones, all of which are known to be active during Quaternary time.

Locally, the subject site is situated within the extreme southeast portion of the Los Angeles Basin on the flank of the rolling hills at the confluence between the Santa Ana Mountains to the east and San Joaquin Hills to the west. Based on a review of available geologic maps in our library, the subject site and immediate vicinity is underlain by shallow, marine-derived sedimentary bedrock of the Pliocene age (approximately 1.8 – 5 million years ago) Niguel Formation (map unit Tn). The Niguel Formation in the site area is generally composed of a white to yellowish-gray, fine to coarse-grained, friable, moderately indurated sandstone with interbeds of yellowish-gray siltstone.

A Regional Geologic Map is attached as Plate 5.

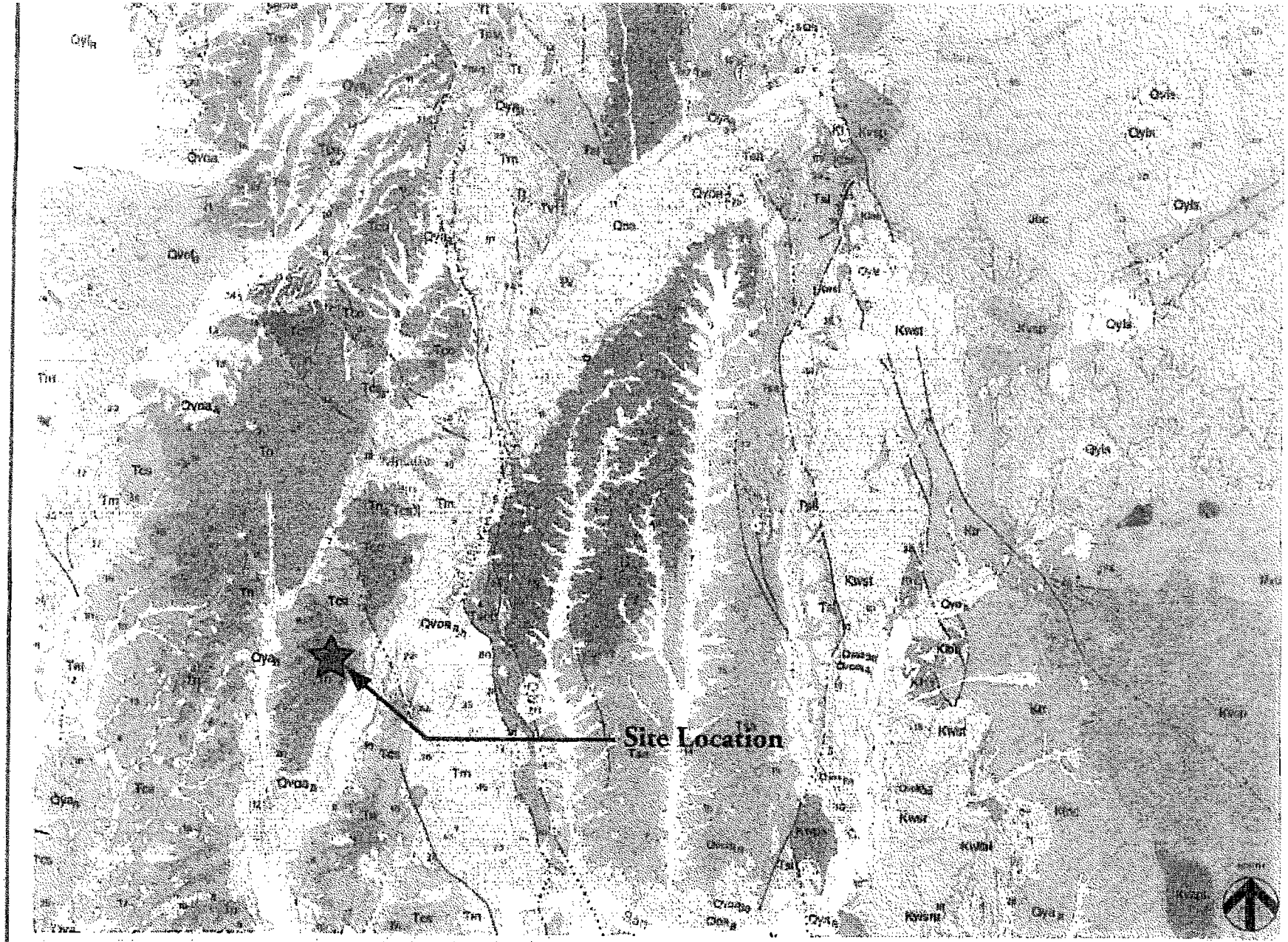
3.3 FAULTING AND SEISMICITY

A risk common to all areas of southern California that should not be overlooked is the potential for damage resulting from seismic events (earthquakes). The site is located within a seismically active area, as is all of southern California. Although we are not aware of any active or potentially active faults on or within the immediate vicinity of the site, earthquakes generated on large regional faults such as the Newport-Inglewood, Elsinore, San Andreas, etc., could affect the site. The closest known active fault to the site is the northwest-trending Newport-Inglewood Fault Zone, located approximately 8 miles (13 km) southwest of the subject site.

The Newport-Inglewood Fault Zone is generally considered part of the larger, continuous Newport-Inglewood – Rose Canyon Fault Zone, which extends for a distance of approximately 150 miles from its onshore, northwestern termination along the Santa Monica fault near West Los Angeles and then southeast offshore. The fault zone reappears onshore near La Jolla and then continues southward into the San Diego Bay where it either terminates or continues into Baja, California. Motion along this fault zone is generally considered to be right-lateral, strike-slip with some component of vertical slip. This fault zone has an estimated slip rate of 0.8 to 2.1 millimeters per year and is thought to be capable of producing earthquakes between a moment magnitude 6.0 and 7.2 (Jennings, 1994).

The closest historically recorded moderate to large earthquake is a moment magnitude 4.5 earthquake that had an epicenter located approximately 8 miles (13 km) from the site and occurred on October 27, 1969. This earthquake generated a peak ground acceleration of 0.038g at the site.

The largest recorded historical earthquake to affect the site was the March 11, 1933 Long Beach earthquake, which had an epicenter located approximately 18 miles (29 km) southwest of the site on the offshore segment of the Newport-Inglewood Fault Zone. This earthquake had a moment magnitude of approximately 6.3 and generated an estimated peak ground acceleration of about 0.068g at the subject site.



Regional Geologic Map

AMERICAN GEOTECHNICAL	FN. 32180.02	NOV 2006	Plate 5

The subject site is not located within a currently designated State of California Earthquake Fault Zone. Based on a review of the existing geologic information, no major surface fault crosses through or extends toward the site. The potential for surface rupture resulting from the movement of nearby major faults is not known with certainty but is considered low.

A regional fault map is presented as Plate 6.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 BASIS

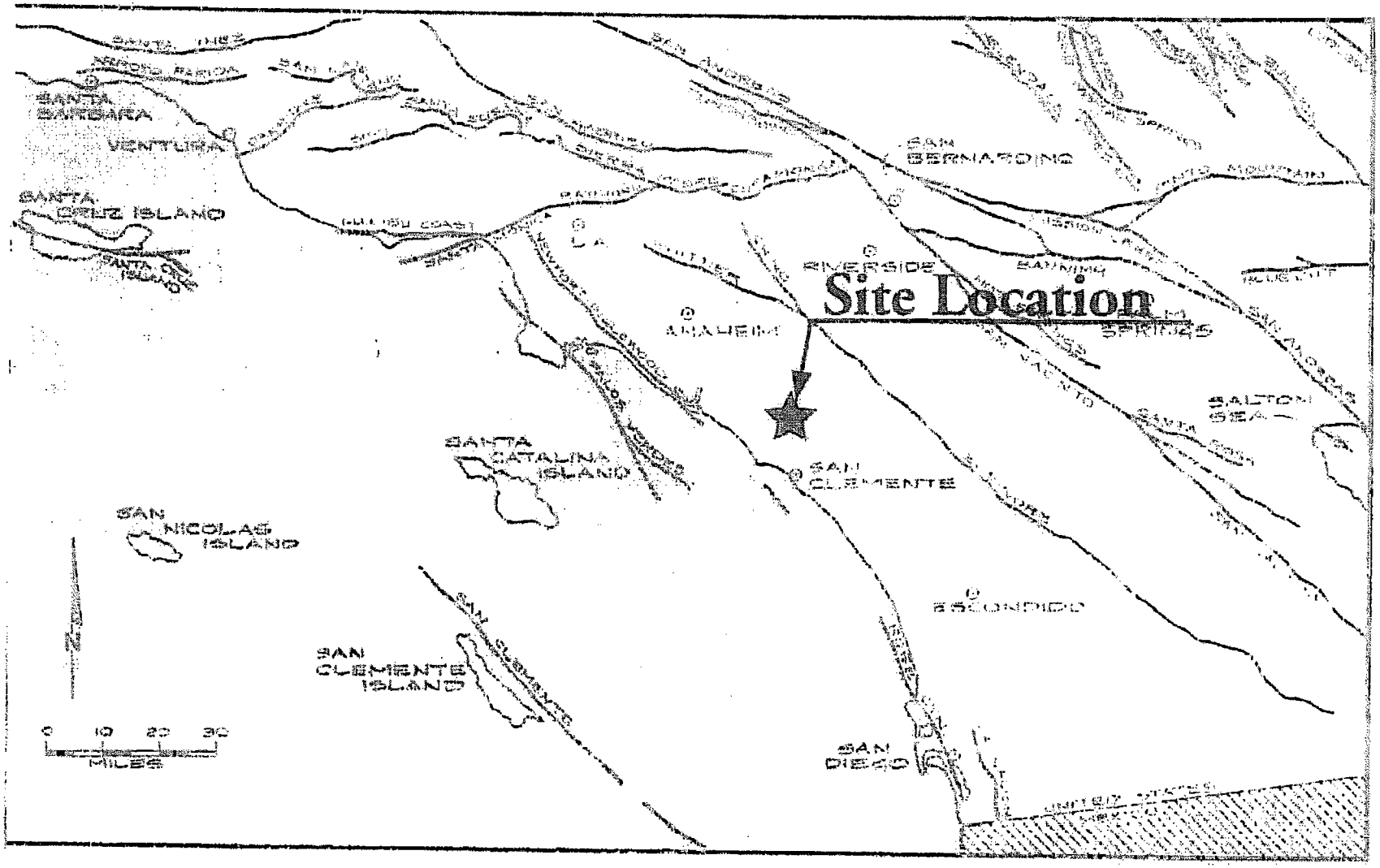
Conclusions and recommendations contained in this report are based upon information provided, information gathered, laboratory testing, engineering and geologic evaluations, experience, and professional judgment. Recommendations contained herein should be considered minimums consistent with the industry practice. More rigorous criteria could be adopted, if a lower risk of future problems is desired. Where alternatives are presented, regardless of what approach is taken, some risk will remain, as is always the case. Usually, the lowest risk is associated with the greatest cost.

4.2 ALTERNATIVES

Where alternatives are presented in this report, the client should consider all information in the report, as well as the advice of other design team members, including the contractor. The client should also request any other information on design alternatives that he deems necessary. After consideration of costs, benefits, and risks, the client should identify the approach that he desires, the project design and construction to take. It should be kept in mind that the governing authority may dictate the manner in which the project proceeds.

4.3 SITE SUITABILITY

Geotechnical exploration, analyses, experience, and judgment result in the conclusion that the proposed improvement is geotechnically feasible. It is our opinion that the site can be improved without hazard of landslide, slippage, or damaging settlement, and improvement can occur without similar adverse impact on the adjoining properties. Realizing this expectation will require adherence to good construction practice, agency and code requirements, the recommendations in this report, and possible addendum recommendations made after the plan review and at the time of construction.



Regional Fault Map of Southern California

AMERICAN GEOTECHNICAL	FN. 32180.02	NOV 2006	Plate 6

4.4 SEISMIC DESIGN CONSIDERATION

4.4.1 UBC Design Parameters

The active fault closest to the site is the Newport-Inglewood Fault located approximately eight miles (13 km) southwest of the subject site. This fault zone has an estimated slip rate of 0.8 to 2.1 millimeters per year and is thought to be capable of producing earthquakes between moment magnitudes of 6.0 to 7.2. The site is not within an Alquist-Priolo Earthquake Fault Zone, and no active faults with ground rupture potential have been mapped at the site. Based on this available information about the fault zone and the site soil conditions, the following seismic design parameters are recommended according to Chapter 16 of the 1997 Edition of the Uniform Building Code (UBC).

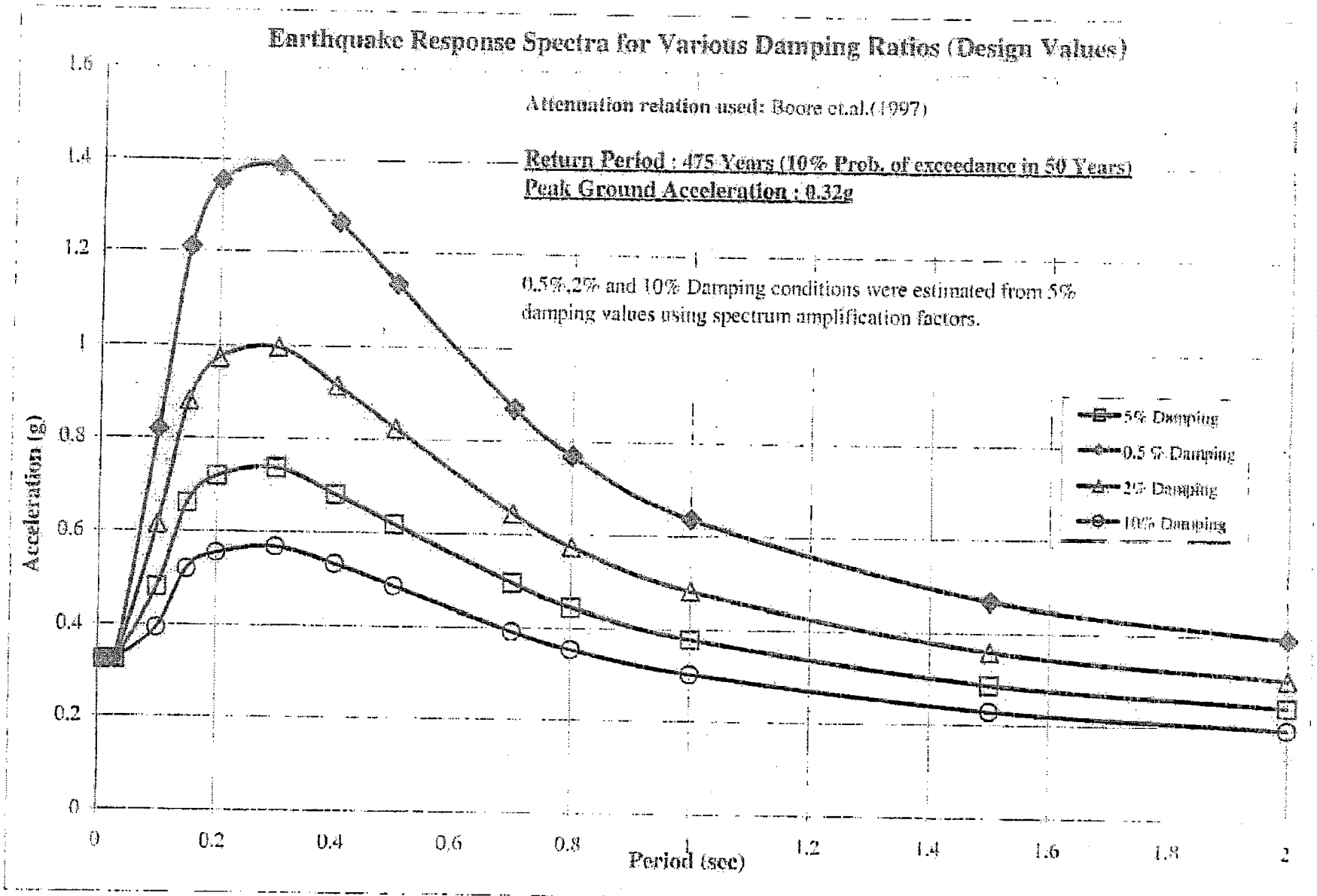
Soil Profile Type	: S_C
Seismic Zone Factor (z)	: 0.4
Seismic Source Type	: B
Near-Source Factor, N_a	: 1.0
Near-Source Factor, N_v	: 1.0
Seismic Coefficient, C_a	: 0.40
Seismic Coefficient, C_v	: 0.56

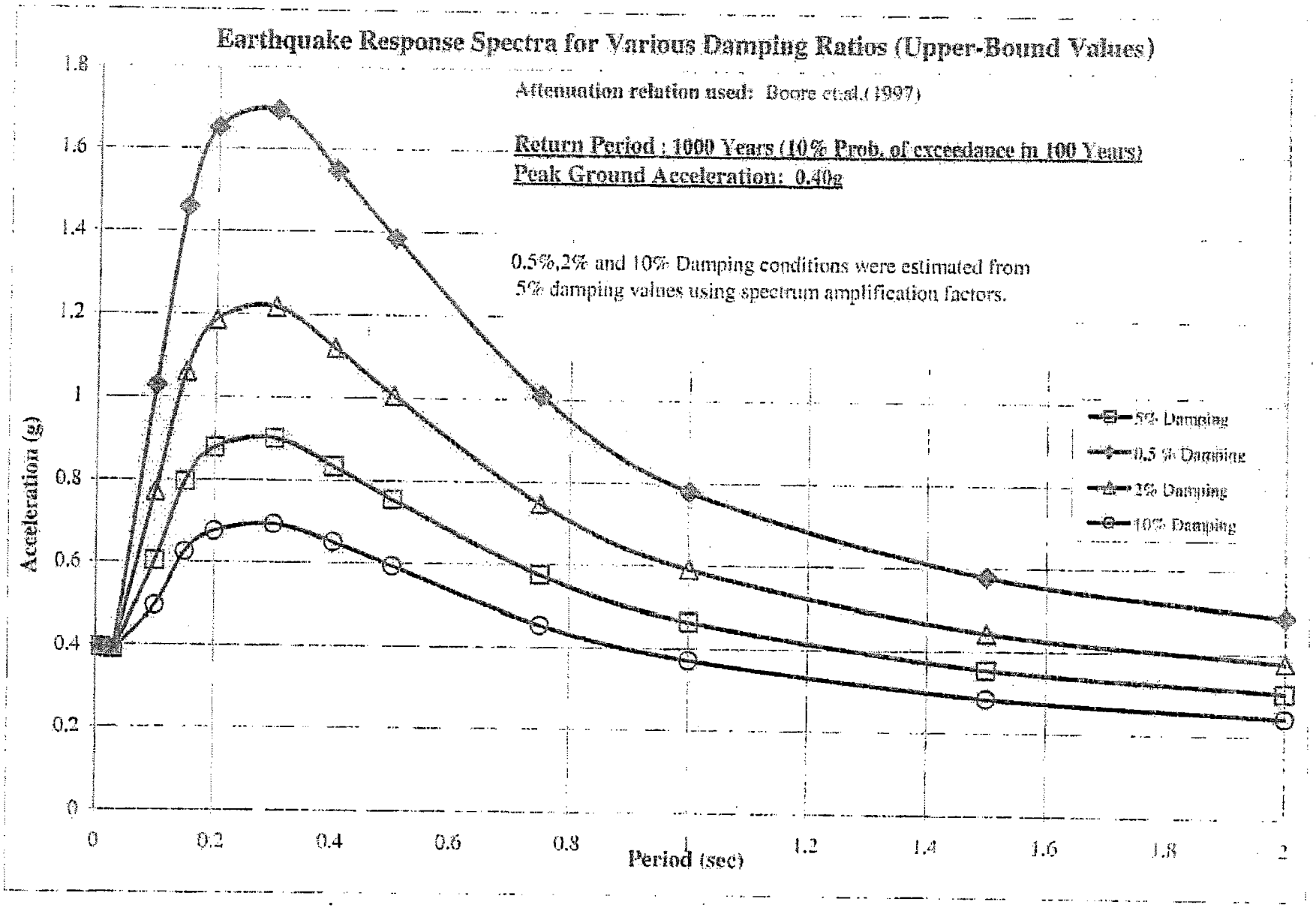
It should be realized that the purpose of the seismic design, utilizing the above parameters, is to safeguard against major structural failures and loss of life and not to limit damage.

4.4.2 Recommended Acceleration Response Spectra (ARS) Curves

For selecting the ground motions for seismic design, the criteria calls for elastic design of the facility for a low-level earthquake and inelastic design against collapse for an upper-level earthquake. The recommended low-level earthquake has a 90% probability of not being exceeded in 50 years, while the upper-level earthquake has a 90% chance of not being exceeded in 100 years. During an upper-level event, the structure would be expected to exhibit considerable ductility and experience structural damage without collapse.

The recommended peak ground surface acceleration for the lower and upper-level events are 0.32 g and 0.40g, respectively. The return periods of these accelerations are approximately 475 and 1,000 years, respectively. Our recommended ARS curves for different damping ratios and lower-level and upper-level earthquakes are presented in Plates 7 and 8, respectively.


Earthquake Response Spectra for Various Damping Ratios (Design Values)
Attenuation relation used: Boore et.al.(1997)
Return Period : 475 Years (10% Prob. of exceedance in 50 Years)
Peak Ground Acceleration : 0.32g
0.5%,2% and 10% Damping conditions were estimated from 5% damping values using spectrum amplification factors.
5% Damping
0.5 % Damping
2% Damping
10% Damping
Acceleration (g)
Period (sec)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2


Earthquake Response Spectra for Various Damping Ratios (Upper-Bound Values)
Attenuation relation used: Boore et.al.(1997)
Return Period : 1000 Years (10% Prob. of exceedance in 100 Years)
Peak Ground Acceleration: 0.40g
0.5%,2% and 10% Damping conditions were estimated from 5% damping values using spectrum amplification factors.
5% Damping
0.5 % Damping
2% Damping
10% Damping
Acceleration (g)
Period (sec)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

4.4.3 Liquefaction Potential

Liquefaction is a sudden loss of strength of a saturated, cohesionless soil caused by cyclic loading (e.g., earthquake shaking). Generally, liquefaction occurs in predominantly poorly consolidated granular soil where the groundwater depth is less than 50 feet. Due to the presence of relatively well-consolidated sedimentary bedrock at shallow depths underlying the site, groundwater was not encountered during our field investigation. According to the Seismic Hazard Zone Map for the San Juan Capistrano Quadrangle, the site is not mapped within a zone of potential liquefaction.

4.4.4 Landslides

Seismically-induced landslides and other slope failures are common occurrences during or soon after earthquakes. However, due to the presence of the very low on-site gradient, the potential for seismically-induced landsliding to occur is very low.

Flooding

The potential for earthquake-induced flooding at the site, caused by the failure of dams or other water-retaining structures as a result of earthquakes, is considered very low. The site is located several miles inland from the ocean, and there are no nearby large bodies of enclosed water. Therefore, the risk of tsunamis or seiches affecting the site during a nearby seismic event is also considered very low.

4.5 EXCEPTIONAL GEOLOGIC HAZARDS AND COMPLICATED SITE CONDITIONS (ITEMS 32 TO 43, CALIFORNIA GEOLOGIC SURVEY) NOTE 48

32. Phase I & II Environmental Assessment Work: Outside the scope of this consulting.

33. Hazardous Materials: Outside the scope of this consulting.

34. California Environmental Quality Act: Outside the scope of this consulting.

35. Ground-Water Quality: Outside the scope of this consulting.

36. On-Site Septic System: Outside the scope of this consulting. However, the presence of the existing septic system at the site is not anticipated.

37. Non-Tectonic Faulting and Hydrocollapse of Alluvial Fan Soils: Due to the results of our investigation and the site geology, the potential for non-tectonic faulting and hydrocollapse of alluvial fan soils is considered null.

38. Regional Subsidence: Regional subsidence at the site is considered very low.

39. Volcanic Eruption: Volcanic eruption at the side is considered nil.

40. Tsunami or Seiche: This item is discussed in flooding section (4.45).

41. Asbestos: Outside the scope of this consulting.

42. Radon-222 Gas: Outside the scope of this consulting.

43. Other Geologic Hazards: It is our opinion that all of the existing geologic conditions and hazards at the site have been discussed in the previous sections of this report.

4.6 GEOCHEMISTRY OF GEOLOGIC SUBGRADE (CORROSION POTENTIAL)

Soil chemical properties are presented in Appendix B. Laboratory Testing indicated that the surface soil at the site has severe levels of sulfate. As such, the concrete to be utilized at the site should be designed for severe levels of sulfate. The concrete should utilize at least Type-V cement with maximum 0.45 water/cement ratios and have 4,500 psi minimum compressive strength at 28 days.

4.7 CONCLUSIONS

Results of our investigation as well as information obtained from previous investigations performed by other consultants indicated significant deformation of the slab-on-grade system. In our opinion, the existing deformation is due to long-term expansive soil/bedrock activity exacerbated by the poor original design and construction of the slab-on-grade. Our laboratory test results indicated the presence of highly expansive soil/bedrock subgrade. Soil with a significant clay fraction tends to possess expansive characteristics. Expansive soil heaves when water is introduced and shrinks as it dries. Pressures induced by heaving soil can be large enough to lift most buildings, and cause doming and/or dishing within the slab-on-grade. Localized doming and/or dishing is apparent within the library slab. However; the results of our investigation indicate that the principal negative impact of the site soil conditions is generally limited only to the front, eastern portion of the slab-on-grade and has not affected the remaining portions of the slab-on-grade. The manometer-level survey performed on the 2nd floor slab also indicated some tilting and doming within the 2nd floor slab of the building. Some of the measured deflections may be due to structural sagging and/or adjustment. We recommend that the project structural engineer review the manometer data and provide any recommendations, if necessary.

To limit expansive soil influences, foundations are typically deepened, the slab-on-grades thickened and both are provided with adequate steel reinforcement. However, the existing slab-on-grade is not designed and/or constructed for the site soil conditions. The existing slab is on the order of 6 inches thick and reinforced with No. 4 bars at 18 to 24 inches on center, each way, located within the lower half of the slab. The reinforcement configuration does not provide proper resistance to stresses applied to the slab by expansive soil. Additionally, based on a review of the foundation plans, it appears that the slab in the area of the most pronounced deformation (i.e., distress) has not been furnished with an edge restraint system, such as grade beams, continuous footings, stiffeners, etc.

4.8 RECOMMENDATIONS

Based on the results of our investigation and the slab deformation, it is our opinion that the entire slab-on-grade system of the Library Building should be removed and properly replaced. However, based on budgetary constraints and accepting more risk of possible future problems within the remaining portion of the slab-on-grade system, partial removal and replacement of the slab within the most affected area could be considered.

As a minimum, the front eastern portion of the Library slab should be removed and properly replaced. The minimum extent of the slab removal area is presented on Plate 9.

Additionally, it is recommended that the entire paver stone/tile covered patio slab along the northeast corner of the building as well as the narrow strip of the existing paver stones/tile along the eastern boundary of the Library addition be removed; the area properly graded for positive drainage, and replaced with a new patio slab.

The new slab should be designed in accordance with one of the two following recommendations:

1. It is recommended that a minimum 14 inch thick slab reinforced with No. 6 bars located at eight inches on center, both ways, be constructed. The fill subgrade beneath the slab-on-grade floors should be compacted to produce a uniformly dense, non-yielding surface.

2. As an alternative, a minimum eight inch thick slab reinforced with No. 6 bars located at 12 inches on center, both ways, can be constructed. The fill subgrade beneath the slab-on-grade floors should be compacted to produce a uniformly dense, non-yielding surface. A layer of free-draining gravel or crushed rock, at least 30 inches thick, should be placed beneath the slab. The gravel or crushed rock should have no more than ten percent passing the 3/4 inch sieve and no more than five percent passing the No. 200 sieve.

A vapor barrier over the gravel or crushed rock should be considered in areas where the migration of moisture through the floor slab would be detrimental. The vapor barrier should be at least 10-mil plastic and should be sealed at all splices, around plumbing, and at the perimeter of the slab areas. Every effort should be made to provide a continuous barrier and care should be taken not to puncture the membrane. Some contractors exercising special care use heavier membranes or double layers of 10-mil plastic with splices staggered and sealed. Once the moisture barrier is in place, it should be covered with two inches of clean sand, such as washed concrete sand.

Plates 10 through 13 represent typical details of the proposed slab repairs.

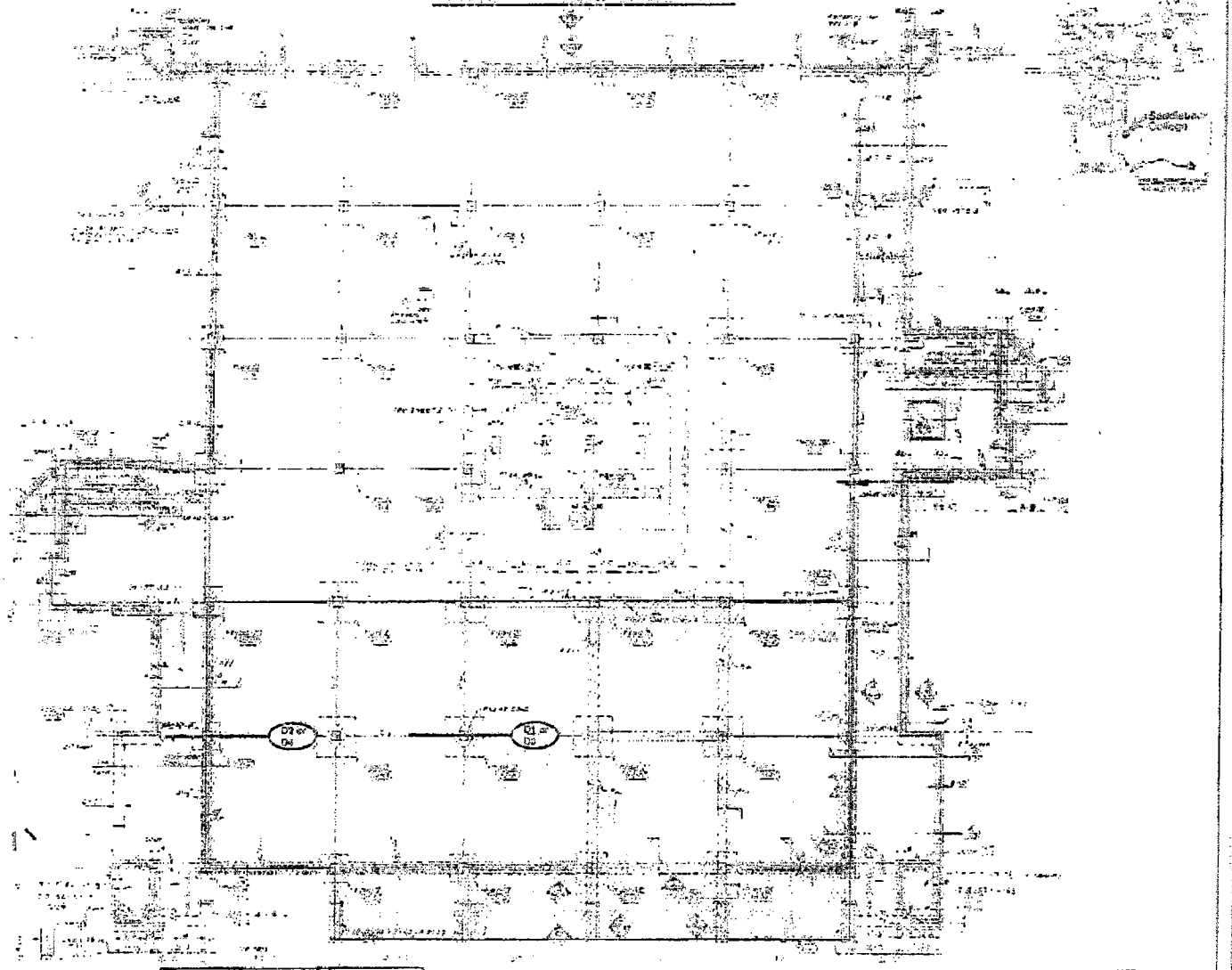
We believe that the above-described repair methods are suitable for the project. However, if desired, other alternative repair options could be developed upon consultation with the project structural engineer.

4.9 CONCRETE

Concrete for all construction should utilize a minimum of seven sacks Type-V cementitious material with maximum 0.45 water/cement ratio, 4,500 psi minimum compressive strength at 28 days. Good quality, Type-F fly ash may be substituted for Type-V cement but not at a degree exceeding about 15% by weight. For slab concrete, four-inch maximum true slump should be used. The actual slump may be increased as needed up to eight inches maximum by the addition of appropriate plasticizing/water-reducing agents. The concrete should be properly cured to minimize risk of shrinkage cracking. One-inch hard rock mixes should be provided. Pea-gravel

Saddleback College

BASEMENT FOUNDATION PLAN



Explanation

- D2 or D4 — Proposed Details for Recommended Repair Options
- Minimum of Proposed Repair

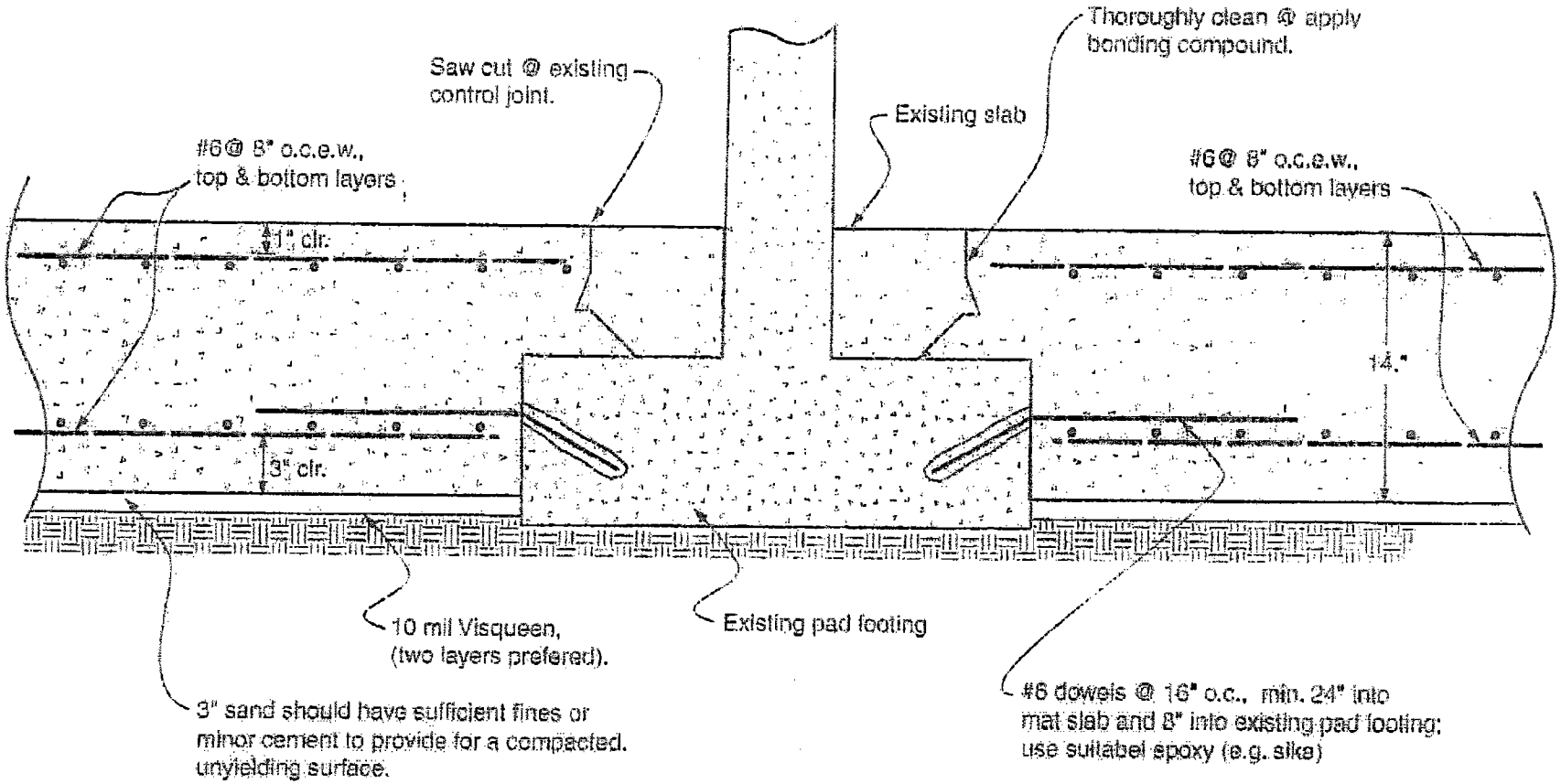
AMERICAN GEOTECHNICAL

MINIMUM LIMIT OF THE PROPOSED REPAIR
SADDLEBACK COMMUNITY COLLEGE
MISSION VIEJO, CALIFORNIA
MISSION VIEJO, CALIFORNIA

Plate 1

OPTION 1

Detail @ interior pad footing



DETAIL 1

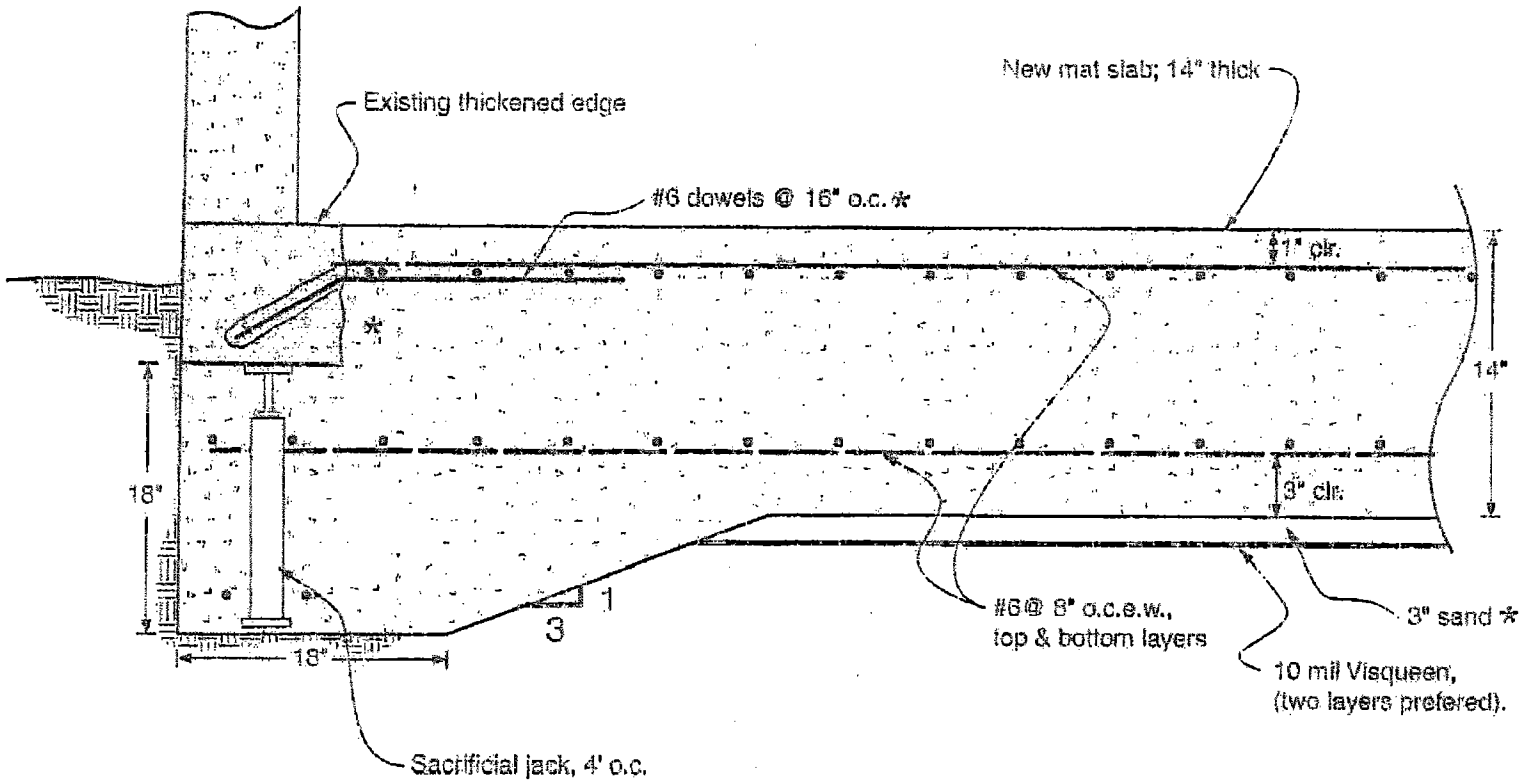
SADDLEBACK OPTION DETAILS

AMERICAN GEOTECHNICAL | EN 99100.00 | NOV 2000

Plate 10

OPTION 1

Detail @ perimeter



DETAIL (2)

* See additional note in Detail (1)

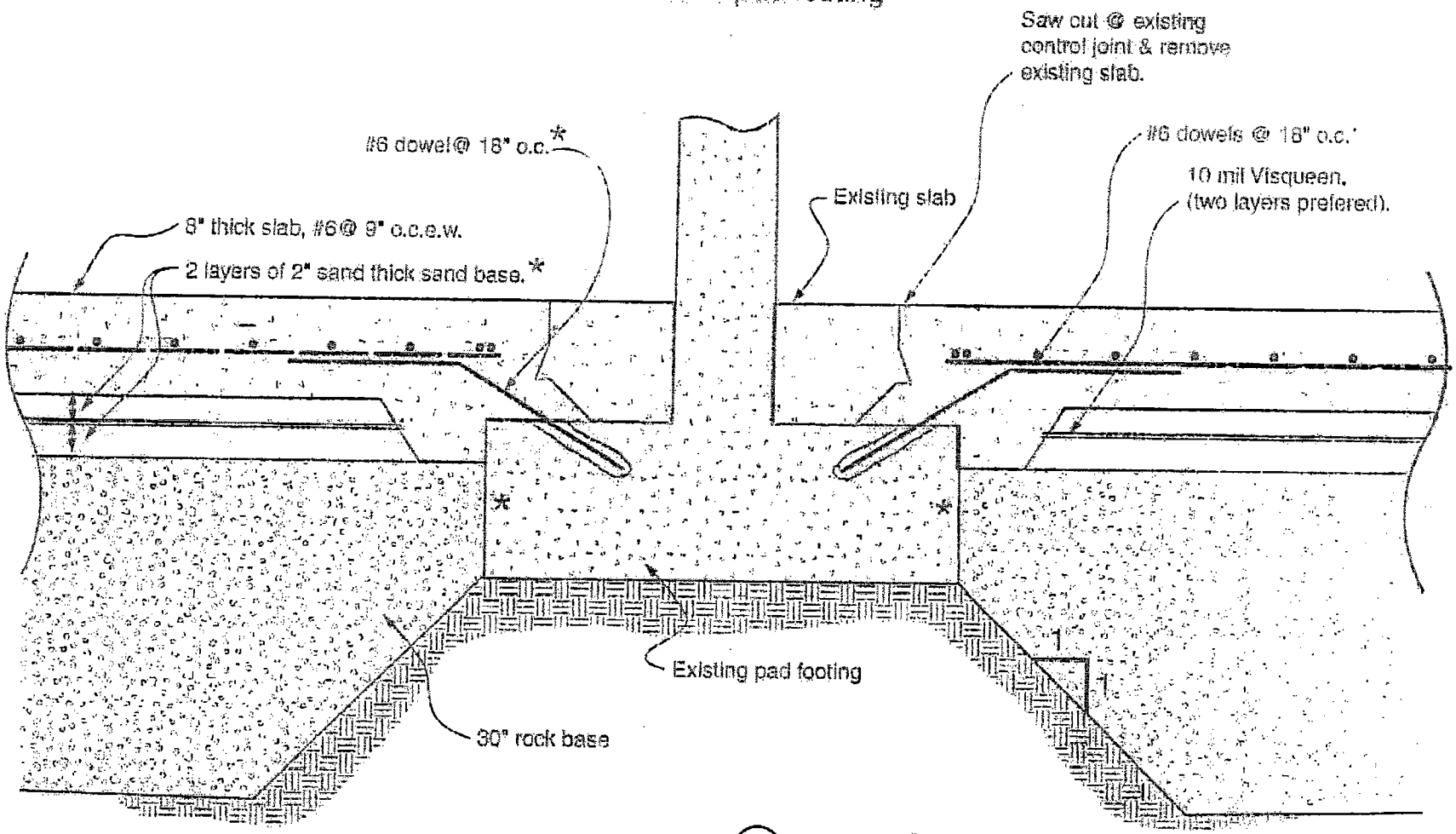
SADDLEBACK OPTION DETAILS

AMERICAN GEOTECHNICAL | EN 32179.02 | NOV 2006

Plate 11

OPTION 2

Detail @ interior pad footing



DETAIL 3

* See additional note in Detail 1

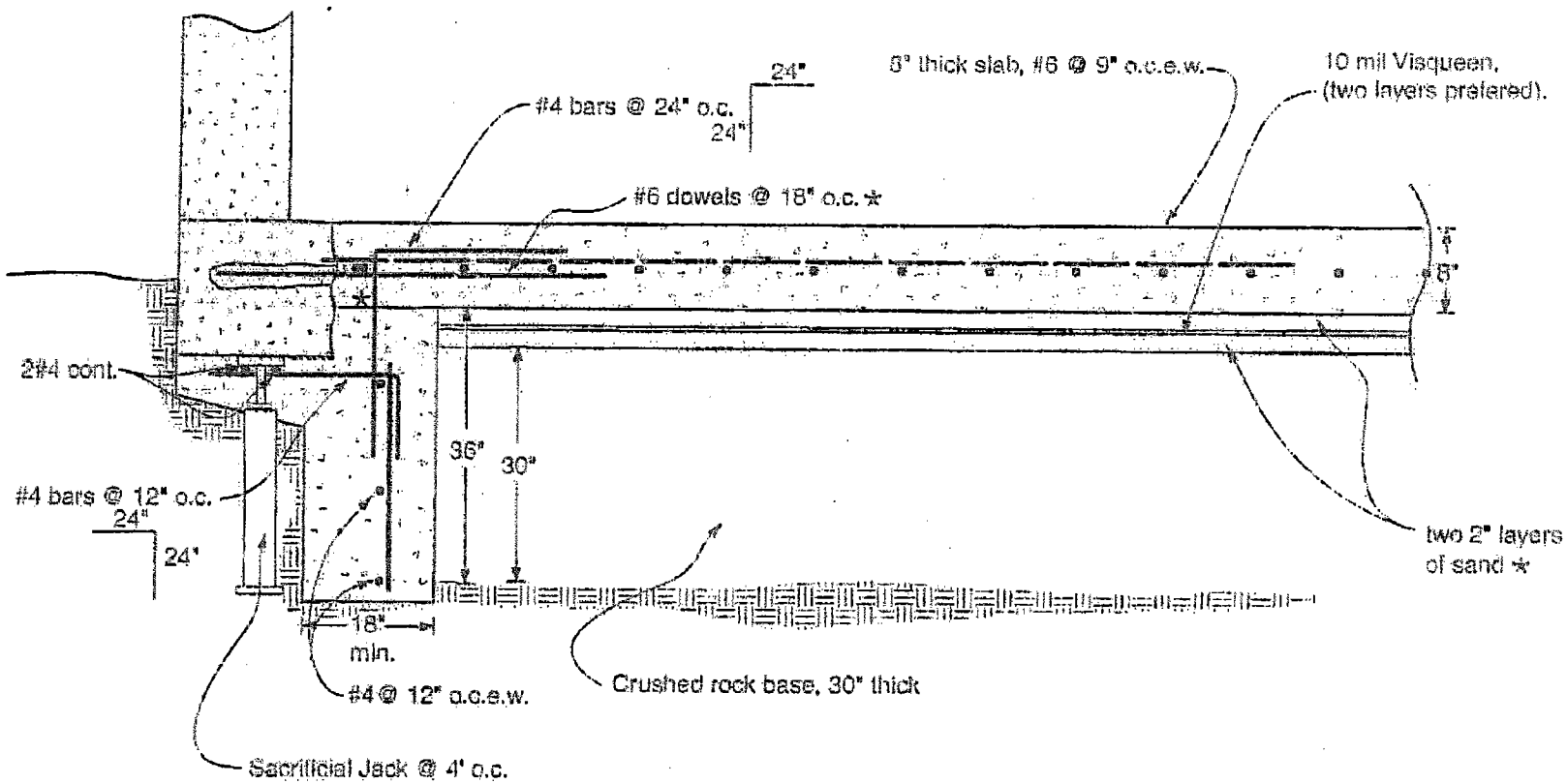
SADDLEBACK OPTION DETAILS

AMERICAN GEOTECHNICAL

Plate 12

OPTION 2

Detail @ perimeter



DETAIL 4

* See additional note in Detail 1

SADDLEBACK OPTION DETAILS

AMERICAN GEOTECHNICAL | FN 32180.02 | NOV 2006

Plate 13

mixes are specifically not recommended but could be utilized for relatively non-critical improvements (e.g., flatwork) and other improvements provided the mix designs consider limiting shrinkage. Contractors/other designers should take care in all aspects of designing mixes, detailing, placing, finishing, and curing concrete.

4.10 REINFORCEMENT PLACEMENT

Care should be taken in the placement of slab reinforcement. Placement details should be in conformance with ACI specifications. Slab reinforcement should be placed in a positive fashion between the mid-point and the upper one-third point of the slab section.

4.11 SLAB CONCRETE WORKMANSHIP

The contractor should be responsible for supplying to the owner concrete mix designs for both slab and foundation concrete. The contractor should provide designs, place, finish, and cure concrete in accordance with all code and ACI recommended procedures. The contractor is referred to the ACI publication "Slabs on Grade."

4.12 DRAINAGE

Drainage should be directed away from structures via non-erodible conduits to suitable disposal areas. Five percent drainage is recommended directly away from the structures. At least a 2% minimum is recommended for drainage over soil areas. Four to five percent minimum is advised for drainage away from the structures and for the planter and the groundcover areas. In pipes or paved swales, 1% should be adopted as the minimum unless otherwise recommended by the project civil engineer. All enclosed planters should be provided with a suitably located drain or drains and/or flooding protection in the form of weep holes or similar.

4.13 MAINTENANCE/PERFORMANCE

Structures in expansive soil areas tend to perform best when moisture conditions are maintained as close to uniform as possible. The amount of movement from heave to shrink can be reduced by limiting the variation in moisture around the isolated individual structures. Since moisture naturally tends to migrate under the slab areas, it is desirable to keep the perimeter of the structures on the "moist side" without allowing ponding to occur.

Planting even small trees within about ten feet of the structure is not recommended because trees usually extract water from the soil. Greater separation is appropriate for larger trees. The task of approaching moisture equilibrium can be aided through the use of properly designed, installed, and adjusted automatic irrigation systems.

4.14 PROJECT SAFETY

The contractor is the party responsible for providing a safe site. This consultant will not direct the contractor's operations and cannot be responsible for the safety of personnel other than his own representatives on site. The contractor should notify the owner if he is aware of and/or anticipates unsafe conditions. If the geotechnical consultant at the time of construction considers conditions unsafe, the contractor, as well as the owner's representative, will be notified. Within this report, the terminology safe or safely may have been utilized. The intent of such use is to imply low risk. Some risk will remain, however, as is always the case.

5.0 REMARKS

Only a portion of subsurface conditions have been reviewed and evaluated. Conclusions, recommendations, and other information contained in this report are based upon the assumptions that subsurface conditions do not vary appreciably between and adjacent to observation points. Although no significant variation is anticipated, it must be recognized that variations can occur.

This report has been prepared for the sole use and benefit of our client. The intent of the report is to advise our client on geotechnical matters involving the existing conditions of the slab-on-grade and remedial repairs. It should be understood that the geotechnical consulting provided and the contents of this report are not perfect. Any errors or omissions noted by any party reviewing this report, and/or any other geotechnical aspect of the project, should be reported to this office in a timely fashion. The client is the only party intended by this office to directly receive the advice. Subsequent use of this report can only be authorized by the client. Any transferring of information or other directed use by the client should be considered "advice by the client."

Geotechnical engineering is characterized by uncertainty. Geotechnical engineering is often described as an inexact science or art. Conclusions and recommendations presented herein are partly based upon the evaluations of technical information gathered, partly on experience, and partly on professional judgment. The conclusions and recommendations presented should be considered "advice." Other consultants could arrive at different conclusions and recommendations. Typically, "minimum" recommendations have been presented. Although some risk will always remain, lower risk of future problems would usually result if more restrictive criteria were adopted. Final decisions on matters presented are the responsibility of the client and/or the governing agencies. No warranties in any respect are made as to the performance of the project.

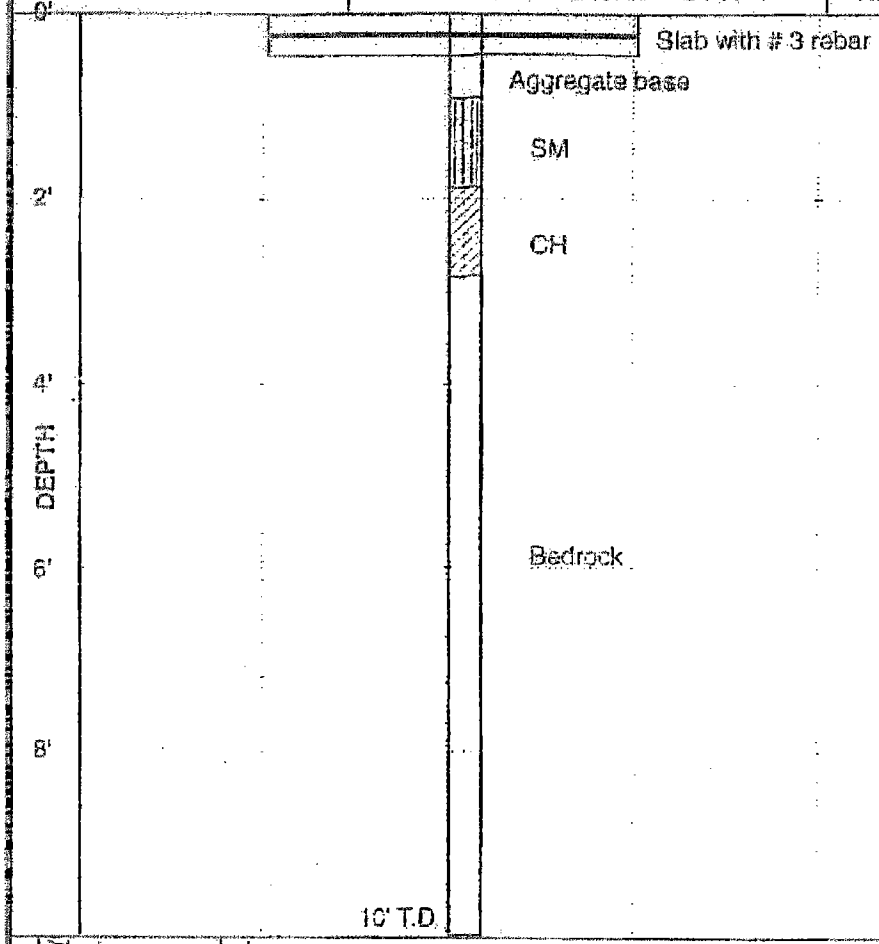
File No. 32180.02
November 27, 2006

APPENDIX A

Boring Logs

GRAPHIC LOG

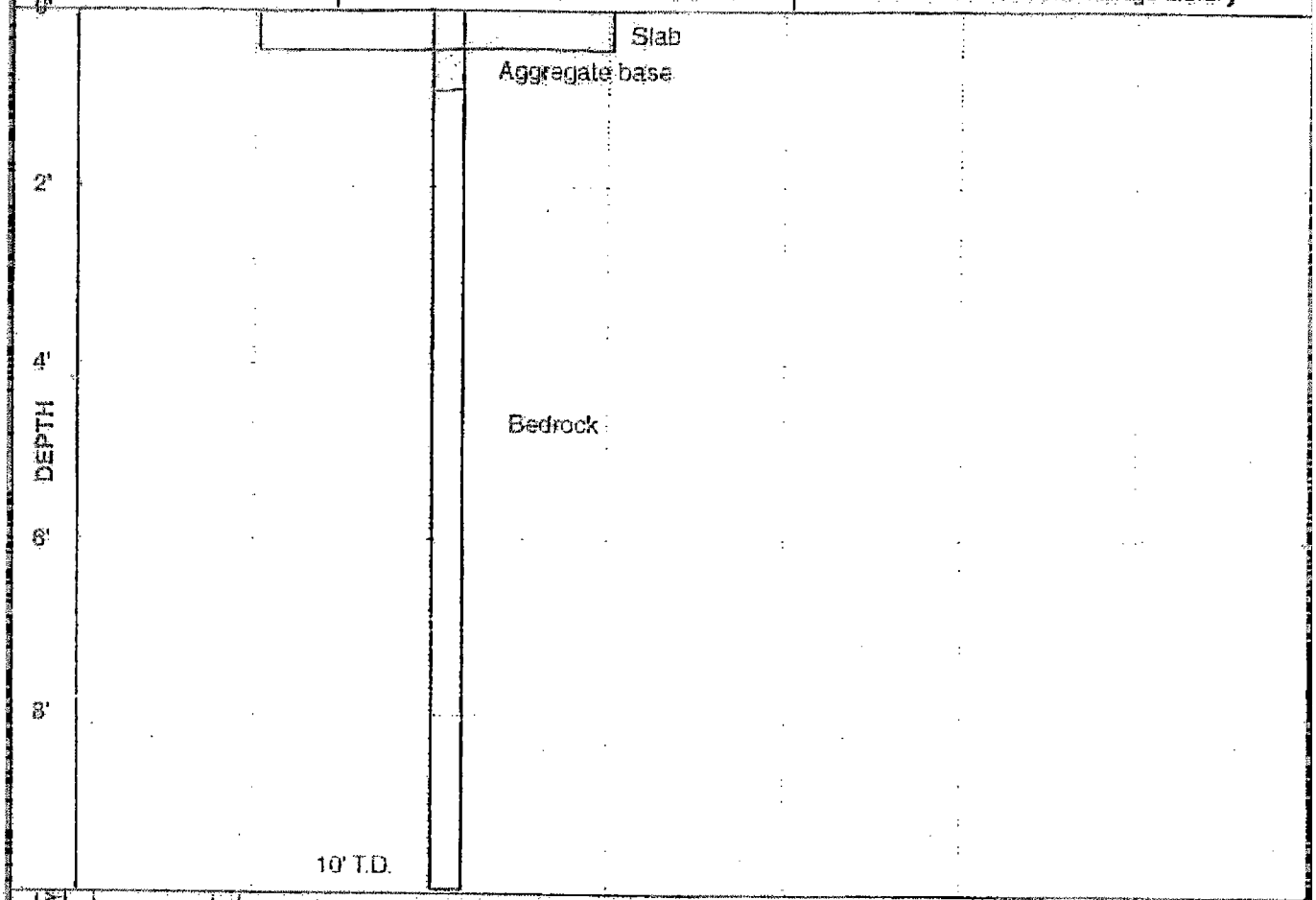
APPROXIMATE SCALE : 1" = 2'	TEST EXCAVATION : AGCI-1
DATE LOGGED : 10/19.02 BY : PW	ADDRESS : Saddleback College Library



RING	SHELBY	BULK	SAMPLE DEPTH	USCS	LOCATION : In Lap Room DESCRIPTION: Classification (USCS), color, moisture, consistency etc.
					0-0.62' SLAB with #3 Rebar
			1'		0.62-0.92' AGGREGATE BASE: Angular Gravel.
			2'		0.92-2.8' FILL: Fine Silty SAND (SM), dark gray, moist, dense. @1.9' CLAY/SILT MIXTURE (CL), dark gray, moist, stiff.
			3'		2.8-10.0' BEDROCK: Niguel Formation SILT/CLAYSTONE, dark gray, moist, stiff to very stiff
			4'		
			5'		
			6'		
			7'		

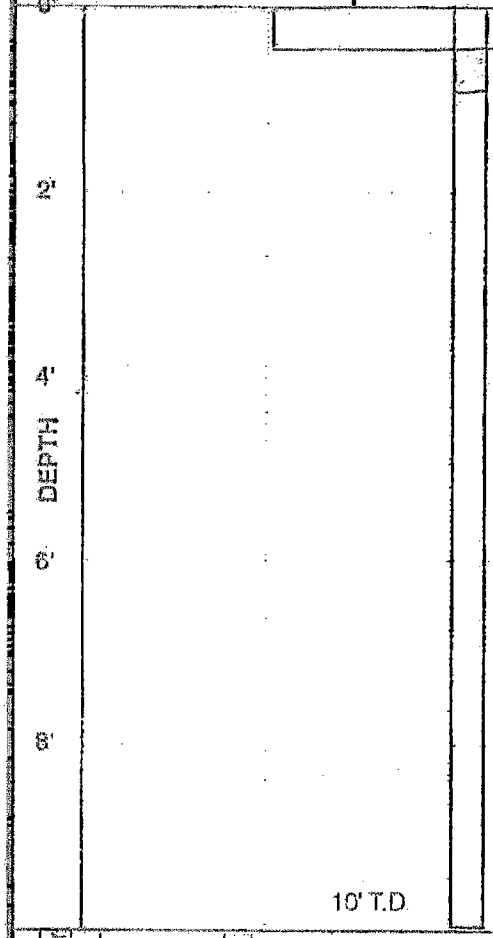
GRAPHIC LOG

APPROXIMATE SCALE : 1" = 2'	TEST EXCAVATION : AGCI-2
DATE LOGGED : 10/19.02 BY : PW	ADDRESS : Saddleback College Library



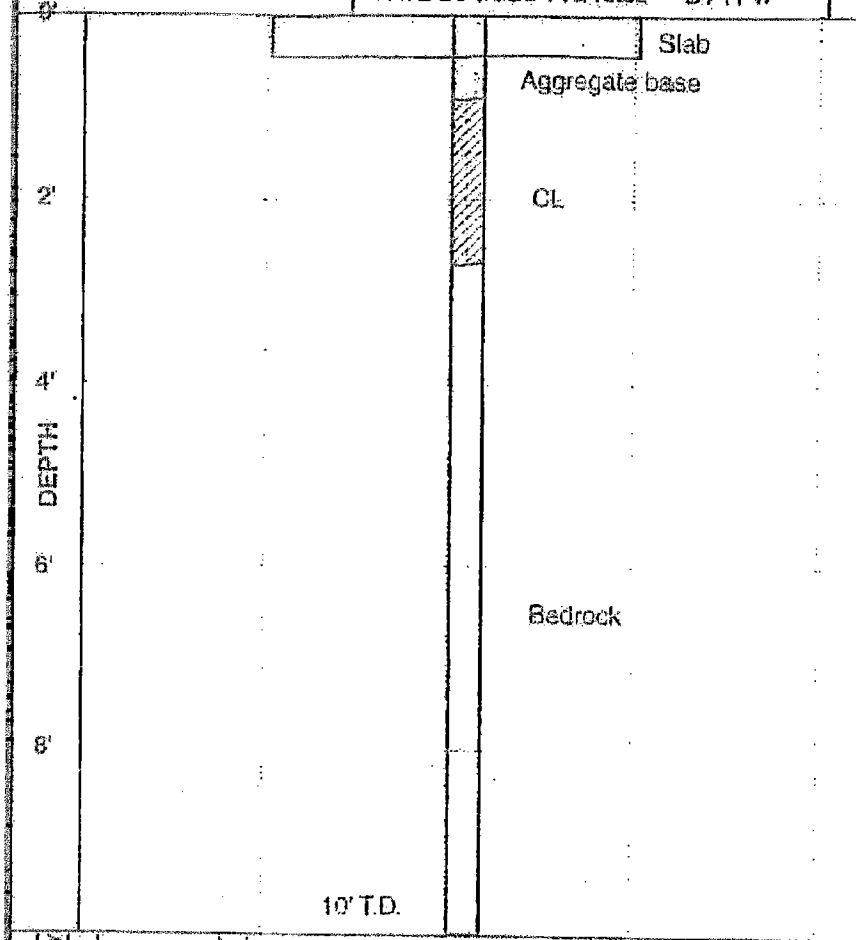
RING	SHELBY	BULK	SAMPLE DEPTH	USCS	LOCATION : In Computer Room DESCRIPTION: Classification (USCS), color, moisture, consistancy etc.
			1'		0-0.7' SLAB
					0.7-1.0' AGGREGATE BASE: Angular Gravel.
			2'		1.0-10.0' BEDROCK: Niguel Formation SILT/CLAYSTONE, dark gray to dark yellowish gray, moist, stiff to hard.
			3'		
			4'		
			5'		
			6'		
			7'		

GRAPHIC LOG	APPROXIMATE SCALE : 1" = 2'	TEST EXCAVATION : AGCI-3
	DATE LOGGED : 10/19.02 BY : BH	ADDRESS : Saddleback College Library



RING	SHELBY	BULK	SAMPLE DEPTH	USCS	LOCATION : In Doorway DESCRIPTION: Classification (USCS), color, moisture, consistency etc.
			1'		0-0.6' SLAB 0.6-0.79' AGGREGATE BASE: Angular Gravel.
			2'		0.79-4.5 FILL: Sandy CLAY (SC); light brown, moist, dense.
			3'		4.5-10.0' BEDROCK: Niguel Formation SILT/CLAYSTONE, dark gray, moist, stiff to very stiff.
			4'		
			5'		
			6'		
			7'		

GRAPHIC LOG	APPROXIMATE SCALE : 1" = 2'	TEST EXCAVATION : AGCI-4
	DATE LOGGED : 10/19.02 BY : PW	ADDRESS : Saddleback College Library



RING	SHELBY	BULK	SAMPLE DEPTH	USCS	LOCATION : In Storage Room near Audio Visual DESCRIPTION: Classification (USCS), color, moisture, consistency etc.
					0-0.54' SLAB
			1'		0.54-0.94' AGGREGATE BASE: Angular Gravel.
			2'		0.94-2.35' FILL: Silty CLAY with sand (CL), grayish brown, moist, very stiff.
			3'		2.35-10.0' BEDROCK: Niguel Formation SILT/CLAYSTONE, yellowish brown, moist, stiff to very stiff. @ 4.0' SANDSTONE, yellowish brown, moist, loose.
			4'		
					@5.4 Becomes very dense
			5'		
			6'		
			7'		

AMERICAN GEOTECHNICAL	Fn. 32180.01	Saddleback College	PLATE A4

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120 / Water Content (%) / Plastic Limit (W_P) — Liquid Limit (W_L) / Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
		CONCRETE SLAB (6.0" thick, #4 rebar at 5.5" from top of slab)				
		CRUSHED ROCK (5" thick, maximum size 0.5 inch)	GP			
		SILT (Fill) brown, clayey, few siltstone fragment, high plastic, moist.	MH			PP > 4.5 tsf
		SHALE (SILTSTONE) dark brown to black, clayey, high plastic, moist.	Ms			EI = 100 PP > 4.5 tsf
						PP > 4.5 tsf
						PP > 4.5 tsf
5		• End of Boring at 4.5 feet. • Boring dry upon completion of drilling. • Auger refusal on rock at 4.5 feet.				
10						
15						

EOBASE, INC.	PROJECT	Library Building, Saddleback Community College Mission Viejo, California		BORING NO. B-1
	DEPTH TO WATER ▽	SURFACE ELEV. ± 430 feet	LOGGED BY JTW	PROJECT NO. P.249.01
	DEPTH TO SLOUGH ▲	DRILL Hand Auger	DATE LOGGED 01/29/94	FIGURE NO. B-2

Note: This log of BORING should be evaluated in conjunction with the complete geotechnical report. This log of BORING represents conditions observed at the specific BORING location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120 / Water Content (%) / Plastic Limit (W_P) — Liquid Limit (W_L) / Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
		BRICK PAVEMENT (2" brick on top of 4" concrete, no reinforcement in concrete)				
		CRUSHED ROCK (6" thick, maximum size 0.5")	GP			
		SILT (Fill brown, clayey, few siltstone fragment, high plastic, moist.	MH			
		SHALE (SILTSTONE) dark brown to black, clayey, high plastic, moist. ... hard to auger.	Ms			PP>4.5 tsf

* End of Boring at 3.0 feet.
* Boring dry upon completion of drilling.
* Auger refusal at 3.0 feet.

EOBASE, INC.	PROJECT	Library Building, Saddleback Community College Mission Viejo, California		BORING NO. B-2
	DEPTH TO WATER ▽	SURFACE ELEV. ± 430 feet	LOGGED BY JTW	PROJECT NO. P-249.01.0
	DEPTH TO SLOUGH ▲	DRILL Hand Auger	DATE LOGGED 01/29/94	FIGURE NO. B-3

ote: This log of BORING should be evaluated in conjunction with the complete geotechnical report. This log BORING represents conditions observed at the specific BORING location and at the date indicated.

File No. 32180.02
November 27, 2006

APPENDIX B

Laboratory Data

Exca. No.	Depth (feet)	Soil Classification USCS	In-Situ Dry Density (Lbs/cu. ft.)	In-Situ Moisture Content (%)	Degree of* Saturation (%)	Expansion Index	Swell(+)/ Collapse(-) (%)	HUD Swell (%) 60 psf	150 psf	650 psf	Soluble Soil Sulfate (mg/kg)
AGCI-1	1.9-2.8	ML-CL	83.0	26.8	70	-	+0.60@250 psf	-	-	-	-
AGCI-1	2.8-3.55	ML-CL	-	-	-	101	-	-	-	-	2290
AGCI-1	2.8-3.55	ML-CL	89.7	25.5	78	-	+0.81@400 psf	6.75	4.88	2.61	-
AGCI-1	3.55-4.1	ML-CL	84.6	26.4	72	-	+0.95@400 psf	-	-	-	-
AGCI-1	4.9-5.3	ML-CL	92.5	23.6	77	-	+0.90@580 psf	-	-	-	-
AGCI-1	6.2-6.9	ML-CL	89.9	25.2	78	-	+0.59@740 psf	-	-	-	-
AGCI-2	1.01-2.01	ML-CL	-	-	-	60	-	-	-	-	2970
AGCI-2	2.01-3.1	ML-CL	76.2	26.3	59	-	+1.80@250 psf	3.85	3.10	2.00	-
AGCI-2	3.1-3.8	ML-CL	99.0	23.2	89	-	+0.90@385 psf	-	-	-	-
AGCI-2	4-4.5	ML-CL	86.4	24.6	70	-	+0.90@455 psf	-	-	-	-
AGCI-2	4.9-5.4	ML-CL	88.4	22.4	67	-	+0.37@560 psf	-	-	-	-
AGCI-2	6-6.5	ML-CL	91.1	20.9	66	-	+0.60@685 psf	-	-	-	-
AGCI-2	6.7-7.15	ML-CL	87.9	15.6	46	-	+0.31@700 psf	-	-	-	-
AGCI-3	1.4-1.9	ML-CL	93.9	18.4	63	-	+0.14@185 psf	-	-	-	-
AGCI-3	2.4-3.1	ML-CL	90.6	18.9	59	-	-0.32@300 psf	-	-	-	-
AGCI-3	3.4-4.0	ML-CL	86.1	22.1	62	-	-0.12@400 psf	-	-	-	-
AGCI-3	4.5-5.0	ML-CL	92.0	20.3	66	-	-0.08@520 psf	-	-	-	-
AGCI-3	5.5-6.0	ML-CL	95.3	20.8	73	-	0.00@320 psf	-	-	-	-
AGCI-3	7.1-7.7	ML-CL	88.6	21.8	65	-	+0.01@800 psf	-	-	-	-

SUMMARY OF LABORATORY TEST DATA			TABLE
AMERICAN GEOTECHNCIAL	F.N. 32180.02	NOV. 2006	B1

Exca. No.	Depth (feet)	Soil Classification USCS	In-Situ Dry Density (Lbs/cu. ft.)	In-Situ Moisture Content (%)	Degree of* Saturation (%)	Expansion Index	Swell(+)/ Collapse(-) (%)	HUD Swell (%) 60 psf	150 psf	650 psf	Soluble Soil Sulfate (mg/kg)
AGCI-4	3.35-3.19	CL	86.2	16.9	48	-	-	-	-	-	-
AGCI-4	4.2-4.7	CL	81.9	5.6	14	-	-2.79@385 psf	-	-	-	-

Note: * Degree of Saturation was calculated using specific gravity of 2.70

SUMMARY OF LABORATORY TEST DATA			TABLE
AMERICAN GEOTECHNCIAL	F.N. 32180.02	NOV. 2006	B1

Core No.	Date Cored	Core Size (in)	Location	Maximum Thickness (inch)	Minimum Thickness (inch)	Average Thickness (inch)	Type of Rein-forcement	Maximum Location of Reinforce-ment (from top of slab) (Inch)	Minimum Location of Reinforce-ment (from top of slab) (Inch)
AGCI-1A	11/01/02	6	Library	2.99	2.89	2.91	Not Found	-	-
AGCI-1B	11/01/02	6	Library	4.34	4.17	4.25	#3 Rebar	3.11	2.71
AGCI-2A	11/01/02	6	Library	2.85	2.69	2.78	No Found	-	-
AGCI-2B	11/01/02	6	Library	5.37	4.95	5.08	#3 Rebar	3.66	3.62
AGCI-3	11/01/02	6	Library	7.58	6.98	7.29	#3 Rebar	4.96	4.52
AGCI-4	11/01/02	6	Library adj.to Audio Lab	6.27	5.87	6.12	#3 Rebar	4.34	3.85

SUMMARY OF CORING DATA

AMERICAN GEOTECHNICAL | F.N. 32180.02 | NOV. 2006 | TABLE B2

H2 ENVIRONMENTAL

Saddleback College
Special Annex Building
28000 Marguerite Pkwy.
Mission Viejo, California
Asbestos & Lead Survey
Project# 1282110 AS

H2 ENVIRONMENTAL

January 21, 2010

Mr. Walt Rice
Saddleback College
28000 Marguerite Pkwy
Mission Viejo, CA 92692

Re: Asbestos & Lead Survey
Special Annex Building
28000 Marguerite Pkwy
Mission Viejo, CA 92692
Project No. 1282110 AS

Dear Mr. Rice,

H2 Environmental Consulting Services received written authorization to proceed on January 18, 2010 to perform an Asbestos and Lead Survey of the above referenced site. The survey was requested by Mr. Walt Rice for the scheduled renovation of the above referenced site. Enclosed is one (1) copy of the Asbestos and Lead Survey report.

H2 Environmental appreciates the opportunity to provide environmental services for this important project. Please do not hesitate to call (909) 628-0369 should there be any questions regarding the Asbestos and Lead XRF Survey report.

Respectfully submitted,
H2 Environmental Consulting Services, Inc.

W. Thomas Haley
Vice – President

Enclosures

H2 ENVIRONMENTAL

ASBESTOS & LEAD SURVEY

Special Annex Building
28000 Marguerite Pkwy
Mission Viejo, CA 92692

Prepared for

Saddleback College
28000 Marguerite Pkwy
Mission Viejo, CA 92692

Prepared by

H2 Environmental Consulting Services, Inc.
13122 6th Street
Chino, California 91710
909-628-0369

H2 ENVIRONMENTAL

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ANALYTICAL RESULTS.....4

FIELD ASSESSMENT WORKSHEETS/CHAIN OF CUSTODY.....5

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2. NVLAP CERTIFICATION
3. METHODOLOGY
4. WARRANTY

GENERAL INFORMATION

H2 Environmental Consulting Services facility was retained by Saddleback College to conduct Asbestos and Lead Survey of Special Annex Building located at 28000 Marguerite Pkwy., Mission Viejo California. The Asbestos and Lead Survey was conducted on January 18, 2010.

The Special Annex Building was unoccupied during the survey. The Special Annex Building consisted of approximately 4,864 square feet of user space and was finished out with Ceiling Tile ceilings. The walls are finished out with Drywall. The floors are covered with Carpet and Floor Tile.

During the Asbestos Survey, a total of 75 samples were collected and submitted for laboratory analysis by Polarized Light Microscopy (PLM). Suspect materials observed during the Asbestos Survey are summarized in the Survey Summary section of this report. Results of analysis identified that the Brown Color Glue under 4" Cove Base, White/Tan Exterior Skim Coat on Exterior Walls, Red/Black Exterior Window Mastic and the Black Mastic Material on Penetrations (Roof Penetrations) samples are Asbestos-Containing Materials.

During the Lead XRF Survey a total of 34 lead XRF samples were collected. Suspect materials observed during the Lead XRF Survey are summarized in the Lead XRF Survey Summary Section of this report. According to the HUD guidelines paint containing lead greater than >1.0, (mg/cm^2) using XRF methods is considered lead bearing material. The materials and the Lead content are outlined on the Section 1 Survey Summary – Lead XRF Survey Results.

This report has been prepared for the exclusive use of Saddleback College.

AUTHORIZATION

Authorization to perform the survey was given by Mr. Walt Rice, in the form of a written authorization to proceed, dated January 15, 2010.

ACM SURVEY RESULTS

Special Annex Building
28000 Marguerite Pkwy
Mission Viejo, CA 92692

The following homogeneous building material types were sampled as part of this survey and their results are summarized in the table below:

MTL #	MATERIAL DESCRIPTION	LOCATION	F/NF[1]	COND.[2]	% ACM	# SAMP.	EST. QUANTIT
01	Yellow/White 2x4 ft. Ceiling Tile	North End of Rm 12, South End of Rm 9, Center of Rm 10	F	Good	ND	3	1,300 SI
02	Pink Color Attic Insulation Material	North End of Rm 12, South End of Rm 9, Center of Rm 10	F	Good	ND	3	1,300 SI
03	White Flooring Material Under Carpet	North End of Rm 9, South End of Rm 9, East of Rm 9	NF	Good	ND	3	99 SF
04	Grey Color Floor Tile 12"x12" in.	North End of Rm 11, West End of Rm 14, East of Rm 10	NF	Good	ND	3	900 SF
05	Yellow Color Glue Under 12"x12" in. Floor Tile (Grey Color)	North End of Rm 11, West End of Rm 14, East of Rm 10	NF	Good	ND	3	900 SF
06	4" Cove Base Blue/Grey Color	North End of Rm 10, South End of Rm 11, West of Rm 14	NF	Good	ND	3	280 SF
07	White Glue Under 4" Cove Base (Blue/Grey Color)	North End of Rm 10, South End of Rm 11, West of Rm 14	NF	Good	ND	3	280 SF
08	Brown Color 4" Cove Base	East End of Rm 12, South End of Rm 12, North End of Rm 12	NF	Good	ND	3	79 SF
09	Brown Color Glue Under 4" Cove Base	East End of Rm 12, South End of Rm 12, North End of Rm 12	NF	Good	<1%	3	79 SF
10	White Color 12"x12" Floor Tile Material Self Adhesive	North End of Rm 5, East End of Rm 6, South End of Rm 5	NF	Good	ND	3	580 SF
11	White Flooring Material Under 12"x12" Floor Tile	North End of Rm 5, East End of Rm 6, South End of Rm 5	NF	Good	ND	3	580 SF
12	Tan/Yellow Color Glue Under Blue/Grey Carpet	South End of Rm 2, East End of Rm 4, Center of Rm 1	NF	Good	ND	3	1,665 SI
13	Grey Color 6" Cove Base	East End of Rm 5, North End of Rm 2, West End of Rm 4	NF	Good	ND	3	508 SF
14	White/Yellow Glue Under 6" Cove Base	East End of Rm 5, North End of Rm 2, West End of Rm 5	NF	Good	ND	3	508 SF
15	White/Tan 4x2 ft. Ceiling Tile	South End of Rm 7, Center of Rm 5, North End of Rm 2	F	Good	ND	3	2,200 S
16	Yellow Color Attic Insulation Above Ceiling Tiles	South End of Rm 7, Center of Rm 5, North End of Rm 2	F	Good	ND	3	2,200 S

17	White Drywall Material	North End of Rm 12, East End of Rm 5, North End of Rm 2	NF	Good	ND	3	9,800 S
18	White Joint Compound Material	North End of Rm 12, East End of Rm 5, North End of Rm 2	NF	Good	ND	3	9,800 S
19	White/Tan Exterior Skim Coat on Exterior Walls	South End of Bldg. Ext., North End of Bldg. Ext., West End of Bldg. Ext.	NF	Good	2%	3	4,000 S
20	Red/Black Exterior Window Mastic	West End of Bldg. Ext., North W. End of Bldg. Ext., West End of Bldg. Ext.	NF	Good	5%	3	60 SF
21	Tan Color Duct Work Insulation Material	N. East End of Roof, South End of Roof, Center of Roof	NF	Good	ND	3	190 S
22	Grey/Silver Black Roofing Mastic Material on Penetrations	North End of Roof, West End of Roof, South End of Roof	NF	Good	ND	3	120 S
23	Black Mastic Material on Penetrations (Roof Penetrations)	East End of Roof, West End of Roof, North End of Roof	NF	Good	8%	3	160 S
24	White/Grey Rolled Roofing Material	South End of Roof, West End of Roof, North End of Roof	NF	Good	ND	3	4,865 S
25	Black Color Roofing Felt Under Rolled Roofing	South End of Roof, West End of Roof, North End of Roof	NF	Good	ND	3	4,865 S
26	ACM Mastic	Behind Chalkboard	-	-	Assume	-	-

ND= None Detected
[1]F = Friable; NF = Non-friable Friability is further defined in Appendix 3.
[2]Cond. = Condition of Materials Either good, fair or poor.
Note: <1% = Calif. Code of Regulations, Title 8, Section 1529, "Asbestos-containing construction material" means any manufactured construction material which contains more than one tenth of 1 percent asbestos by weight." This material will be abated as asbestos containing material, however, it may be disposed of as construction debris.

LEAD XRF SURVEY RESULTS

Special Annex Building
28000 Marguerite Pkwy
Mission Viejo, CA 92692

The list materials and their components where LBP is detected at or in excess of the HUD/EPA standards of 1.0 mg/cm^2 by XRF method which is listed in the table below or by 0.50% by weight of paint chip sample method.

Shot #	Unit	Room Tested	Wall	Color	Component	Substrate	Paint Condition	Result	Neg/Pos
01	SA Bldg.	Room 1	D	Tan	Wall	Drywall	I	0.0	N
02	SA Bldg.	Room 1	A	Tan	Window	Wood	I	0.1	N
03	SA Bldg.	Room 2	B	White	Wall	Drywall	I	-0.2	N
04	SA Bldg.	Room 2	B	White	Window	Wood	I	0.1	N
05	SA Bldg.	Room 2	C	White	Door	Wood	I	0.1	N
06	SA Bldg.	Room 2	C	White	Door Frame	Wood	I	0.2	N
07	SA Bldg.	Room 2	D	White	Door Frame	Metal	I	-0.2	N
08	SA Bldg.	Room 4	C	White	Door	Wood	I	-0.1	N
09	SA Bldg.	Room 4	C	White	Door Frame	Metal	I	1.3	P
10	SA Bldg.	Room 5	B	White	Wall	Drywall	I	-0.1	N
11	SA Bldg.	Room 5	B	White	Window	Wood	I	-0.1	N
12	SA Bldg.	Room 7	A	Orange	Wall	Drywall	I	-0.0	N
13	SA Bldg.	Room 9	A	Grey	Door	Wood	I	-0.1	N
14	SA Bldg.	Room 9	A	Grey	Door Frame	Wood	I	0.1	N
15	SA Bldg.	Room 10	B	Grey	Wall	Drywall	I	-0.1	N
16	SA Bldg.	Room 13	A	White	Wall	Drywall	I	-0.1	N
17	SA Bldg.	Room 14	B	Black	Wall	Drywall	I	-0.1	N
18	SA Bldg.	Room 1	A	Black	Duct Work	Metal	I	-0.2	N

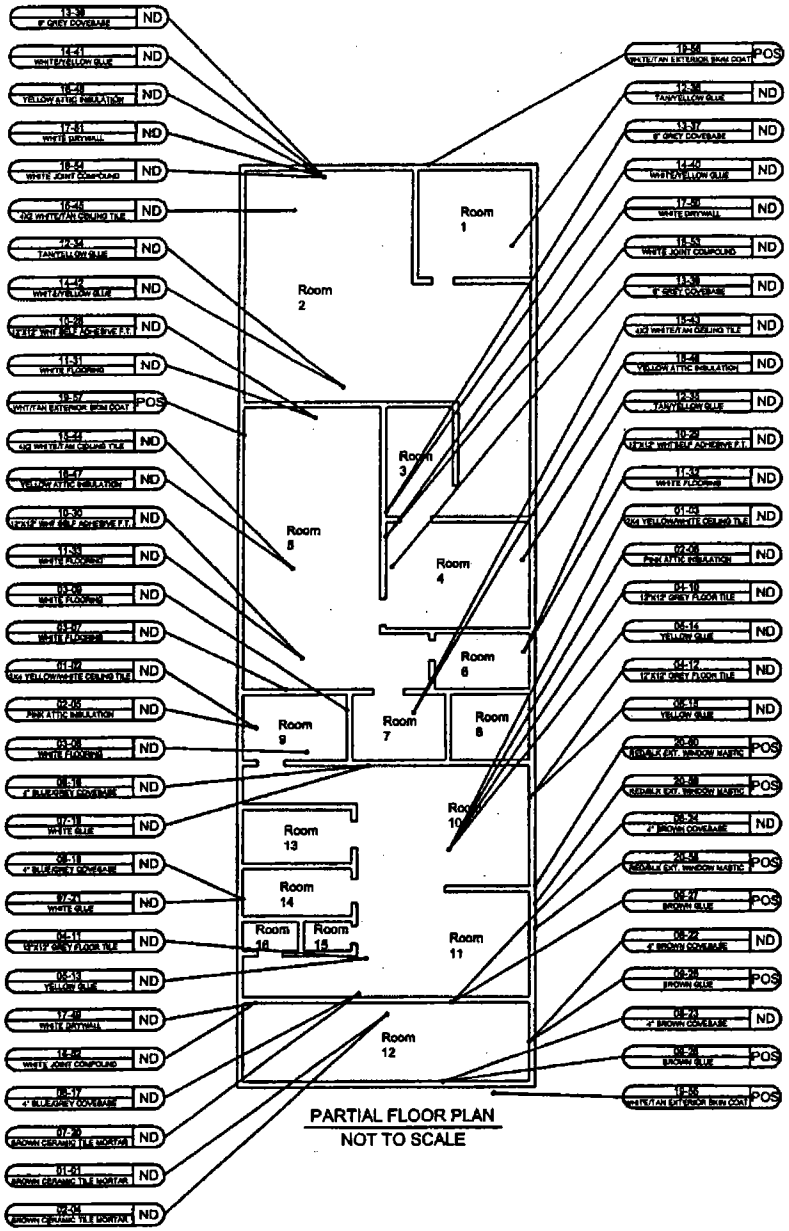
LEAD XRF SURVEY RESULTS

Special Annex Building
28000 Marguerite Pkwy
Mission Viejo, CA 92692

The list materials and their components where LBP is detected at or in excess of the HUD/EPA standards of 1.0 mg/cm^2 by XRF method which is listed in the table below or by 0.50% by weight of paint chip sample method.

Shot #	Unit	Room Tested	Wall	Color	Component	Substrate	Paint Condition	Result	Neg/Pos
19	SA Bldg.	Room 12	C	Black	Door	Wood	I	-0.0	N
20	SA Bldg.	Room 12	C	Black	Door Frame	Wood	I	-0.3	N
21	SA Bldg.	Room 12	C	Black	Wall	Plywood	I	0.3	N
22	SA Bldg.	Ext. of Bldg.	D	Red	Door	Wood	I	0.2	N
23	SA Bldg.	Ext. of Bldg.	D	Red	Door Frame	Metal	I	0.1	N
24	SA Bldg.	Ext. of Bldg.	D	Off White	Wall	Wood	I	0.2	N
25	SA Bldg.	Ext. of Bldg.	D	Brown	Fascia	Wood	I	0.2	N
26	SA Bldg.	Ext. of Bldg.	D	Off White	AC Unit/Wall	Metal	I	1.3	P
27	SA Bldg.	Ext. of Bldg.	D	Off White	Soffit	Wood	I	0.1	N
28	SA Bldg.	Ext. of Bldg.	D	Red	Fire Extinguisher Box	Metal	I	0.1	N
29	SA Bldg.	Room 2	B	Red	I-Beam	Metal	I	0.2	N
30	SA Bldg.	Roof	A	Grey	AC/Unit	Metal	I	-0.1	N
31	SA Bldg.	Roof	A	Tan	AC/Unit	Metal	I	0.2	N
32	SA Bldg.	Roof	C	Green	AC/Unit	Metal	I	0.1	N
33	SA Bldg.	Roof	C	Green	Fan	Metal	I	0.1	N
34	SA Bldg.	Roof	C	White	Duct Work	Metal	I	0.0	N

SECTION 3
CAD SAMPLE LOCATIONS



PARTIAL FLOOR PLAN
NOT TO SCALE

LEGEND

SAMPLE GROUP — SAMPLE NUMBER — RESULTS

02-006 | ND
BLACK MASTIC

MATERIAL DESCRIPTION

NA = NOT ANALYZED
ND = NONE DETECTED
POS = POSITIVE

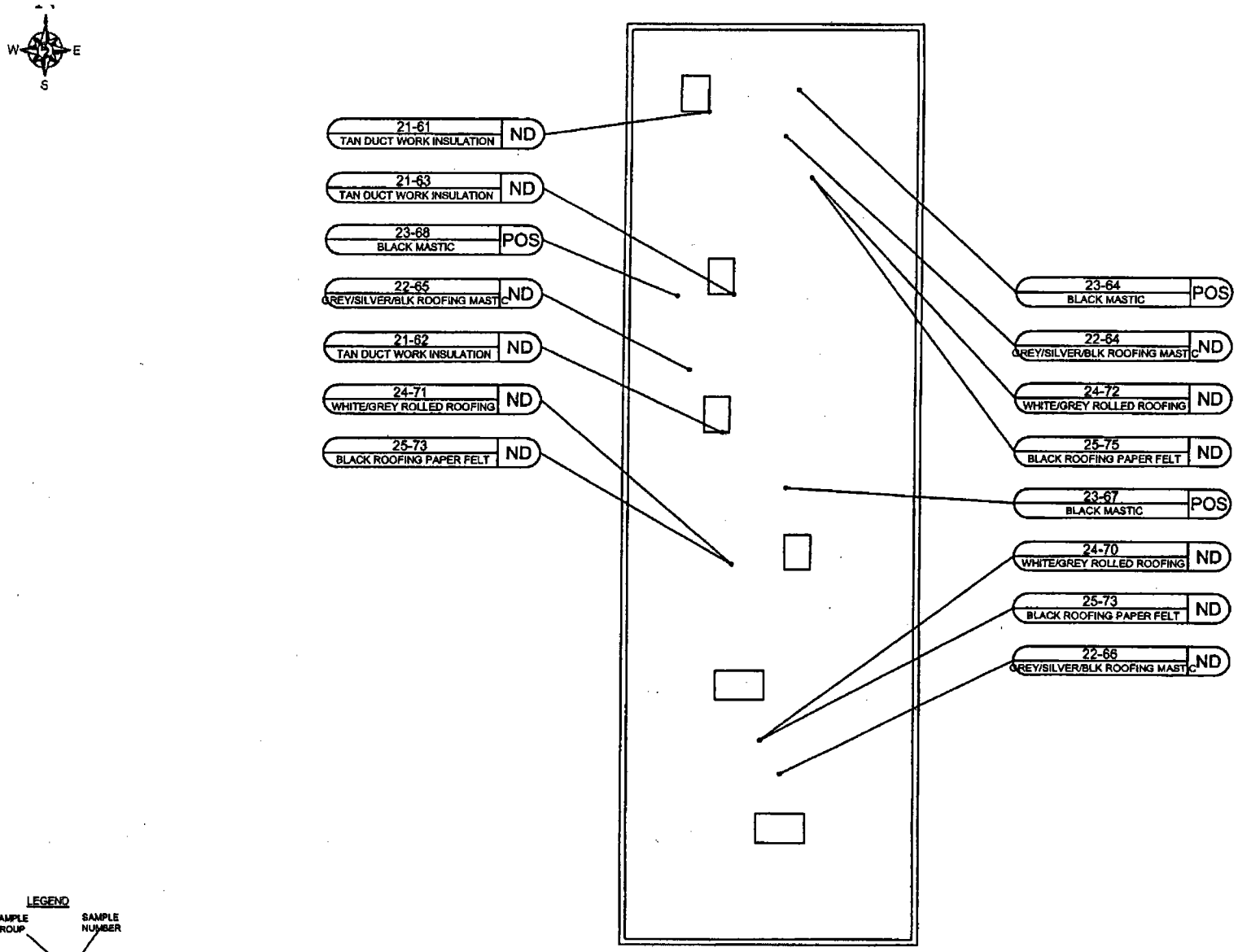
ABBREVIATIONS : DW = DRYWALL, JC = JOINT COMPOUND, FT = FLOOR TILE, M = FLOOR TILE MASTIC, CT = CEILING TILE, C.BASE = COVEBASE MATERIAL, C.BASE M = COVEBASE MASTIC

ENVIRONMENTAL CONSULTING SERVICES

DATE:	PROJ NO:
1/18/10	1282110AS
FIGURE:	DRAWN BY:

SADDLEBACK COLLEGE
ASBESTOS SURVEY, SPECIAL ANNEX BLDG

MARGUERITE PKWY.



MARGUERITE PKWY.

LEGEND

SAMPLE GROUP — SAMPLE NUMBER — RESULTS

02-008 | ND

BLACK MASTIC

MATERIAL DESCRIPTION

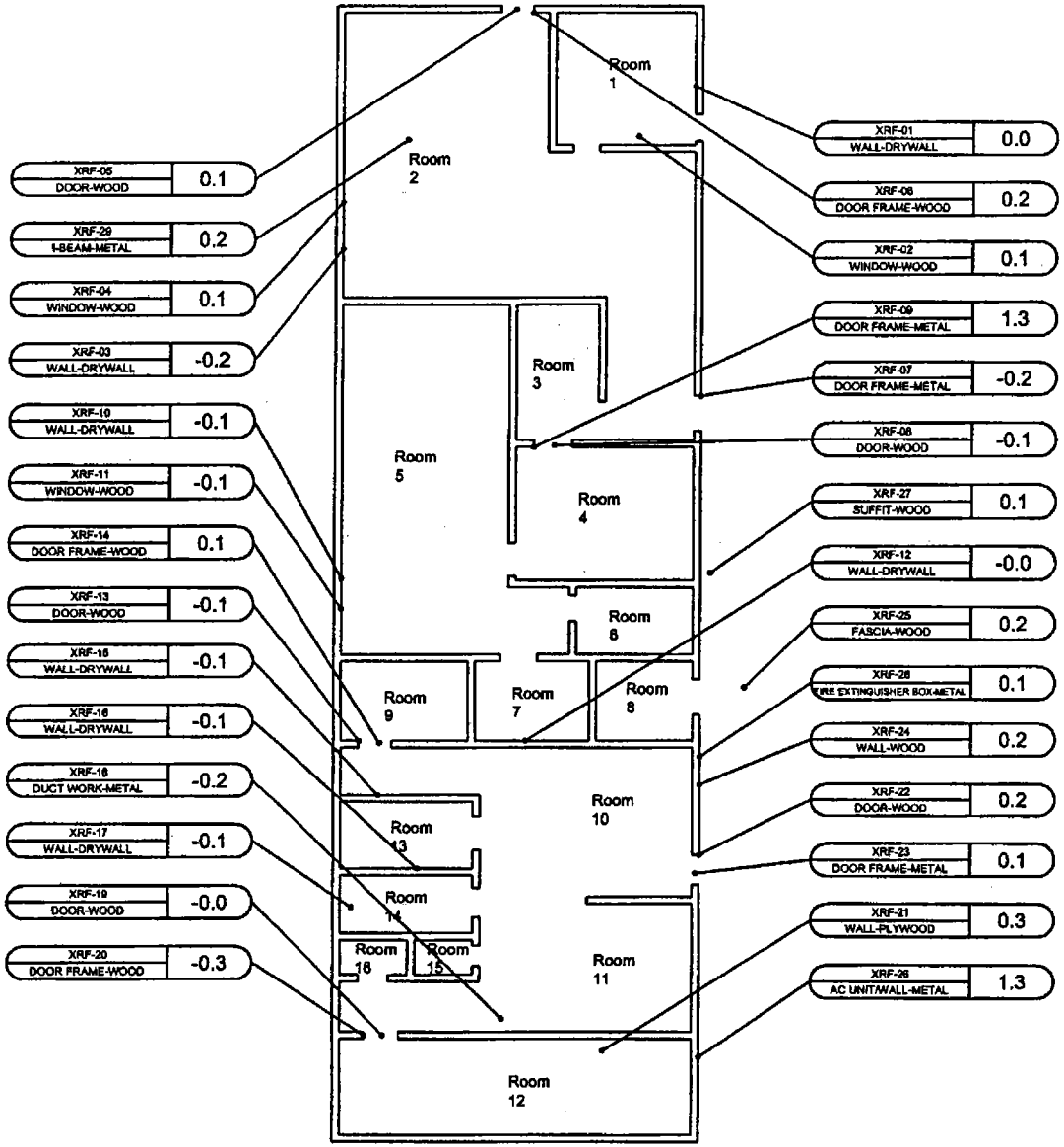
NA = NOT ANALYZED
ND = NONE DETECTED
POS = POSITIVE

ABBREVIATIONS : DW = DRYWALL, JC = JOINT COMPOUND, FT = FLOOR TILE, M = FLOOR TILE MASTIC, CT = CEILING TILE, C.BASE = COVEBASE MATERIAL, C.BASE M = COVEBASE MASTIC

ENVIRONMENTAL CONSULTING SERVICES

DATE: 1/18/10	PROJ NO: 1282110AS
FIGURE:	DRAWN BY:

SADDLEBACK COLLEGE
ASBESTOS SURVEY, SPECIAL ANNEX BLDG



PARTIAL FLOOR PLAN

NOT TO SCALE

MARGUERITE PKWY.

LEGEND

SAMPLE NUMBER

XRF-01 FLOOR-CONCRETE 12345 — RESULTS

TYPE OF SAMPLE

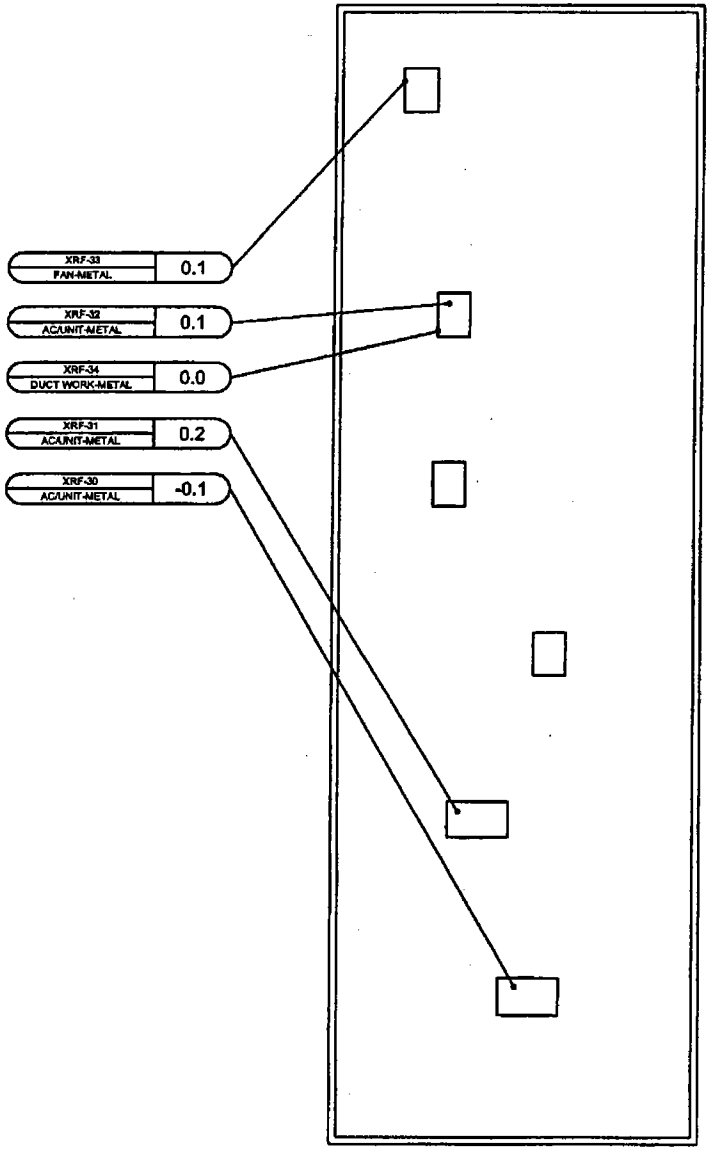
RESULTS FOR LEAD SAMPLE ARE NOTED AS mg/cm² = MILLIGRAMS PER SQUARED CENTIMETER

ENVIRONMENTAL CONSULTING SERVICES

DATE: 1/18/10	PROJ NO: 1282110AS
FIGURE:	DRAWN BY:

SADDLEBACK COLLEGE

LEAD XRF SURVEY, SPECIAL ANNEX BLDG



ROOF

NOT TO SCALE

MARGUERITE PKWY.

LEGEND

SAMPLE NUMBER

XRF-01 | 12345 | FLOOR-CONCRETE

RESULTS

TYPE OF SAMPLE

RESULTS FOR LEAD SAMPLE ARE NOTED AS mg/cm² = MILLIGRAMS PER SQUARED CENTIMETER

ENVIRONMENTAL CONSULTING SERVICES

DATE:	PROJ NO:
1/18/10	1282110AS
FIGURE:	DRAWN BY:

SADDLEBACK COLLEGE

LEAD XRF SURVEY, SPECIAL ANNEX BLDG

SECTION 4
ANALYTICAL RESULTS

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ttn: **Thomas Haley**
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13122 6th Street
Chino, CA 91710

ax: Phone: (909) 628-0369

roject: **1282110AS / Saddleback College / 2800 Marguerite Parkway Mission Viejo, CA 92692**

Customer ID: 32H2EN50
Customer PO:
Received: 01/19/10 3:45 PM
LA Testing Order: 321000595

LA Testing Proj:
Analysis Date: 1/20/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
mple	**Description**	**Appearance**	**%**	**Fibrous**	**%**	**Non-Fibrous**	**% Type**
118 01-01 *1000595-0001*	N end of room 12	White/Yellow Fibrous Heterogeneous	90%	Glass	10%	Non-fibrous (other)	**None Detected**
118 01-02 *1000595-0002*	S end of room 9	White/Yellow Fibrous Heterogeneous	90%	Glass	10%	Non-fibrous (other)	**None Detected**
118 01-03 *1000595-0003*	Center of room 10	White/Yellow Fibrous Heterogeneous	90%	Glass	10%	Non-fibrous (other)	**None Detected**
118 02-04 *1000595-0004*	N end of room 12	Red/Black/Pink Fibrous Heterogeneous	10% 60%	Cellulose Min. Wool	30%	Non-fibrous (other)	**None Detected**
118 02-05 *1000595-0005*	S end of room 9	Black/Silver/Pink Fibrous Heterogeneous	10% 60%	Cellulose Min. Wool	30%	Non-fibrous (other)	**None Detected**
118 02-06 *1000595-0006*	Center end of room 10	Brown/Black Fibrous Heterogeneous	5% 65%	Cellulose Min. Wool	30%	Non-fibrous (other)	**None Detected**
118 03-07 *1000595-0007*	N end of room 9	White Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**

alyst(s)

u-anh Pham Duong (50)
fik Vartanian, Ph.D (25)

Derrick Tanner, Laboratory Manager
or other approved signatory

e to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected y require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express ten approval of LA Testing. LA Testing's liability is limited to the cost of analysis. LA Testingbears no responsibility for sample collection activities or analytical method limitations. rpretation and use of test results are the responsibility of the client. The test results contained within this report meet the requirements of NELAC unless otherwise noted. Samples eived in good condition unless otherwise noted. Samples received in good condition unless otherwise noted.
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Received: 01/19/10 3:45 PM
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Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
ample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
0118 03-08 321000595-0008	S end of room 9	White Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
0118 03-09 321000595-0009	E end of room 9	White Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
0118 04-10 321000595-0010	N end of room 11	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
0118 04-11 321000595-0011	W end of room 14	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
0118 04-12 321000595-0012	E end of room 10	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
0118 05-13 321000595-0013	N end of room 11	Yellow Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
0118 05-14 321000595-0014	W end of room 14	Gray/Yellow Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**

nalyst(s)

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Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
ample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
118 05-15 21000595-0015	E end of room 10	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
118 06-16 21000595-0016	N end of room 10	Blue Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
118 06-17 21000595-0017	S end of room 11	Blue Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
118 06-18 21000595-0018	W end of room 14	Blue Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
118 07-19 21000595-0019	N end of room 10	Tan/Cream Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
118 07-20 21000595-0020	S end of room 11	Tan/Cream Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
118 07-21 21000595-0021	W end of room 14	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**

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Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

ample	Description	Appearance	Non-Asbestos % Fibrous	Non-Asbestos % Non-Fibrous	Asbestos % Type
)118 08-22 *21000595-0022*	E end of room 12	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
)118 08-23 *21000595-0023*	S end of room 12	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
)118 08-24 *21000595-0024*	N end of room 12	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
118 09-25 *21000595-0025*	E end of room 12	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	**<1% Anthophyllite**
118 09-26 *21000595-0026*	S end of room 12	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	**<1% Anthophyllite**
118 09-27 *21000595-0027*	N end of room 12	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	**<1% Anthophyllite**
118 10-28 *21000595-0028*	N end of room 5	White Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**

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Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
mple	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
118 10-29 21000595-0029	E end of room 6	White Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
118 10-30 21000595-0030	S end of room 5	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
118 11-31 21000595-0031	N end of room 5	White/Yellow Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
118 11-32 21000595-0032	E end of room 6	White/Yellow Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
118 11-33 21000595-0033	S end of room 5	Brown/White Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
118 12-34 21000595-0034	S end of room 2	Tan/Yellow Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
118 12-35 21000595-0035	E end of room 4	Tan/Yellow Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**

alyst(s)

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Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

ample	Description	Appearance	Non-Asbestos % Fibrous	Non-Asbestos % Non-Fibrous	Asbestos % Type
)118 12-36 *21000595-0036*	Center end of room 1	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
)118 13-37 *21000595-0037*	E end of room 5	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
)118 13-38 *21000595-0038*	N end of room 2	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
)118 13-39 *21000595-0039*	W end of room 4	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
)118 14-40 *21000595-0040*	E end of room 5	White/Cream Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
)118 14-41 *21000595-0041*	N end of room 2	White/Cream Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
)118 14-42 *21000595-0042*	W end of room 5	Brown/Gray/White Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**

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LA Testing Proj:
Analysis Date: 1/20/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
ample	Description	Appearance	%	Fibrous	%	Non-Fibrous	% Type
118 15-43 21000595-0043	S end of room 7	White/Beige Fibrous Heterogeneous	50% 20%	Cellulose Min. Wool	10% 20%	Non-fibrous (other) Perlite	**None Detected**
118 15-44 21000595-0044	Center of room 5	White/Beige Fibrous Heterogeneous	50% 20%	Cellulose Min. Wool	10% 20%	Non-fibrous (other) Perlite	**None Detected**
118 15-45 21000595-0045	N end of room 2	Gray/White Fibrous Heterogeneous	35% 15%	Cellulose Min. Wool	45% 5%	Non-fibrous (other) Perlite	**None Detected**
118 16-46 21000595-0046	S end of room 7	Brown/Silver/Yellow Fibrous Heterogeneous	20% 60%	Cellulose Glass	20%	Non-fibrous (other)	**None Detected**
118 16-47 21000595-0047	Center end of room 5	Brown/Yellow Fibrous Heterogeneous	30% 60%	Cellulose Glass	10%	Non-fibrous (other)	**None Detected**
118 16-48 21000595-0048	N end of room 2	White/Yellow Fibrous Homogeneous	90%	Glass	10%	Non-fibrous (other)	**None Detected**
118 17-49 21000595-0049	N end of room 12	White Non-Fibrous Homogeneous	3% 2%	Cellulose Glass	95%	Non-fibrous (other)	**None Detected**

alyst(s)

eu-anh Pham Duong (50)
afik Vartanian, Ph.D (25)

Derrick Tanner, Laboratory Manager
or other approved signatory

e to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected ay require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express itten approval of LA Testing. LA Testing's liability is limited to the cost of analysis. LA Testingbears no responsibility for sample collection activities or analytical method limitations. erpretation and use of test results are the responsibility of the client. The test results contained within this report meet the requirements of NELAC unless otherwise noted. Samples ceived in good condition unless otherwise noted. Samples received in good condition unless otherwise noted.
mples analyzed by LA Testing 520 Mission Street, South PasadenaCA NVLAP Lab Code 200232-0, AIHA IHLAP 102814, CA ELAP 2283

LA Testing
520 Mission Street, South Pasadena, CA 91030
Phone: (323) 254-9960 Fax: (323) 254-9982 Email: pasadenalab@latesting.com

Attn: **Thomas Haley**
H2 Environmental Consulting Services
13122 6th Street
Chino, CA 91710

Fax: Phone: (909) 628-0369

Project: **1282110AS / Saddleback College / 2800 Marguerite Parkway Mission Viejo, CA 92692**

Customer ID: 32H2EN50
Customer PO:
Received: 01/19/10 3:45 PM
LA Testing Order: 321000595

LA Testing Proj:
Analysis Date: 1/20/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
ample	Description	Appearance	%	Fibrous	%	Non-Fibrous	% Type
)118 17-50 *21000595-0050*	E end of room 5	Brown/White Fibrous Heterogeneous	10% 2%	Cellulose Glass	88%	Non-fibrous (other)	**None Detected**
)118 17-51 *21000595-0051*	N end of room 2	Brown/White Fibrous Heterogeneous	15% 3%	Cellulose Glass	82%	Non-fibrous (other)	**None Detected**
)118 18-52 *21000595-0052*	N end of room 12	White Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
)118 18-53 *21000595-0053*	E end of room 5	White/Beige Non-Fibrous Heterogeneous			100%	Non-fibrous (other)	**None Detected**
)118 18-54 *21000595-0054*	N end of room 2	White Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
)118 19-55 *21000595-0055*	S end of bldg ext	Beige/Olive Non-Fibrous Heterogeneous			98%	Non-fibrous (other)	**2% Chrysotile**
)118 19-56 *21000595-0056*	N end of bldg ext	Beige/Olive Non-Fibrous Heterogeneous			98%	Non-fibrous (other)	**2% Chrysotile**

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Analysis Date: 1/20/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos	
mple	Description	Appearance	%	Fibrous	%	Non-Fibrous	%	Type
118 19-57 21000595-0057	W end of bldg ext	Brown/White Non-Fibrous Heterogeneous			98%	Non-fibrous (other)	2%	Chrysotile
118 20-58 21000595-0058	W end of bldg ext	Brown/Black Non-Fibrous Heterogeneous	10%	Cellulose	85%	Non-fibrous (other)	5%	Chrysotile
118 20-59 21000595-0059	N/W end of bldg ext	Brown/Black Fibrous Heterogeneous	10%	Cellulose	85%	Non-fibrous (other)	5%	Chrysotile
118 20-60 21000595-0060	W end of bldg ext	Brown/Black Fibrous Homogeneous	5%	Cellulose	90%	Non-fibrous (other)	5%	Chrysotile
118 21-61 21000595-0061	N/E end of roof	Beige/Gold Non-Fibrous Heterogeneous	5%	Cellulose	85% 10%	Non-fibrous (other) Mica	None Detected	
118 21-62 21000595-0062	S end of roof	Beige/Gold Non-Fibrous Heterogeneous	5%	Cellulose	85% 10%	Non-fibrous (other) Mica	None Detected	
118 21-63 21000595-0063	Center of roof	Gray Non-Fibrous Homogeneous	2%	Cellulose	88% 10%	Non-fibrous (other) Mica	None Detected	

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Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
ample	Description	Appearance	%	Fibrous	%	Non-Fibrous	% Type
)118 22-64 *21000595-0064*	N end of roof	Black/Silver Non-Fibrous Heterogeneous	5%	Synthetic	95%	Non-fibrous (other)	**None Detected**
)118 22-65 *21000595-0065*	W end of roof	Black/Silver Non-Fibrous Heterogeneous			100%	Non-fibrous (other)	**None Detected**
)118 22-66 *21000595-0066*	S end of roof	Black/Silver Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
)118 23-67 *21000595-0067*	E end of roof	Black Fibrous Heterogeneous	5%	Cellulose	92%	Non-fibrous (other)	**3% Chrysotile**
)118 23-68 *21000595-0068*	W end of roof	Black Fibrous Heterogeneous			92%	Non-fibrous (other)	**8% Chrysotile**
118 23-69 *21000595-0069*	N end of roof	Black Non-Fibrous Homogeneous	5%	Cellulose	92%	Non-fibrous (other)	**3% Chrysotile**
118 24-70 *21000595-0070*	S end of roof	Black/Silver Fibrous Heterogeneous	5%	Synthetic	95%	Non-fibrous (other)	**None Detected**

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Analysis Date: 1/20/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
mple	Description	Appearance	%	Fibrous	%	Non-Fibrous	% Type
118 24-71 *1000595-0071*	W end of roof	Black/Silver Non-Fibrous Heterogeneous	3% 2%	Glass Synthetic	95%	Non-fibrous (other)	**None Detected**
118 24-72 *1000595-0072*	N end of roof	Black/Silver Fibrous Heterogeneous	5%	Glass	95%	Non-fibrous (other)	**None Detected**
118 25-73 *1000595-0073*	S end of roof	Black Fibrous Heterogeneous	10%	Glass	90%	Non-fibrous (other)	**None Detected**
118 25-74 *1000595-0074*	W end of roof	Black Fibrous Heterogeneous	10%	Glass	90%	Non-fibrous (other)	**None Detected**
118 25-75 *1000595-0075*	N end of roof	Black Fibrous Homogeneous	10%	Glass	90%	Non-fibrous (other)	**None Detected**

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THIS IS THE LAST PAGE OF THE REPORT.

SECTION 5
FIELD ASSESSMENT WORKSHEET/CHAIN OF CUSTODY

ENVIRONMENTAL CONSULTING SERVICES, INC.

Bulk Sampling Form

☐ Stop at First Positive ☒ 24 Hour turn around ☐ Rush turn around (4 Hours)
X Do Not Layer Samples

CLIENT: Saddleback College	PROJECT NO.: 1282110AS
PROJECT ID: Special Annex Bldg	DATE: 1/18/10 PAGE 1 OF 4
PROJECT LOCATION: 28000 Marguerite Pkwy, Mission Viejo, CA 92692	INSPECTOR: Alberto Sanchez

GRP. NO.	SAMP. NO	MATERIAL DESCRIPTION	LOCATION OF SAMPLE	QTY	% POS
01	01	Yellow/white 2X4 FT.	North end of Rm 12	1300 ☒	
↓	02	Ceiling Tile	South - end of Rm 9	↓	
↓	03	↓	Center of Rm 10	↓	
02	04	Pink color Attic	North - end of Rm 12	1300 ☒	
↓	05	Insulation Material	South - end of Rm 9	↓	
↓	06	↓	Center - end of Rm 10	↓	
03	07	white Flooring	North - end of Rm 9	99 ☒	
↓	08	material under	South - end of Rm 9	↓	
↓	09	Carpet.	East - end of Rm 9	↓	
04	10	Grey color Floor	North - end of Rm 11	900 ☒	
↓	11	Tile 12"x12" under.	West - end of Rm 14	↓	
↓	12	↓	East - end of Rm 10	↓	
05	13	Yellow Color glue	North - end of Rm 11	900 ☒	
↓	14	under 12x12 inch	West - end of Rm 14	↓	
↓	15	Floor Tile (Gray color)	East - end of Rm 10	↓	
06	16	4" in coveblase	North end of Rm 10	280 ☒	
↓	17	Blue/gray color	South - end of Rm 11	↓	
↓	18	↓	West - end of Rm 14	↓	
07	19	white glue under	North - end of Rm 10	280 ☒	
↓	20	4" in coveblase	South - end of Rm 11	↓	
↓	21	(Blue/gray color)	West - end of Rm 14	↓	

Notes:

13122 6th Street • Chino, CA 91710
(909) 628-0369 • Fax (909) 613-5845 • H2Environmental.com

ENVIRONMENTAL CONSULTING SERVICES, INC.

Bulk Sampling Form

☐ Stop at First Positive ☒ 24 Hour turn around ☐ Rush turn around (4 Hours)
X Do Not Layer Samples

LIENT: Saddleback College	PROJECT NO.: 12821\0AS
ROJECT ID: Special Annex BLDG	DATE: 1/18/10 PAGE 2 OF 4
ROJECT LOCATION: 100 Marguerite Pkwy, Mission Viejo, CA 92692	INSPECTOR: Alberto Sanchez

GRP. NO.	SAMP. NO	MATERIAL DESCRIPTION	LOCATION OF SAMPLE	QTY	% POS
8	22	Brown color 4"in	East-end of Rm 12	79 ☐	
	23	Cove base	South-end of Rm 12		
	24		North-end of Rm 12		
9	25	Brown color	East-end of Rm 12		
	26	glue under 4"in	South-end of Rm 12		
	27	Cove base	North-end of Rm 12		
10	28	white color 12"x12"inch	North-end of Rm 5	580 ☐	
	29	Floor Tile Material	East-end of Rm 6		
	30	Self adhesive	South-end of Rm 5		
11	31	white Flooring	North-end of Rm 5		
	32	material under	East-end of Rm 6		
	33	12"x12"in Floor Tile	South-end of Rm 5		
12	34	Tan/yellow color	South-end of Rm 2	1665 ☐	
	35	glue under	East-end of Rm 4		
	36	Blue/green Carpet.	Center-end of Rm 1		
13	37	Grey color	East-end of Rm 5	508 ☐	
	38	6"in cove base	North-end of Rm 2		
	39		West-end of Rm 4		
14	40	white/yellow glue	East-end of Rm 5		
	41	under 6"in	North-end of Rm 2		
	42	cove base	West-end of Rm 5		

Notes:

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Bulk Sampling Form

☐ Stop at First Positive ☒ 24 Hour turn around ☐ Rush turn around (4 Hours)
X Do Not Layer Samples

CLIENT Saddleback College	PROJECT NO. 1282110AS
PROJECT ID Special Annex Bldg	DATE 1-18-10 / PAGE 3 OF 4
PROJECT LOCATION 2800 Marguerite Pkwy, Mission Viejo, Ca. 92692	INSPECTOR M-CY A.S

GRP. NO.	SAMP. NO	MATERIAL DESCRIPTION	LOCATION OF SAMPLE	QTY	% POS
15	43	white/Tan 4x2 FT.	South - end of Rm 7	2200 ☒	
↓	44	Ceiling Tile.	Center of Rm 5	↓	
↓	45	↓	North - end of Rm 2	↓	
16	46	Yellow color	South - end of Rm 7	↓	
↓	47	Attic Insulation Above	Center - end of Rm 5	↓	
↓	48	ceiling Tiles.	North - end of Rm 2	↓	
17	49	white Drywall	North - end of Rm 12	9800 ☒	
↓	50	material	East - end of Rm 5	↓	
↓	51	↓	North - end of Rm 2	↓	
18	52	white joint compound	North - end of Rm 12	↓	
↓	53	material	East - end of Rm 5	↓	
↓	54	↓	North - end of Rm 2	↓	
19	55	white/Tan Ext.	South - end of Bldg. ext	4000 ☒	
↓	56	Skimcoat on	North - end of Bldg ext.	↓	
↓	57	ext. walls.	West - end of Bldg. ext.	↓	
20	58	Red/Black Ext.	West - end of Bldg. ext	60 ☒	
↓	59	Window Mastic	North W. end of Bldg. ext.	↓	
↓	60	↓	West - end of Bldg. Ext.	↓	
21	61	Tan color Roof	N. East - end of Roof.	190 ☒	
↓	62	Wave Insulation	South - end of Roof	↓	
↓	63	Material	Center of Roof.	↓	

Notes:

ENVIRONMENTAL CONSULTING SERVICES, INC.

Bulk Sampling Form

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X Do Not Layer Samples

CLIENT Saddleback College	PROJECT NO. 1282110 AS
PROJECT ID Special Annex Bldg.	DATE 1-18-10 PAGE 4 OF 4
PROJECT LOCATION 28000 Marguerite Pkwy, Mission Viejo, Ca. 92692	INSPECTOR M.C., A.S.

GRP. NO.	SAMP. NO	MATERIAL DESCRIPTION	LOCATION OF SAMPLE	QTY	% POS
22	64	Grey/Silver Black	North - end of Roof	120 ☒	
↓	65	Roofing, Mastic Material	West - end of Roof	↓	
↓	66	on penetrations	South - end of Roof	↓	
23	67	Black Mastic	East - end of Roof	160 ☒	
↓	68	Material on penetration	West - end of Roof	↓	
↓	69	(Roof penetrations)	North - end of Roof	↓	
24	70	White/Grey	South - end of Roof	4865 ☒	
↓	71	Rolled Roofing	West - end of Roof	↓	
↓	72	Material	North - end of Roof	↓	
25	73	Black color	South - end of Roof	↓	
↓	74	Roofing paper Felt	West - end of Roof	↓	
↓	75	under (Rolled Roofing)	North - end of Roof	↓	

Notes:

Assume ACM Mastic behind Chalkboard.

CONSULTING SERVICES, INC.

13122 6th Street
Chino, CA 91710-9008
Office: 909-628-0369 Fax: 909-613-5845

LEAD XRF SURVEY RESULTS

Client Name Saddleback College	**Project Number** 12821105
Project Name Special Annex BLDG	**Inspector(s)** Alberto Sanchez
Project Location / Address 28000 Marguerite Pkwy, Mission Viejo, CA 92692	**Date** 1/18/10

The list materials and their components where LBP is detected at or in excess of the HUD/EPA standards of (1.0 mg/cm²) by XRF method which is listed in the table below or by 0.50% by weight of paint chip sample method.

Shot #	QTY (SF)	Unit	Room Tested	Wall	Color	Component	Substrate	Paint Condition	Result mg/cm²	Neg / Pos
01	200 ft	SA	Rm #1	D	TAN	wall	Drywall	(I) / D	0.0	(N) / P
02	2 EA		Rm #1	A	TAN	window	wood	(I) / D	0.1	(N) / P
03	3,000 ft		Rm #2	B	white	wall	Drywall	(I) / D	-0.2	(N) / P
04	200 ft		Rm #2	B	white	window	wood	(I) / D	0.1	(N) / P
05	100 ft		Rm #2	C	white	Door	wood	(I) / D	0.1	(N) / P
06	80 ft		Rm #2	C	white	Door Frame	wood	(I) / D	0.2	(N) / P
07	100 ft		Rm #2	D	white	Door Frame	metal	(I) / D	-0.2	(N) / P
08	8 ft		Rm #4	C	white	Door	wood	(I) / D	-0.1	(N) / P
09	4 EA		Rm #4	C	white	Door Frame	metal	(I) / D	1.3	N / (P)
10	3,000 ft		Rm #5	B	white	wall	Drywall	(I) / D	-0.1	(N) / P
11	200 ft		Rm #5	B	white	window	wood	(I) / D	-0.1	(N) / P
12	300 ft		Rm #7	A	orange	wall	Drywall	(I) / D	-0.0	(N) / P
13	40 ft		Rm #9	A	Gray	Door	wood	(I) / D	-0.1	(N) / P
14	20 ft		Rm #9	A	Gray	Door Frame	wood	(I) / D	0.1	(N) / P
15	300 ft		Rm #10	B	Gray	wall	Drywall	(I) / D	-0.1	(N) / P
16	3,000 ft		Rm #13	A	white	wall	Drywall	(I) / D	-0.1	(N) / P
17	50 ft		Rm #14	B	Blk	wall	Drywall	(I) / D	-0.1	(N) / P

Paint Condition: I- Intact D- Deteriorated

Reading: N-Negative (Less than 1.0 mg/cm² not classified as LBP)
P-Positive (Greater than or equal 1.0 mg/cm² classified as LBP)

mg/cm²: Milligram Per Square Centimeter

H2 Environmental Consulting Services, Inc.
13122 6th Street
Chino, CA 91710-9008
Office: 909-628-0369 Fax: 909-613-5845

LEAD XRF SURVEY RESULTS

Client Name Saddleback College	**Project Number** 12521104S
Project Name Special Annex Bldg	**Inspector(s)** A.J., M.G.
Project Location / Address 2000 Marguerite Pkwy, Mission Viejo, CA 92692	**Date** 1/18/10

The list materials and their components where LBP is detected at or in excess of the HUD/EPA standards of (1.0 mg/cm²) by XRF method which is listed in the table below or by 0.50% by weight of paint chip sample method.

Shot #	QTY (SF)	Unit	Room Tested	Wall	Color	Component	Substrate	Paint Condition	Result mg/cm²	Neg / Pos
18	400	SA	Rm #1	A	Blk	Door/work	metal	I / D	-0.2	N / P
19	400		Rm 12	C	Blk	Door	wood	I / D	-0.0	N / P
20	200		Rm 12	C	Blk	Door Frame	wood	I / D	-0.3	N / P
21	600		Rm 12	C	Blk	wall	Plywood	I / D	0.3	N / P
22	400		Out of Bldg	D	Red	Door	wood	I / D	0.2	N / P
23	200			D	Red	Door Frame	metal	I / D	0.1	N / P
24	4,000			D	offwhite	wall	wood	I / D	0.2	N / P
25	200			D	Blu.	Fascia	wood	I / D	0.2	N / P
26	2 EA			D	offwhite	AC unit/wall	metal	I / D	1.3	N / P
27	1,000			D	offwhite	soffit	wood	I / D	0.1	N / P
28	2 EA			D	Red	Fire Extinguisher Box	metal	I / D	0.1	N / P
29	3,000		Rm #2	B	Red	2-beam	metal	I / D	0.2	N / P
30	100		Roof	A	Gray	AC unit	metal	I / D	-0.1	N / P
31	100			A	Tan	AC unit	metal	I / D	0.2	N / P
32	100			C	Green	AC unit	metal	I / D	0.1	N / P
33	200			C	Green	Fan	metal	I / D	0.1	N / P
34	100			C	white	Door/work	metal	I / D	0.0	N / P

Paint Condition: I- Intact D- Deteriorated

Reading: N-Negative (Less than 1.0 mg/cm² not classified as LBP)
P-Positive (Greater than or equal 1.0 mg/cm² classified as LBP)

APPENDICES

APPENDIX 1

INSPECTOR'S CERTIFICATES

In an effort to save paper and per some repeat clients request to reduce the size of the reports, H2 Environmental has reduced the size of the inspector's certifications to make them fit on one page. If you feel the need to receive a full size set of certifications, feel free to call our office (909) 628-0369 and request the copies you need. Thank you for your assistance in this matter.

CALIFORNIA
DEPARTMENT OF INDUSTRIAL RELATIONS
DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
ASBESTOS CONSULTANT AND TRAINER APPROVAL UNIT
Sacramento Center, Suite 1
Sacramento, CA 95825
(916) 574-2583 Fax: (916) 483-6572

Arnold Schwarzenegger, Governor

May 15, 2009

Environmental Consulting Services, Inc.
Attn: Thomas Haley
12 6th St
Chino, CA 91710-1006

Certified Asbestos Consultant or Technician

Enclosed is your certification card. To maintain your certification, please abide by the rules printed on the back of the certification card.

Your certification is valid for a period of one year. If you wish to renew your certification, you must apply for renewal at least 60 days before the expiration date shown on your card. (8 CCR 341.15(b)(1)).

Please hold and do not send copies of your required AHERA refresher renewal certificates to our office until you apply for renewal of your certification. Certificates must be kept current if you are actively working as a CAC or CSST. The grace period is only for those who are not actively working as a CAC or CSST.

Please inform our office at the above address, fax number or asbuildir.ca.gov of any changes in your contact/mailing information within 15 days of the change.

Sincerely,

Industrial Hygienist

Enclosure: Certification Card

State of California
Division of Occupational Safety and Health
Certified Asbestos Consultant
William Thomas Haley
Certificate No. 93-[illegible]
Expires on [illegible]

Global Environmental Training

This is to certify that

W. Thomas Haley

SS# 4362

Has completed course work that meets the criteria required for EPA/AHERA (TSCA Title II) Approval Recertification and NESHAPs Regulations Training.

Asbestos in Buildings: Abatement Contractor Supervisor Refresher

April 4, 2009 — Course Date
29080-CSR — Certificate Number
April 4, 2010 — Expiration Date
CA-023-04 — Course Approval Number

Mark Vargas, Course Director

Global Environmental Training

This is to certify that

W. Thomas Haley

SS# 4362

Has completed course work that meets the criteria required for EPA/AHERA (TSCA Title II) Approval Recertification and NESHAPs Regulations Training.

Asbestos in Buildings: Building Inspector Refresher

April 5, 2009 — Course Date
29064-BIR — Certificate Number
April 5, 2010 — Expiration Date
CA-023-06 — Course Approval Number

Mark Vargas, Course Director

Global Environmental Training

This is to certify that

W. Thomas Haley

SS# 4362

Has completed course work that meets the criteria required for EPA/AHERA (TSCA Title II) Approval Recertification and NESHAPs Regulations Training.

Asbestos in Buildings: Abatement Project Designer Refresher

January 9, 2009 — Course Date
29017-PDR — Certificate Number
January 9, 2010 — Expiration Date
CA-023-10 — Course Approval Number

Mark Vargas, Course Director

Global Environmental Training

This is to certify that

W. Thomas Haley

SS# 4362

Has completed course work that meets the criteria required for EPA/AHERA (TSCA Title II) Approval Recertification and NESHAPs Regulations Training.

Asbestos in Buildings: Management Planner Refresher

January 8, 2009 — Course Date
29018-MPR — Certificate Number
January 8, 2010 — Expiration Date
CA-023-11 — Course Approval Number

Mark Vargas, Course Director

This is to certify that
W. Thomas Haley
has completed
the NIOSH 48-hr approved course
Sampling and Evaluating Airborne Asbestos Dust
by
Hall-Kimbrell ENVIRONMENTAL SERVICES
in Lawrence, Kansas on June 27 - 30, 1989.
KENNON E. HALL

American IAQ Council

hereby certify that

W. Thomas Haley

has met all the specific requirements and completed the examination process, including additional professional development, and is hereby recognized as a

Council-certified Indoor Environmental Consultant

CIEC

Executive Director

Certified Indoor Consultant

Mr. William T. Haley
H2 Environmental Consulting Services, Inc.
13122 6th Street
Chino, California 91710

State of California Department of Public Health
Environmental Laboratory Accreditation Program

State of California
California Environmental Protection Agency
Department of Pesticide Regulation
Pest Control

THE STATE OF CALIFORNIA

Director, Department of Pesticide Regulation

CERTIFICATE OF ATTENDANCE

This certificate is awarded to

W. Thomas Haley

in recognition of attendance to

Basic AeroSeminar

February 13, 2004
Sponsored by Aerotech Laboratories, Inc.

This course has been approved for 1.0 Industrial Hygiene CM Point from the American Board of Industrial Hygiene approval # and 1/2 Unit of Continuing Education Credit from the ACAC.

Environmental Assessment Association

EAA

hereby certifies that

W. Thomas Haley, CEI

has been qualified for membership in the

Environmental Assessment Association

and has been admitted by its Board of Directors and declared to be a

CEI

Certified Environmental Inspector

and is hereby granted this certificate under the conditions presented in its bylaws.

Signed and presented this 13th day of March, 2001

Robert H. Johnson
President/CEO Robert G. Johnson

ENVIRONMENTAL CONSULTING SERVICES, INC.

QUALITATIVE FIT TEST

Employee Name W. Thomas Haley S.S.# 1362

Employee Signature [signature] Date 5/26/09

Location: H2 Environmental

Respirator Specifications:

Brand North

Size Large

Model 7700

Type Half Face

Test Results

Negative Pressure Tests: ✓Pass ☐Fail

Positive Pressure Tests: ✓Pass ☐Fail

Irritant Smoke Tests: ✓Pass ☐Fail

Trainer Name: Alberto Enchiz

Trainer Signature [signature] Date 5/21/09

Comments:

13122 6th Street • Chino, CA 91710
(909) 628-0369 • Fax (909) 615-6815 •

Certificate of Attendance

The individual named below attended the 2007 Annual Meeting & Exposition of the Indoor Air Quality Association, held October 14 – October 17, 2007 in Las Vegas, NV.

Presented to

Thomas Haley

Glenn Fellman, Executive Director

Robert G. Baker, President

INDOOR AIR QUALITY ASSOCIATION

Membership Certificate

THIS DOCUMENT IS TO CERTIFY THAT

Thomas Haley

IS A MEMBER IN GOOD STANDING AND ENTITLED TO ALL RIGHTS & PRIVILEGES OF ASSOCIATION MEMBERSHIP

DEPARTMENT OF TOXIC SUBSTANCES CONTROL
REGISTERED ENVIRONMENTAL ASSESSOR PROGRAM
1001 I Street, P.O. Box 806, Sacramento, CA 95812-0806

REGISTRATION FEE RECEIPT

DATE: APRIL 28, 2008 ANNUAL EXPIRES ON:

AMOUNT RECEIVED: $100

W. Thomas Haley
H2 Environmental Consulting Services, Inc.
13122 6th St
Chino, CA 91710

NOTE: Your fee for renewal is due
Please keep your registration information updated at

REGISTERED ENVIRONMENTAL ASSESSOR

Issued to W. Thomas Haley

IAQA-AmIAQ-IESO 2005

The Unification Conference

Certificate of Attendance

The individual named below attended the 2005 Annual Meeting & Exposition of Indoor Air Quality Association (IAQA), American Indoor Air Quality Council (AmIAQ) and Indoor Environmental Standards Organization (IESO), held jointly October 6-9, 2005 in Orlando, FL. The meeting included more than 20 hours of educational content.

Presented to:

W. Thomas Haley

To verify the authenticity of this document, please contact the Indoor Air Quality Association (IAQA)

Certificate of Attendance

certifies that

W. Thomas Haley

has successfully completed the

Basic Strategies for Conducting Meaningful Microbial IAQ Investigations

2.0 IH CM Points or 1.6 CEUs ABIH Approval #12557 16 CPOs from BOMI

December 10 – December 11, 2003
Date

Executive Director

Environmental Assessment Association

EAA

hereby certifies that

W. Thomas Haley, CES

has been qualified for membership in the

Environmental Assessment Association

and has been admitted by its Board of Directors and declared to be a

CES

Certified Environmental Specialist

and is hereby granted this certificate under the conditions presented in its bylaws.

Signed and sealed this 6th day of March, 2001

Robert G. Johnson

LA TESTING, INC.

certifies that

Tom Haley

IAQ and INDUSTRIAL HYGIENE WORKSHOP

IMEL Certificate No. 94-TH-CA
Course Date: March 31, 1994
Lawndale, Anaheim, CA.

COURSE INSTRUCTORS:

CREDITS & CONTINUING EDUCATION:

Sponsored by:

LA Testing, Inc.
10172 Nod Street
Los Alamitos, CA 90720
Phone (800) 255-1196
Fax (714) 761-3712
www.lactesting.com

James Dobrowski, Ph.D.
National Director of Microbiology

Environmental, Mold, Pesticide, IAQ, Asbestos, Lead, Formaldehyde and Metabolic Testing Since 1981

Certificate of Training

Thomas Haley

Has completed an awareness course in general compliance with 29 CFR 1910.1200 and applicable provisions of 29 CFR 1910.120.

Clandestine Methamphetamine Labs

Presented on this date: January 13, 2003
Course Date: January 13, 2003
Certificate Number: 031-6-1113

DaLisle Associates LTD
3903 E. Eastside Road
Berrien, Michigan 49082
(269) 273-4001

Thomas M. Sweetbury, Instructor

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
ASBESTOS CONSULTANT and TRAINER APPROVAL UNIT
2211 Park Towne Circle, Suite 1
Sacramento, CA 95825
Tel: (916) 574-3083 Fax: (916) 483-0672

312243211T 251 213

H2 Environmental Consulting Services, Inc.
Alberto P Sanchez
13122 6th Street
Chino CA 91710-9008

January 12, 2009

Dear Certified Asbestos Consultant or Technician:

Enclosed is your certification card. To maintain your certification, please abide by the rules printed on the back of the certification card.

Your certification is valid for a period of one year. If you wish to renew your certification, you must apply for renewal at least 60 days before the expiration date shown on your card. [8 CCR 341.15(h)(1)].

Please hold and do not send copies of your required AHERA refresher renewal certificates to our office until you apply for renewal of your certification. Certificates must be kept current if you are actively working as a CAC or CSST. The grace period is only for those who are not actively working as a CAC or CSST.

Please inform our office at the above address, fax number or actu@dir.ca.gov of any changes in your contact/mailing information within 15 days of the change.

Sincerely,

Jeff Ferrell
Senior Industrial Hygienist

JF/ms

Attachment: Certification Card
cc: File

State of California
Division of Occupational Safety and Health
Asbestos Consultant Technician

Global Environmental Training

This is to certify that

Alberto Sanchez

SS# 7746

Has completed course work that meets the criteria required for EPA/AHERA (TSCA Title II) Approved Reaccreditation and NESHAPs Regulations Training *

Asbestos in Buildings: Building Inspector Refresher

April 5, 2009
Course Date

29065-BIR
Certificate Number

April 5, 2010
Expiration Date

CA - 023 - 06
Course Approval Number

Maria Virgen
Course Director

3520 W. Cameron Ave., Suite 300 * West Covina, CA 91790 (909) 962-0400
*This course meets California requirements

Global Environmental Training

This is to certify that

Alberto Sanchez

SS# 7746

Has completed course work that meets the criteria required for EPA/AHERA (TSCA Title II) Approved Reaccreditation and NESHAPs Regulations Training *

Asbestos in Buildings: Abatement Contractor Supervisor Refresher

April 4 2009
Course Date

29081-CSR
Certificate Number

April 4, 2010
Expiration Date

CA - 023 - 04
Course Approval Number

Maria Virgen
Course Director

3520 W. Cameron Ave., Suite 300 * West Covina, CA 91790 (909) 962-0400
*This course meets California requirements

H2 Environmental Consulting Services, Inc.

This is to certify that

ALBERTO SANCHEZ

HAS SUCESSFULLY COMPLETED A

NIOSH 582 EQUIVILANCY COURSE

The course included: Airborne Fiber Sampling, Temperature & Pressure Corrections of Air Sample Flow Rates, Calibration & Alignment of Optical Microscopy, Evaluation of Air Sampling Data and NIOSH Method 7400 Fiber Counting Rules

ON

June 5, 2002
Course Date

710506
Certificate Number

W. Thomas Haley
REA, CAC # 85-1702

8270 Schaefer Avenue, Suite #2, Chino, CA 91710 Phone (909) 628-0369 Fax (909) 613-6343

State of California Department of Public Health
Lead-Related Construction Certificate

Mr. Alberto P. Sanchez
H2 Environmental Consulting Services, Inc.
13122 6th Street
Chino, California 91710

Certificate of Achievement

This is to certify that

Alberto Sanchez

on the 11th day of April 2007 successfully completed the Battery training for

RMD's LPA-1 Lead Paint Inspection System

including but not limited to the topics of Radiation Safety, DOT Regulations, and the Proper Use of the Instrument.

Jessie Parker, Vice President, RMD
44 Hunt St., Watertown, Massachusetts

ENVIRONMENTAL CONSULTING SERVICES, INC.

QUALITATIVE FIT TEST

Employee Name: Alberto Sanchez S.S.#: 7748

Employee Signature: Date: 5/26/09

Location: H2 Environmental

Respirator Specifications:

Brand: North

Size: Large

Model: 7700

Type: Half Face

Test Results

Negative Pressure Tests:	☒ Pass	☐ Fail
Positive Pressure Tests:	☒ Pass	☐ Fail
Irritant Smoke Tests:	☒ Pass	☐ Fail

Trainer Name: Victor Ruiz

Trainer Signature: Date: 05-26-09

Comments:

13123 5th Street • Chino, CA 91710
(909) 628-0369 • Fax (909) 613-2845 • H2Environmental.com

Certificate of Training

Alberto Sanchez

Has completed an awareness course in general compliance with 29 CFR 1910.1200 and applicable provisions of 29 CFR 1910.1126.

Clandestine Methamphetamine Labs

DeLisle Associates LTD
3620 E. Spinnaker Road
Perrien, Michigan 49963
(269) 373-5500

Thomas E. Boomsma, Instructor

Presented on this date: January 15, 2008
Course Date: January 15, 2008
Certificate Number: MM-A1016

CERTIFIED INDOOR ENVIRONMENTALIST COURSE

This certificate of completion documents that the following individual has completed the 32 hour "IAQA Certified Indoor Environmentalist Course" on 5/20/2009 in Los Angeles, CA.

Alberto Sanchez

This course is certified by IAQA and is designed to impart individuals with expertise in the fundamental principles of indoor environmental quality which may be utilized in the practice of data collection, application of specific building products, and observation of conditions which may affect occupant acceptability of the indoor environment. This document does not bestow professional credentials or certification to the individual named above.

Glenn E. Feinman
Executive Director, IAQA

Document # 11234

ASSOCIATION

[redacted]

SUNBELT Rental Services

This certifies that Alberto Sanchez has successfully completed the following module: April 2010 Platform Operator with H2 Environmental

Certificate of Training ANSI A92 Aerial Platform Safety

CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

November 20, 2006

Mr. W. Thomas Haley
H2 Environmental Consulting Services, Inc.
3370 Schaefer Ave., Suite J
Chino, CA 91710-9008

Reference: Mr. Albert Sanchez

Dear Mr. Haley,

I would like to take this opportunity to commend Mr. Albert Sanchez for the excellent job performance on behalf of the University. As the project hygienist assigned by your firm, Mr. Sanchez has provided valuable assistance to me in monitoring the hazardous materials abatement on the University Library Renovation Project. I have appreciated his detailed daily logs which has informed me of the day to day activities. On many occasions, he has been proactive in informing me of unforeseen conditions prior to receiving official notification from the General Contractor.

I look forward to working with Mr. Sanchez on the remaining portion of the hazardous material removal as well as future construction projects.

Sincerely,

Ted K. Nakasuji

Ted K. Nakasuji
Senior Inspector of Record

CAPE

June 1, 2005

W. Thomas Haley, REA, CAC
H2, Vice President
3370 Schaefer Avenue
Chino, California 91710

Mr. Haley:

Throughout the months of April and May 2005, I had the pleasure of working with H2 Project Manager, Albert Sanchez, for the ACM Abatement Project at March Air Reserve Base in Riverside, California. Mr. Sanchez held the position of Third Party Air Monitor for this CAPE project.

On a daily basis and like clockwork, Mr. Sanchez performed air monitoring tasks, managed detailed daily logs, conducted numerous bulk surveys throughout the Base, and enforced safety and regulation oversight in accordance with the work plan. During this project, it became clear that Mr. Sanchez is proficient in maintaining high quality interaction during team activities and reliability relating to individual tasks.

Because CAPE requires background monitoring prior to abatement activities, on numerous occasions Mr. Sanchez would voluntarily report to work hours prior to scheduled work activities and/or remain at the work site after scheduled work hours to ensure that abatement could continue to commence in a timely manner.

Mr. Sanchez is responsible, polite, dedicated, and comprehensive. Without hesitation, I would recommend Mr. Sanchez be recognized as an excellent leader representing your company. And, in the future I hope that I have the opportunity to work with Mr. Sanchez.

If you would like additional information or have any questions, please contact me at (310) 863-9314.

Sincerely,

Juliet Mais, C.E.A.
Staff Scientist

PCM

Memorandum

To: Ernie Robles (via hand delivery 1 page(s))
H2 Environmental Consulting Services
From: Raj Kapil – PCM PM
Date: 08/26/04
My Fax: # 310-383-0097
My Phone: # 818-261-5412 Cell

Subject: H2 Environmental Job Performance Review @ Hoover St.-6 Unit Apt for Hazmat Monitoring

Ernie-My review of your employee Albert Sanchez at the above mentioned project is as follows:

(1) Diligent in producing positive solutions to resolve unforeseen site conditions.
(2) Very proactive
(3) Team player with all participants
(4) On-arrival-always earlier than required
(5) Maintaining good daily observation records
(6) Open to criticism and suggestions with the willingness to produce positive feed back
(7) I thoroughly recommend Albert Sanchez for future projects with PCM and any other projects that H2 Environmental undertake with other clients

Sincerely

Raj Kapil

MILLER BROOKS Environmental, Inc.

To: Ernie Robles – H2 Environmental

August 30, 2004

From: Doug Maclean Miller Brooks

Project: Patton USARC- Bell, Ca.

Subject: Abatement Of Roofing Mastic Bldg. # 221

I would like to thank you for accommodating my request to have Alberto Sanchez as your technician on such short notice on the abatement that was performed on Thursday, August 26th at this project.

As I conveyed to you on August 3rd after the abatement of Bldg. # 1, it was indeed a pleasure to have Albert here to work with the Miller Brooks personnel on site as his assistance was indeed an asset to us on those four days.

Should the need arise in the future, I would hope that you could arrange to have him available once again.

Cc: Scott Potuzard
Tom Haley
Alberto Sanchez

8124 Moon Street, Ste. 203 • Huntington Beach, CA 92648-4602 • Telephone (714) 960-4066 • Fax (714) 960-2463

APPENDIX 2

NVLAP CERTIFICATION

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200232-0

LA Testing
S. Pasadena, CA

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

BULK ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2009-07-01 through 2010-06-30
Effective dates

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)

AIHA

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

LA Testing
2200 Amapola Court, Suite 201, Torrance, CA 90501
Laboratory ID: 166297

has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC thereby conforming to the ISO/IEC 17025:2005 international standard, *General Requirements for the Competence of Testing and Calibration Laboratories*. The above named laboratory, along with all premises from which key activities are performed, as listed above, have been accredited by AIHA-LAP, LLC in the following:

ACCREDITATION PROGRAMS

☐	INDUSTRIAL HYGIENE	Accreditation Expires:
☐	ENVIRONMENTAL LEAD	Accreditation Expires:
✓	ENVIRONMENTAL MICROBIOLOGY	Accreditation Expires: 03/01/2011
☐	FOOD	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory customer accreditation is confined on the attached Scope of Accreditation. Continued accreditation is contingent upon successful ongoing compliance with AIHA-LAP, LLC requirements. This certificate is not valid without the attached Scope of Accreditation. Please review the AIHA-LAP, LLC website (www.aihaaccreditation.com) for the most current status of the scope of accreditation.

Pamela A. Kaufe, CIH
Chairperson, Analytical Accreditation Board

Date Issued: 06/24/2009

NVLAP® National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

LA Testing
159 Pasadena Avenue
S. Pasadena, CA 91030
Mr. Derrick Tanner
Phone: (323) 254-9960 Fax: (323) 254-9982
E-Mail: dtanner@latesting.com
URL: http://www.latesting.com

AIRBORNE ASBESTOS FIBER ANALYSIS (TEM) — **NVLAP LAB CODE 200232-0**

NVLAP Code	*Designation / Description*
18/A02	U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

NVLAP® National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

LA Testing
159 Pasadena Avenue
S. Pasadena, CA 91030
Mr. Derrick Tanner
Phone: (323) 254-9960 Fax: (323) 254-9982
E-Mail: dtanner@latesting.com
URL: http://www.latesting.com

BULK ASBESTOS FIBER ANALYSIS (PLM) — **NVLAP LAB CODE 200232-0**

NVLAP Code	*Designation / Description*
18/A01	EPA-600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples

---

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200232-0

LA Testing
S. Pasadena, CA

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

AIRBORNE ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2009-07-01 through 2010-06-30
Effective dates

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01

APPENDIX 3

METHODOLOGY

SURVEY METHODOLOGY

ASSESSMENT STUDY GENERAL ORGANIZATION

Prior to beginning the actual inspection, the inspector met with Mr. Louis Sessler, Contractor, to discuss the facility inspection and gain access.

Inspection Procedures

Access was obtained from Mr. Louis Sessler, Contractor. The Asbestos and Lead Survey was performed by Mr. W. Thomas Haley a California Licensed Consultant/Lead Inspector/Assessor/Project Monitor and Mr. Albert Sanchez, a Certified Site Surveillance Technician, (See Appendix 1). An initial building walkthrough was conducted to determine the presence of suspect materials, which were accessible and/or exposed. Materials, which were similar in general appearance, were grouped into homogeneous sampling areas.

Homogeneous Material Classifications

A preliminary walkthrough of the spaces was conducted to determine areas of materials, which were visually similar in color, texture, general appearance, and which appeared to have been installed at the same time. Such materials are termed "homogeneous materials" by the EPA. During this walkthrough, the approximate locations of these homogeneous materials were also noted. Only materials, which were and/or exposed and suspected to contain asbestos, were identified.

Following the EPA, California State and local protocol, each identified suspect homogeneous material may be placed in one of the following EPA classifications:

- **Surfacing Materials** (spray or trowel applied materials)
- **Thermal System Insulation** (materials applied to various mechanical systems)
- **Miscellaneous Materials** (any material which do not fit either of the above categories, such as vinyl floor tiles...etc.)

Sampling Procedures

EPA guidelines were used to determine the sampling protocol. Sampling locations that were chosen are representative of the homogeneous sampling area. While an effort was made to collect samples randomly, samples were taken preferentially from damaged areas or areas which were the least visible to minimize disturbance of the material. After each sample was extracted, a spray encapsulant was applied to the sampled area to prevent potential fiber release.

LEAD

The inspector performs a visual walk-thru of the building noting all substrates, building, and painting histories. Upon completion the inspector takes a paint chip sample of each noted area and paint down to the substrate. This is to ensure that all layers of paint are tested. When this is done, the sample is placed in an individual container with a unique sample number denoting the building and sample number. At the same time, the inspector fills out a log giving the sample number, color, physical description of the substrate, and the building and what area it was extracted from. Also, the inspector plots the sample on a diagram. The inspector then transports the samples and log to an accredited laboratory along with a chain of custody form that are signed by both the inspector and the laboratory. The laboratory analyzed it by Atomic Absorption Spectrometry (AAS).

When the results from the laboratory are given, a sample log is created and a positive material log is prepared for the report. The positive samples are also plotted on a CAD drawing of the building(s).

QUANTIFICATION

Quantities of accessible and/or exposed building materials that were suspected of containing asbestos were estimated. This estimation was performed by taking approximate measurements in the field and/or estimating quantities based on drawings provided by the client. Materials such as pipe insulation and associated mudded joint packing (MJP) were categorized according to the outside diameter of the insulation. Pipe lagging was quantified by linear footage while the actual numbers of MJPs were counted. Insulation on mechanical equipment such as boilers and ductwork were quantified by the square footage of the surface area of suspect insulation. Similarly, fireproofing, plasters, ceiling and floor tiles, and transite panels were measured in square feet of surface area.

Quantities are estimated and should be confirmed by an engineering survey if renovation or demolition is contemplated. The level of detail provided by an engineering survey, which is required for a construction estimate, is beyond the scope of this survey.

LABORATORY METHODOLOGY

Method of Analysis (Asbestos)

Analysis was performed by using the bulk sample for visual observation and slide preparation(s) for microscopic examination and identification. The samples were mounted on slides and then analyzed for asbestos (chrysotile, amosite, crocidolite, anthophyllite, and actinolite/tremolite), fibrous non-asbestos constituents (mineral wool, paper, etc.), and non-fibrous constituents. Asbestos was identified by refractive indices, morphology, color, pleochroism, birefringence, extinction characteristics, and signs of elongation. The same characteristics were used to identify the non-asbestos constituents.

The microscopist visually estimated relative amounts of each constituent by determining the volume of each constituent in proportion to the total volume of the sample, using a stereoscope.

Method of Analysis (Lead)

Atomic Absorption Spectroscopy (AAS)
A wide variety of inorganic elements and matrices are analyzed by atomic absorption spectroscopy (AAS). AAS is the method of choice for precise quantitative determination of single elements in air, water, soil, paint and other matrices. The laboratory's primary instruments are equipped with flame and graphite furnace analytical capability. Flame analysis is suitable for most analytes and matrices including paint, wipes, soils, and air samples. Graphite furnace procedures dramatically decrease detection limits and are appropriate when testing lead in drinking eater and personal air monitoring samples. The laboratory also maintains a mercury analyzer with excellent detection limits for mercury in variety of matrices.

Laboratory Quality Control Program

LA Testing Environmental Laboratory, a licensed (NVLAP# 200232-0) a licensed California State Laboratory, maintains an in-house quality control program that consists of blind reanalysis of ten percent of all samples. There is also voluntary quality control reanalysis and mandatory source material dependent quality control reanalysis for sample types that are particularly difficult to analyze.

REPORT FORMAT

The laboratory results were analyzed and the results presented using the H2 Environmental management program and are presented in the analytical results section of this report. Since the results are oriented to data only, a short explanation of each element contained therein is given below. It explains the content of each data column and its relationship with other items on the page.

ASBESTOS

Report Number - This line represents the assigned laboratory report number for each particular set of samples submitted to the laboratory.

Client Identification (sample number) - This column represents the homogenous material number followed by the field sample number assigned in the field.

Area Sampled - This column describes the area where the actual sample was collected as described by the inspector at the time of the survey.

Type of Material - This column describes the material submitted and analyzed.

Asbestos Results (type & percent) - This column provides the specific type of asbestos found in each sample.

Composition - This column provides a description of the materials found during the analytical process that was not found to be asbestos (i.e. binders, other fibrous materials, etc.)

LEAD

Material Number - This line represents the assigned laboratory report number for each particular set of samples submitted to the laboratory.

Area Sampled - This column describes the area where the actual sample was collected as described by the inspector at the time of the survey.

Substrate - This column describes the material submitted and analyzed.

Lead Results – Lead Containing Paint or Ceramic Tiles is defined as paint, tile or other surface coatings, that contain an amount of lead that is greater than or equal to:

1.0 mg/cm^2 By XRF Method

Sampled Building Materials – Section 1 *Survey Summary*

Homogeneous Material Number - This number is the field sample number.

Material Description – Indicates size and type of suspect sampled material.

Location(s) of Material - This column provides the general location of the suspect material.

F/NF - Describes whether the material is friable or non-friable.

Condition – Indicates current appearance of the material during the inspection.

% ACM – Percentage of Asbestos found after analysis.

Samp. – Number of samples taken.

Quantity – Square or linear measurement of suspect materials sampled.

APPENDIX 4

WARRANTY

WARRANTY

H2 Environmental Consulting Services warrants that the findings contained herein have been promulgated in general accordance with accepted professional practices at the time of its preparation as applied by professionals in the community. Changes in the state of the art or in applicable regulations cannot be anticipated and have not been addressed in this report.

The field and laboratory results reported herein are considered sufficient in detail and scope to determine the presence, condition and hazard potential of accessible and/or exposed suspect asbestos/lead containing building materials on the property at the time of inspection. Test results are valid only for the material tested.

There is a possibility that conditions may exist which could not be identified within the scope of the survey or which were not apparent during the site visit.

This inspection covered only those areas, which were exposed and/or physically accessible to the inspector as outlined by the scope of work. The study is also limited to the information available from the client at the time it was conducted.

No other warranties are implied or expressed.

H2 ENVIRONMENTAL

Saddleback College
Classroom Complex Building
28000 Marguerite Pkwy.
Mission Viejo, California
Asbestos & Lead Survey/
Hazardous Materials
Project# 1282210 AS

H2 ENVIRONMENTAL

January 28, 2010

Mr. Walt Rice
Saddleback College
28000 Marguerite Pkwy
Mission Viejo, CA 92692

Re: Asbestos & Lead Survey/Hazardous Materials
Classroom Complex Building
28000 Marguerite Pkwy
Mission Viejo, CA 92692
Project No. 1282210 AS

Dear Mr. Rice,

H2 Environmental Consulting Services received written authorization to proceed on January 18, 2010 to perform an Asbestos and Lead XRF Survey/Hazardous Materials of the above referenced site. The survey was requested by Mr. Walt Rice for the scheduled renovation of the above referenced site. Enclosed is one (1) copy of the Asbestos and Lead Survey/Hazardous Materials report.

H2 Environmental appreciates the opportunity to provide environmental services for this important project. Please do not hesitate to call (909) 628-0369 should there be any questions regarding the Asbestos and Lead XRF Survey/Hazardous Materials report.

Respectfully submitted,
H2 Environmental Consulting Services, Inc.

W. Thomas Haley
Vice – President

Enclosures

H2 ENVIRONMENTAL

ASBESTOS & LEAD SURVEY

Classroom Complex Building
28000 Marguerite Pkwy
Mission Viejo, CA 92692

Prepared for

Saddleback College
28000 Marguerite Pkwy
Mission Viejo, CA 92692

Prepared by

H2 Environmental Consulting Services, Inc.
13122 6th Street
Chino, California 91710
909-628-0369

H2 ENVIRONMENTAL

TABLE OF CONTENTS

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ANALYTICAL RESULTS	4
FIELD ASSESSMENT WORKSHEETS/CHAIN OF CUSTODY	5

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1. INSPECTOR'S CERTIFICATES
2. NVLAP CERTIFICATION
3. METHODOLOGY
4. WARRANTY

GENERAL INFORMATION

H2 Environmental Consulting Services facility was retained by Saddleback College to conduct Asbestos and Lead Survey of Classroom Complex Building located at 28000 Marguerite Pkwy., Mission ViejoCalifornia. The Asbestos and Lead Survey was conducted on January 18, 2010.

The Classroom Complex Building was unoccupied during the survey. The Classroom Complex Building consisted of approximately 7,548 square feet of user space and was finished out with 2'x4' Ceiling Tiles ceilings. The walls are finished out with Drywall. The floors are covered with Carpet.

During the Asbestos Survey, a total of 51 samples were collected and submitted for laboratory analysis by Polarized Light Microscopy (PLM). Suspect materials observed during the Asbestos Survey are summarized in the Survey Summary section of this report. Results of analysis identified that none of the sampled materials are Asbestos-Containing Materials.

The following materials were assumed to be Hazardous Materials:

- Light Tubes (260)
- PCB's (130)
- Outside Lighting (10)
- Fire Extinguishers (1)
- Transformer (1)
- E-Waste
- A/C Units (10)

During the Lead XRF Survey a total of 34 lead XRF samples were collected. Suspect materials observed during the Lead XRF Survey are summarized in the Lead XRF Survey Summary Section of this report. According to the HUD guidelines paint containing lead greater than >1.0, (mg/cm^2) using XRF methods is considered lead bearing material. The materials and the Lead content are outlined on the Section 1 Survey Summary – Lead XRF Survey Results.

This report has been prepared for the exclusive use of Saddleback College.

AUTHORIZATION

Authorization to perform the survey was given by Mr. Walt Rice in the form of a written authorization to proceed, dated January 15, 2010.

ACM SURVEY RESULTS

Classroom Complex Building
28000 Marguerite Pkwy
Mission Viejo, CA 92692

The following homogeneous building material types were sampled as part of this survey and their results are summarized in the table below:

MTL #	MATERIAL DESCRIPTION	LOCATION	F/NF[1]	COND.[2]	% ACM	# SAMP.	EST. QUANTITY
01	White 2'x4' Ceiling Tile	East End of CCG6 Rm, South East End of CC8 Rm, South End of CC2 Rm	F	Good	ND	3	5,371 SF
02	White Drywall	East End Wall of CC6 Rm, S. East End Wall of CC8 Rm, South Wall End of CC2 Rm	NF	Good	ND	3	8,420 SF
03	Attic Insulation Yellow Color	North End of CC6 Rm, South End of CC2 Rm, Center of Rm CC4	F	Good	ND	3	5,371 SF
04	White Color Joint Compound Around Material	N. West End of CC4 Rm, South End of CC2 Rm, S. West End of CC8 Rm	NF	Good	ND	3	8,420 SF
05	Tan/Yellow Color Insulation Behind Drywall (walls)	N. East End of Rm CC6, S. East End of Rm CC8, South End of Rm CC2	F	Good	ND	3	8,420 SF
06	Tan/Yellow Color Glue Under Floor Carpet	North End of Rm CC7, S. East End of Rm CC8, South End of Rm CC2	NF	Good	ND	3	5,371 SF
07	4" Grey Color Cove Base	North East of Rm CC7, S. East End of Rm CC8, South End of Rm CC2	NF	Good	ND	3	860 SF
08	Brown/Yellow Color Glue Under 4" Cove Base	North East of Rm CC7, S. East End of Rm CC8, South End of Rm CC2	NF	Good	ND	3	860 SF
09	Yellow Color Basement Insulation	North End of Bldg. Basement, East End of Bldg. Basement, South End of bldg. Basement	F	Good	ND	3	5,371 S
10	Rolled Roofing Material Grey Color	North End of Bldg. Roof, South End of Bldg. Roof, West End of Bldg. Roof	NF	Good	ND	3	7,548 S
11	Black Color Felt Paper Under Rolled Roofing Material	North End of Bldg. Roof, South End of Bldg. Roof, West End of Bldg. Roof	NF	Good	ND	3	7,548 S
12	Black Color Mastic Penetration Material	North End of Bldg. Roof, South End of Bldg. Roof, West End of Bldg. Roof	NF	Good	ND	3	280 SF

13	Grey/White Color Mastic on Air Ducts (Air Units)	East End of Bldg. Roof, North End of Bldg. Roof, South End of Bldg. Roof	NF	Good	ND	3	150 S
14	White Mastic Material on Air Units Penetrations	East End of Bldg. Roof, North End of Bldg. Roof, South End of Bldg. Roof	NF	Good	ND	3	80 S
15	Roofing Patches Material on Black/Silver Foil Color	North End of Bldg. Roof, East End of Bldg. Roof, South End of Bldg. Roof	NF	Good	ND	3	160 S
16	Brown Color 4" Cove Base on Closet Room	North End of CC6 Rm Closet, West End of CC6 Rm Closet, South End of CC6 Rm Closet	NF	Good	ND	3	10 LI
17	Brown Color Glue Under 4" Cove Base	North End of CC6 Rm Closet, West End of CC6 Rm Closet, South End of CC6 Rm Closet	NF	Good	ND	3	10 LI
18	ACM on Mastic	Behind Chalkboards	-	-	Assume	-	-
19	Light Tubes	-	-	-	Assume	-	260
20	PCB's	-	-	-	Assume	-	130
21	Outside Lighting	-	-	-	Assume	-	10
22	Fire Extinguisher	-	-	-	Assume	-	1
23	Transformer	-	-	-	Assume	-	1
24	E-Waste	-	-	-	Assume	-	-
25	A/C Units	-	-	-	Assume	-	10

ND= None Detected
[1]F = Friable; NF = Non-friable Friability is further defined in Appendix 3.
[2]Cond. = Condition of Materials Either good, fair or poor.
Note: <1% = Calif. Code of Regulations, Title 8, Section 1529, "Asbestos-containing construction material" means any manufactured construction material which contains more than one tenth of 1 percent asbestos by weight." This material will be abated as asbestos containing material, however, it may be disposed of as construction debris.

LEAD XRF SURVEY RESULTS

Classroom Complex Building
28000 Marguerite Pkwy
Mission Viejo, CA 92692

The list materials and their components where LBP is detected at or in excess of the HUD/EPA standards of 1.0 mg/cm^2 by XRF method which is listed in the table below or by 0.50% by weight of paint chip sample method.

Shot #	Unit	Room Tested	Wall	Color	Component	Substrate	Paint Condition	Result	Neg/Pos
01	Bldg.# 10	CC6	D	Red	Door	Metal	I	-0.1	N
02	Bldg.# 10	CC6	D	Red	Door Frame	Metal	I	0.2	N
03	Bldg.# 10	CC6	C	White	Door	Wood	I	-0.0	N
04	Bldg.# 10	CC6	C	Brown	Door Frame	Wood	I	-0.1	N
05	Bldg.# 10	CC6	A	Brown	Window	Metal	I	-0.2	N
06	Bldg.# 10	CC6	B	Brown	Window	Wood	I	-0.1	N
07	Bldg.# 10	CC6	B	White	Wall Paper	Drywall	I	-0.0	N
08	Bldg.# 10	CC7	A	Grey	Elec. Panel	Metal	I	-0.2	N
09	Bldg.# 10	CC8	D	Off White	Elec. Post	Metal	I	-0.0	N
10	Bldg.# 10	CC5	C	Brown	Window	Wood	I	0.2	N
11	Bldg.# 10	CC4	B	Red	Door	Metal	I	-0.0	N
12	Bldg.# 10	CC4	B	Red	Door Frame	Metal	I	-0.0	N
13	Bldg.# 10	CC4	B	Black	Window Frame	Metal	I	-0.0	N
14	Bldg.# 10	CC2	A	Red	I-Beam	Metal	I	0.1	N
15	Bldg.# 10	CC2	C	Red	Door	Metal	I	-0.1	N
16	Bldg.# 10	CC2	C	Red	Door Frame	Metal	I	-0.0	N
17	Bldg.# 10	CC2	C	White	Wallpaper	Drywall	I	-0.1	N

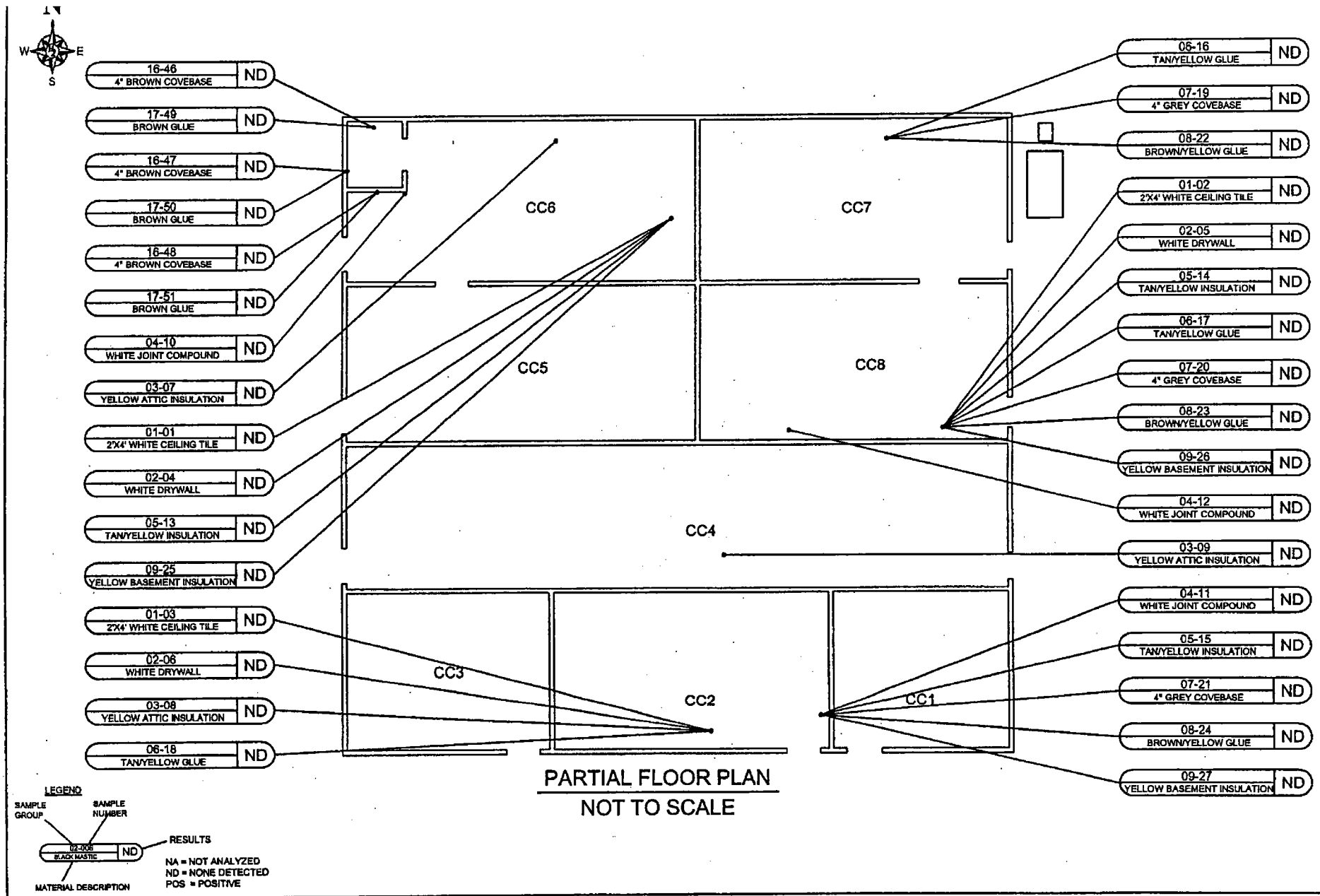
LEAD XRF SURVEY RESULTS

Classroom Complex Building
28000 Marguerite Pkwy
Mission Viejo, CA 92692

The list materials and their components where LBP is detected at or in excess of the HUD/EPA standards of 1.0 mg/cm^2 by XRF method which is listed in the table below or by 0.50% by weight of paint chip sample method.

Shot #	Unit	Room Tested	Wall	Color	Component	Substrate	Paint Condition	Result	Neg/Pos
18	Bldg.# 10	Ext. of Bldg.	D	Red	Door	Metal	I	0.2	N
19	Bldg.# 10	Ext. of Bldg.	D	Red	Door Frame	Metal	I	0.1	N
20	Bldg.# 10	Ext. of Bldg.	D	White	Wall	Wood	I	0.0	N
21	Bldg.# 10	Ext. of Bldg.	D	Brown	Window	Wood	I	0.0	N
22	Bldg.# 10	Ext. of Bldg.	D	Brown	Downspout	Metal	I	-0.0	N
23	Bldg.# 10	Ext. of Bldg.	D	Brown	Wall Molding Strip	Wood	I	-0.2	N
24	Bldg.# 10	Ext. of Bldg.	B	Brown	Fascia	Wood	I	0.1	N
25	Bldg.# 10	Ext. of Bldg.	B	White	Soffit	Wood	I	0.1	N
26	Bldg.# 10	Ext. of Bldg.	B	White	Pipe	Metal	I	-0.1	N
27	Bldg.# 10	Ext. of Bldg.	C	Red	Fire Extinguisher Box	Metal	I	-0.0	N
28	Bldg.# 10	Ext. of Bldg.	C	Red	Door	Metal	I	-0.1	N
29	Bldg.# 10	Ext. of Bldg.	C	Red	Door Frame	Metal	I	-0.1	N
30	Bldg.# 10	Ext. of Bldg.	C	Red/White	Wall	Wood	I	-0.1	N
31	Bldg.# 10	Roof	B	Tan	AC/Unit	Metal	I	-0.6	N
32	Bldg.# 10	Roof	B	Grey	AC/Unit	Metal	I	-0.3	N
33	Bldg.# 10	Roof	A	White	Door Frame	Metal	I	-0.1	N
34	Bldg.# 10	Roof	A	White	Wall	Wood	I	0.0	N

SECTION 3
CAD SAMPLE LOCATIONS



PARTIAL FLOOR PLAN

NOT TO SCALE

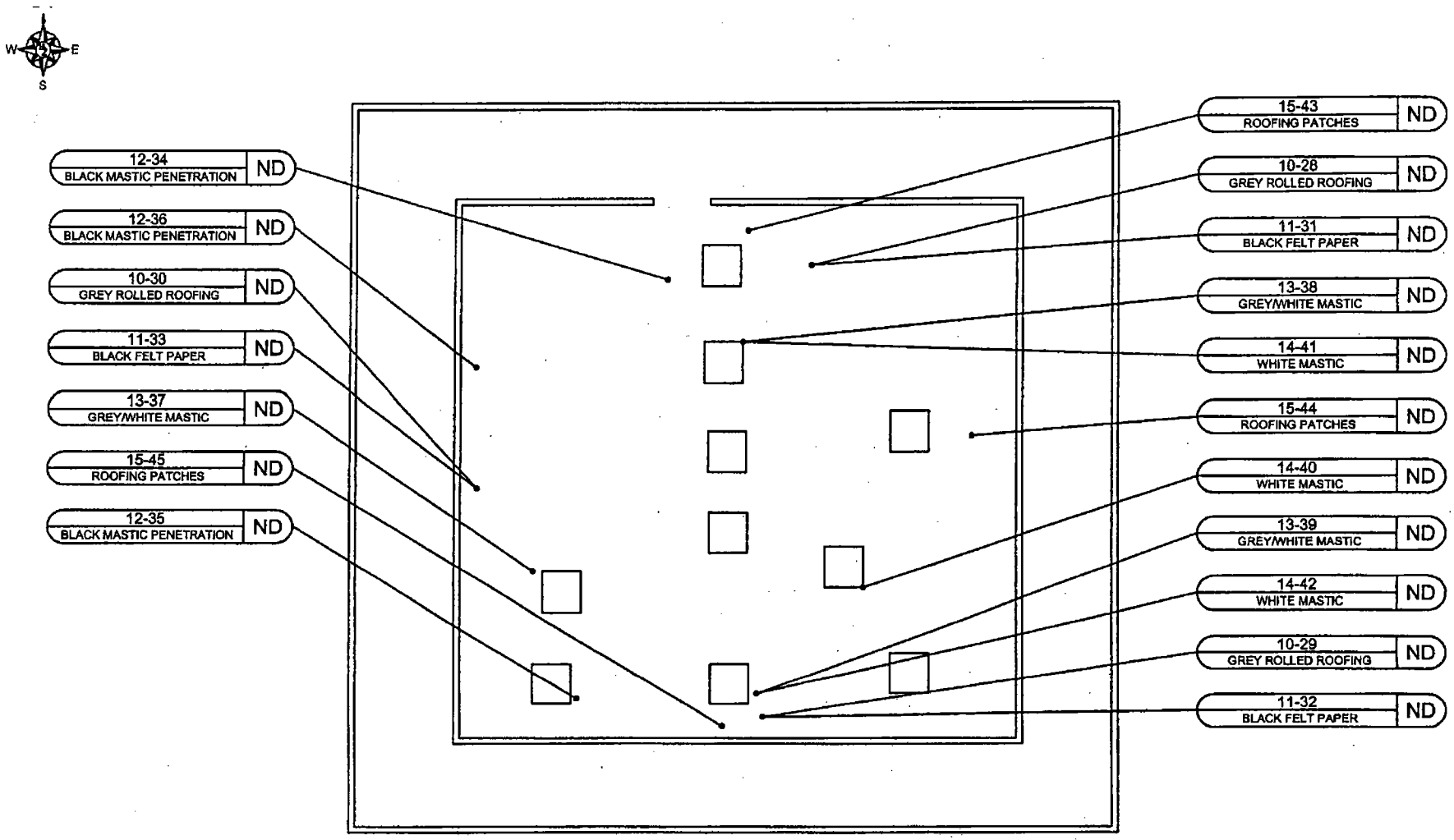
ABBREVIATIONS : DW = DRYWALL, JC = JOINT COMPOUND, FT = FLOOR TILE, M = FLOOR TILE MASTIC, CT = CEILING TILE, C.BASE = COVEBASE MATERIAL, C.BASE M = COVEBASE MASTIC

ENVIRONMENTAL CONSULTING SERVICES

DATE:	PROJ NO:
1/18/10	1282210AS
FIGURE: 1	DRAWN BY: MT

SADDLEBACK COLLEGE

ASBESTOS SURVEY, CLASSROOM COMPLEX BLDG. #10



ROOF

NOT TO SCALE

LEGEND

SAMPLE GROUP — SAMPLE NUMBER — RESULTS

02-008 BLACK MASTIC ND

MATERIAL DESCRIPTION

NA = NOT ANALYZED
ND = NONE DETECTED
POS = POSITIVE

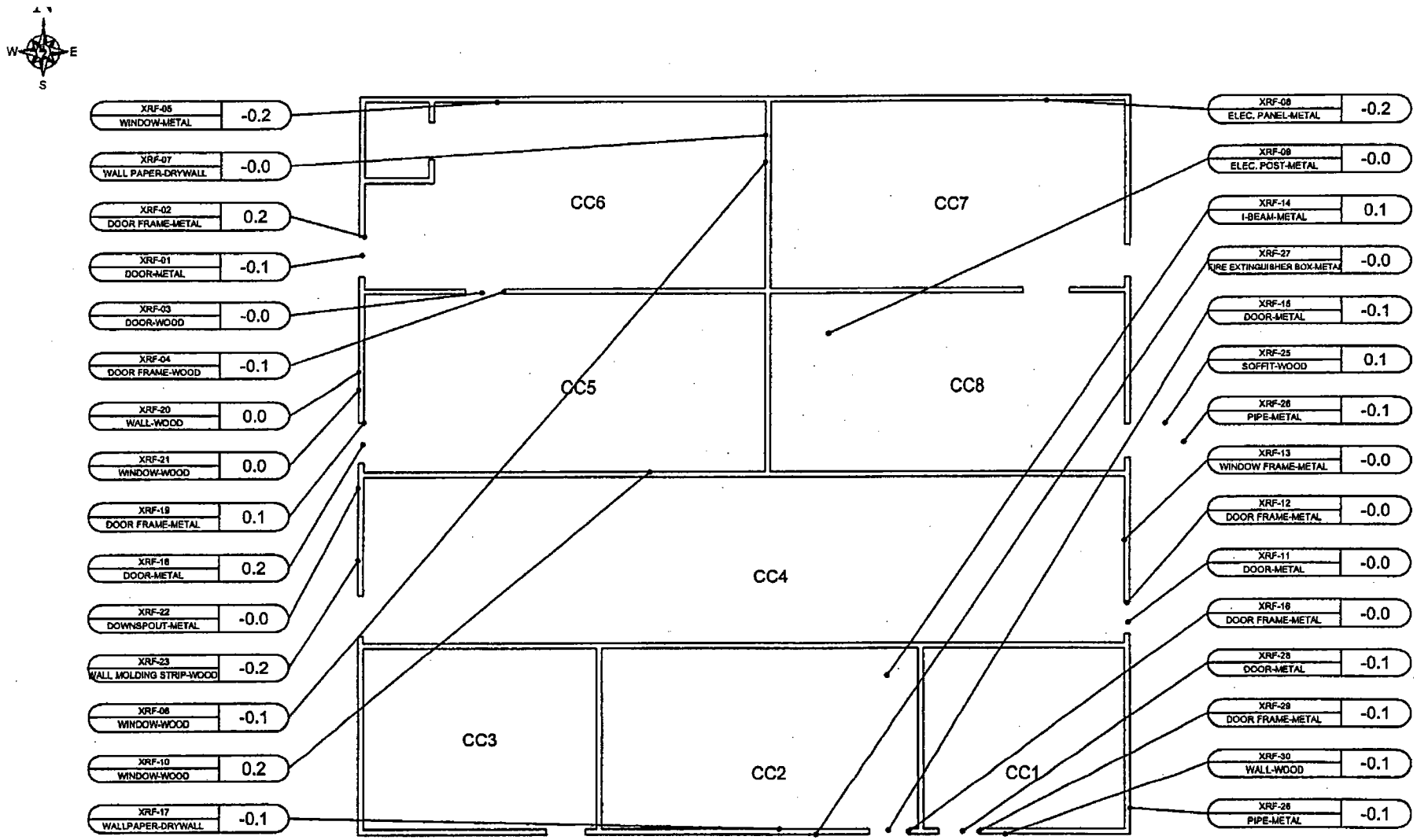
ABBREVIATIONS : DW = DRYWALL, JC = JOINT COMPOUND, FT = FLOOR TILE, M = FLOOR TILE MASTIC, CT = CEILING TILE, C.BASE = COVEBASE MATERIAL, C.BASE M = COVEBASE MASTIC

ENVIRONMENTAL CONSULTING SERVICES

DATE: 1/18/10	PROJ NO: 1282210AS
FIGURE: 2	DRAWN BY: MT

SADDLEBACK COLLEGE
ASBESTOS SURVEY, CLASSROOM COMPLEX BLDG. #10

...RGUERITE PKWY.



PARTIAL FLOOR PLAN
NOT TO SCALE

LEGEND

SAMPLE NUMBER

XRF-01 FLOOR-CONCRETE 12345 — RESULTS

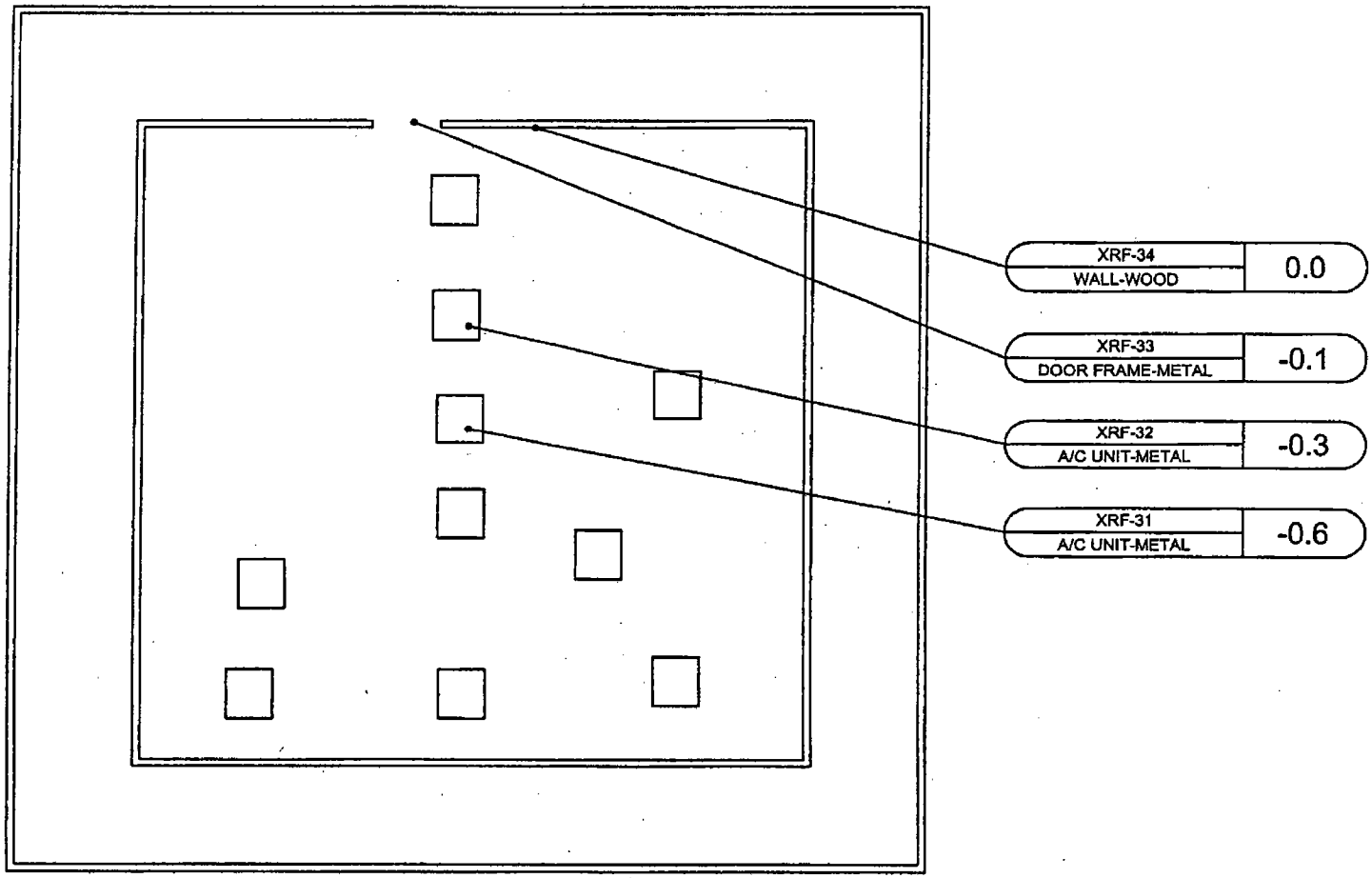
TYPE OF SAMPLE

RESULTS FOR LEAD SAMPLE ARE NOTED AS mg/cm² = MILLIGRAMS PER SQUARED CENTIMETER

ENVIRONMENTAL CONSULTING SERVICES

DATE: 1/18/10	PROJ NO: 1282210AS
FIGURE: 2	DRAWN BY: MT

SADDLEBACK COLLEGE
LEAD XRF SURVEY, CLASSROOM COMPLEX BLDG. #10



ROOF

NOT TO SCALE

LEGEND

SAMPLE NUMBER

XRF-01 | 12345
FLOOR-CONCRETE

RESULTS

TYPE OF SAMPLE

RESULTS FOR LEAD SAMPLE ARE NOTED AS mg/cm² = MILLIGRAMS PER SQUARED CENTIMETER

ARGUERITE PKWY.

ENVIRONMENTAL CONSULTING SERVICES

DATE:	PROJ NO:
1/18/10	1282210AS
FIGURE: 4	DRAWN BY: MT

SADDLEBACK COLLEGE

LEAD XRF SURVEY, CLASSROOM COMPLEX BLDG. #10

SECTION 4
ANALYTICAL RESULTS

LA Testing
520 Mission Street, South Pasadena, CA 91030
Phone: (323) 254-9960 Fax: (323) 254-9982 Email: pasadenalab@latesting.com

Attn: **Thomas Haley**
H2 Environmental Consulting Services
13122 6th Street
Chino, CA 91710

Fax: Phone: (909) 628-0369

Project: **1282210AS / Saddleback College / Classroom Complex Bldg #10 / 2800 Marguerite Parkway Mission Viejo, CA 92692**

Customer ID: 32H2EN50
Customer PO:
Received: 01/19/10 3:45 PM
LA Testing Order: 321000598

LA Testing Proj:
Analysis Date: 1/20/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
ample	Description	Appearance	%	Fibrous	%	Non-Fibrous	% Type
118 01-01 21000598-0001	E end of CC6 room	Gray/White Fibrous Heterogeneous	35% 25%	Cellulose Glass	35% 5%	Non-fibrous (other) Perlite	**None Detected**
118 01-02 21000598-0002	S/E end of CC8 room	Gray/White Fibrous Heterogeneous	30% 20%	Cellulose Glass	47% 3%	Non-fibrous (other) Perlite	**None Detected**
118 01-03 21000598-0003	S end of CC2 room	Gray/White Fibrous Heterogeneous	40% 10%	Cellulose Glass	40% 10%	Non-fibrous (other) Perlite	**None Detected**
118 02-04 21000598-0004	E end wall of CC6 room	Brown/White Fibrous Heterogeneous	10%	Cellulose	90%	Non-fibrous (other)	**None Detected**
118 02-05 21000598-0005	S/E end wall of CC8 room	Brown/White Fibrous Homogeneous	10%	Cellulose	90%	Non-fibrous (other)	**None Detected**
118 02-06 21000598-0006	S wall end of CC2 room	White Non-Fibrous Heterogeneous	10%	Cellulose	90%	Non-fibrous (other)	**None Detected**
118 03-07 21000598-0007	N end of CC6 room	Yellow Fibrous Homogeneous	90%	Glass	10%	Non-fibrous (other)	**None Detected**

alyst(s)

ger Casillas (17)
fik Vartanian, Ph.D (34)

Derrick Tanner, Laboratory Manager
or other approved signatory

e to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected y require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express itten approval of LA Testing. LA Testing's liability is limited to the cost of analysis. LA Testingbears no responsibility for sample collection activities or analytical method limitations. rpretation and use of test results are the responsibility of the client. The test results contained within this report meet the requirements of NELAC unless otherwise noted. Samples eived in good condition unless otherwise noted. Samples received in good condition unless otherwise noted.
nples analyzed by LA Testing 520 Mission Street, South PasadenaCA NVLAP Lab Code 200232-0, AIHA IHLAP 102814, CA ELAP 2283

LA Testing
520 Mission Street, South Pasadena, CA 91030
Phone: (323) 254-9960 Fax: (323) 254-9982 Email: pasadenalab@latesting.com

Attn: **Thomas Haley**
H2 Environmental Consulting Services
13122 6th Street
Chino, CA 91710

Fax: Phone: (909) 628-0369

Project: **1282210AS / Saddleback College / Classroom Complex Bldg #10 / 2800 Marguerite Parkway Mission Viejo, CA 92692**

Customer ID: 32H2EN50
Customer PO:
Received: 01/19/10 3:45 PM
LA Testing Order: 321000598

LA Testing Proj:
Analysis Date: 1/20/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
ample	Description	Appearance	%	Fibrous	%	Non-Fibrous	% Type
0118 03-08 321000598-0008	S end of CC2 room	Yellow Fibrous Homogeneous	95%	Glass	5%	Non-fibrous (other)	**None Detected**
0118 03-09 321000598-0009	Center of room CC4 room	Yellow Fibrous Heterogeneous	90%	Glass	10%	Non-fibrous (other)	**None Detected**
0118 04-10 321000598-0010	N/W end of room CC6	White Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
0118 04-11 321000598-0011	S end of CC2 room	White Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
0118 04-12 321000598-0012	S/W end of CC8 room	White Non-Fibrous Heterogeneous			100%	Non-fibrous (other)	**None Detected**
0118 05-13 321000598-0013	N/E end of room CC6	Yellow Fibrous Homogeneous	90%	Glass	10%	Non-fibrous (other)	**None Detected**
0118 05-14 321000598-0014	S/E end of room CC8	Yellow Fibrous Homogeneous	90%	Glass	10%	Non-fibrous (other)	**None Detected**

nalyst(s)

oger Casillas (17)
afik Vartanian, Ph.D (34)

Derrick Tanner, Laboratory Manager
or other approved signatory

ue to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected ay require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express ritten approval of LA Testing. LA Testing's liability is limited to the cost of analysis. LA Testingbears no responsibility for sample collection activities or analytical method limitations. terpretation and use of test results are the responsibility of the client. The test results contained within this report meet the requirements of NELAC unless otherwise noted. Samples ceived in good condition unless otherwise noted. Samples received in good condition unless otherwise noted.
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Attn: **Thomas Haley**
H2 Environmental Consulting Services
13122 6th Street
Chino, CA 91710

Fax: Phone: (909) 628-0369

Project: **1282210AS / Saddleback College / Classroom Complex Bldg #10 / 2800 Marguerite Parkway Mission Viejo, CA 92692**

Customer ID: 32H2EN50
Customer PO:
Received: 01/19/10 3:45 PM
LA Testing Order: 321000598

LA Testing Proj:
Analysis Date: 1/20/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
ample	Description	Appearance	%	Fibrous	%	Non-Fibrous	% Type
)118 05-15 *21000598-0015*	S end of room CC2	Yellow Fibrous Heterogeneous	90%	Glass	10%	Non-fibrous (other)	**None Detected**
)118 06-16 *21000598-0016*	N end of room CC7	Brown Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
)118 06-17 *21000598-0017*	S/E end of room CC8	Brown Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
)118 06-18 *21000598-0018*	S end of room CC2	Yellow Non-Fibrous Heterogeneous			100%	Non-fibrous (other)	**None Detected**
)118 07-19 *21000598-0019*	N/E of room CC7	Gray Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
)118 07-20 *21000598-0020*	S/E end of room CC8	Gray Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
)118 07-21 *21000598-0021*	S end of room CC2	Gray Non-Fibrous Heterogeneous			100%	Non-fibrous (other)	**None Detected**

alyst(s)

ger Casillas (17)
afik Vartanian, Ph.D (34)

Derrick Tanner, Laboratory Manager
or other approved signatory

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mples analyzed by LA Testing 520 Mission Street, South PasadenaCA NVLAP Lab Code 200232-0, AIHA IHLAP 102814, CA ELAP 2283

LA Testing
520 Mission Street, South Pasadena, CA 91030
Phone: (323) 254-9960 Fax: (323) 254-9982 Email: pasadenalab@latesting.com

Attn: **Thomas Haley**
H2 Environmental Consulting Services
13122 6th Street
Chino, CA 91710

Fax: Phone: (909) 628-0369

Project: **1282210AS / Saddleback College / Classroom Complex Bldg #10 / 2800 Marguerite Parkway Mission Viejo, CA 92692**

Customer ID: 32H2EN50
Customer PO:
Received: 01/19/10 3:45 PM
LA Testing Order: 321000598

LA Testing Proj:
Analysis Date: 1/20/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
ample	Description	Appearance	%	Fibrous	%	Non-Fibrous	% Type
)118 08-22 *21000598-0022*	N/E end of room CC7	Brown/Tan Non-Fibrous Heterogeneous	5%	Wollastonite	95%	Non-fibrous (other)	**None Detected**
)118 08-23 *21000598-0023*	S/E end of room CC8	Brown/Tan Non-Fibrous Heterogeneous	5%	Wollastonite	95%	Non-fibrous (other)	**None Detected**
)118 08-24 *21000598-0024*	S end of room CC2	Brown Non-Fibrous Heterogeneous	2%	Wollastonite	98%	Non-fibrous (other)	**None Detected**
)118 09-25 *21000598-0025*	N end of bldg basement	Yellow Fibrous Homogeneous	95%	Glass	5%	Non-fibrous (other)	**None Detected**
)118 09-26 *21000598-0026*	E end of bldg basement	Yellow Fibrous Heterogeneous	90%	Glass	10%	Non-fibrous (other)	**None Detected**
118 09-27 *21000598-0027*	S end of bldg basement	Yellow Fibrous Heterogeneous	90%	Glass	10%	Non-fibrous (other)	**None Detected**
118 10-28 *21000598-0028*	N end of bldg roof	White/Black Non-Fibrous Heterogeneous	5%	Glass	95%	Non-fibrous (other)	**None Detected**

alyst(s)

ger Casillas (17)
ifik Vartanian, Ph.D (34)

Derrick Tanner, Laboratory Manager
or other approved signatory

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Chino, CA 91710

Fax: Phone: (909) 628-0369

Project: **1282210AS / Saddleback College / Classroom Complex Bldg #10 / 2800 Marguerite Parkway Mission Viejo, CA 92692**

Customer ID: 32H2EN50
Customer PO:
Received: 01/19/10 3:45 PM
LA Testing Order: 321000598

LA Testing Proj:
Analysis Date: 1/20/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
ample	Description	Appearance	%	Fibrous	%	Non-Fibrous	% Type
)118 10-29 *21000598-0029*	S end of bldg roof	White/Black Non-Fibrous Homogeneous	15%	Glass	85%	Non-fibrous (other)	**None Detected**
)118 10-30 *21000598-0030*	W end of bldg roof	White/Black Non-Fibrous Heterogeneous	10%	Glass	90%	Non-fibrous (other)	**None Detected**
)118 11-31 *21000598-0031*	N end of bldg roof	Black Non-Fibrous Homogeneous	5%	Glass	95%	Non-fibrous (other)	**None Detected**
118 11-32 *21000598-0032*	S end of bldg roof	Black Non-Fibrous Heterogeneous	5%	Glass	95%	Non-fibrous (other)	**None Detected**
118 11-33 *21000598-0033*	W end of bldg roof	Black Non-Fibrous Heterogeneous	10%	Glass	90%	Non-fibrous (other)	**None Detected**
118 12-34 *21000598-0034*	N end of bldg roof	Gray/Black Non-Fibrous Heterogeneous			100%	Non-fibrous (other)	**None Detected**
118 12-35 *21000598-0035*	S end bldg roof	Gray/Black Non-Fibrous Heterogeneous			100%	Non-fibrous (other)	**None Detected**

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Project: **1282210AS / Saddleback College / Classroom Complex Bldg #10 / 2800 Marguerite Parkway Mission Viejo, CA 92692**

Customer ID: 32H2EN50
Customer PO:
Received: 01/19/10 3:45 PM
LA Testing Order: 321000598

LA Testing Proj:
Analysis Date: 1/20/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
ample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
)118 12-36 *21000598-0036*	W end of bldg roof	Black Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
)118 13-37 *21000598-0037*	E end of bldg roof	Gray/White Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
)118 13-38 *21000598-0038*	N end of bldg roof	Gray/Tan Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
)118 13-39 *21000598-0039*	S end of bldg roof	Gray/Beige Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
)118 14-40 *21000598-0040*	E end of bldg roof	Gray/Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
)118 14-41 *21000598-0041*	N end of bldg roof	White Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
)118 14-42 *21000598-0042*	S end of bldg roof	White Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**

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Project: **1282210AS / Saddleback College / Classroom Complex Bldg #10 / 2800 Marguerite Parkway Mission Viejo, CA 92692**

Customer ID: 32H2EN50
Customer PO:
Received: 01/19/10 3:45 PM
LA Testing Order: 321000598
LA Testing Proj:
Analysis Date: 1/20/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
ample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
118 15-43 *21000598-0043*	N end of roof	Black/Silver Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
118 15-44 *21000598-0044*	E end of roof	Black/Silver Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
118 15-45 *21000598-0045*	S end of roof	Black/Silver Non-Fibrous Heterogeneous	5% Glass	95% Non-fibrous (other)	**None Detected**
118 16-46 *21000598-0046*	N end of CC6 room closet	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
118 16-47 *21000598-0047*	W end of CC6 room closet	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
118 16-48 *21000598-0048*	S end of CC6 room closet	Brown Non-Fibrous Heterogeneous		100% Non-fibrous (other)	**None Detected**
118 17-49 *21000598-0049*	N end of CC6 room closet	Brown Non-Fibrous Homogeneous	5% Wollastonite	95% Non-fibrous (other)	**None Detected**

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Project: **1282210AS / Saddleback College / Classroom Complex Bldg #10 / 2800 Marguerite Parkway Mission Viejo, CA 92692**

Customer ID: 32H2EN50
Customer PO:
Received: 01/19/10 3:45 PM
LA Testing Order: 321000598

LA Testing Proj:
Analysis Date: 1/20/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
Sample	Description	Appearance	%	Fibrous	%	Non-Fibrous	% Type
0118 17-50 *321000598-0050*	W end of CC6 room closet	Brown Non-Fibrous Homogeneous	5%	Wollastonite	95%	Non-fibrous (other)	**None Detected**
0118 17-51 *321000598-0051*	S end of CC6 room closet	Brown Non-Fibrous Heterogeneous	2%	Wollastonite	98%	Non-fibrous (other)	**None Detected**

nalyst(s)

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Rafik Vartanian, Ph.D (34)

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THIS IS THE LAST PAGE OF THE REPORT.

SECTION 5
FIELD ASSESSMENT WORKSHEET/CHAIN OF CUSTODY

ENVIRONMENTAL CONSULTING SERVICES, INC.

Bulk Sampling Form

☐ Stop at First Positive ☒ 24 Hour turn around ☐ Rush turn around (4 Hours)
X Do Not Layer Samples

CLIENT: Saddleback College	PROJECT NO. 128 2210AS
PROJECT ID: Classroom Complex Bldg	DATE 1-18-10 / PAGE 1 OF 3
PROJECT LOCATION: 28000 Marguerite Pkwy, Mission Viejo, Ca. 92692	INSPECTOR: M.A., A.S.

GRP. NO.	SAMP. NO	MATERIAL DESCRIPTION	LOCATION OF SAMPLE	QTY	% POS
01	01	white 2'x4'	East-end of CC6 RM.	5371 ft	
↓	02	ceiling tile	South East-end of CC8 RM.	↓	
↓	03	↓	South-end of CC2 Rm.	↓	
02	04	White Drywall	East-end wall of CC6 Rm	8420 ft	
↓	05	↓	S. East-end wall of CC8 Rm	↓	
↓	06	↓	South-wall end of CC2 Rm.	↓	
03	07	Attic Insulation	North-end of CC6 Rm	5371 ft	
↓	08	Yellow color	South-end of CC2 Rm.	↓	
↓	09	↓	Center of Rm CC4 Rm	↓	
04	10	white color Joint/comp-	N. West end of Rm CC6	8420 ft	
↓	11	ound Material	South-end of CC2 Rm.	↓	
↓	12	↓	S West-end of CC8 Rm.	↓	
05	13	Tan/yellow color	N. East-end of RM. CC6	8420 ft	
↓	14	Insulation behind	S. East-end of Rm CC8	↓	
↓	15	Drywall (walls)	South-end of Rm CC2	↓	
06	16	Tan/yellow color	North end of Rm. CC7	5371 ft	
↓	17	glue under Floor	S. East-end of Rm CC8	↓	
↓	18	Carpet.	South-end of Rm. CC2	↓	
07	19	4" Tan Gray Color	North East of Rm CC7	860 ft	
↓	20	Cove base	S. East-end of Rm CC8	↓	
↓	21	↓	South-end of Rm. CC2	↓	

Notes:

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(909) 628-0369 • Fax (909) 613-5845 • H2Environmental.com

ENVIRONMENTAL CONSULTING SERVICES, INC.

Bulk Sampling Form

☐ Stop at First Positive ☒ 24 Hour turn around ☐ Rush turn around (4 Hours)
X Do Not Layer Samples

CLIENT Saddleback College		PROJECT NO. 1282210 AS	
PROJECT ID Classroom Complex Bldg.		DATE 1-18-12	PAGE 2 OF 3
PROJECT LOCATION 28000 Marguerite pkwy, Mission Viejo Ca. 92692		INSPECTOR M. Ch., A.S.	

GRP. NO.	SAMP. NO	MATERIAL DESCRIPTION	LOCATION OF SAMPLE	QTY	% POS
08	22	Brown/yellow color	North East-end of Rm CC7	860 ☒	
↓	23	glue under 4"in	S. East-end of Rm CC8	↓	
↓	24	Covebase	South-end of Rm CC2	↓	
09	25	Yellow color Base-	North-end of Bldg. Basement	5371 ☒	
↓	26	ment Insulation	East-end of Bldg Basement	↓	
↓	27	↓	South-end of Bldg Basement	↓	
10	28	Rolled Roofing	North-end of Bldg. Roof	754 ☒	
↓	29	Material Gray Color	South-end of Bldg. Roof	↓	
↓	30	↓	West-end of Bldg. Roof	↓	
11	31	Black color Felt	North-end of Bldg. Roof	↓	
↓	32	Paper under Rolled	South-end of Bldg roof	↓	
↓	33	Roofing material	West-end of Bldg roof	↓	
12	34	Black color	North-end of Bldg. Roof	280 ☒	
↓	35	Mastic Penetration	South-end Bldg Roof	↓	
↓	36	Material.	West-end Bldg. Roof	↓	
13	37	Gray/white color	East-end of Bldg. Roof	150 ☒	
↓	38	Mastic on Air Ducts	North-end of Bldg Roof	↓	
↓	39	(Air units)	South-end of Bldg Roof	↓	
14	40	white mastic material	East-end of Bldg Roof	80 ☒	
↓	41	on Air units	North-end of Bldg Roof	↓	
↓	42	penetrations	South-end of Bldg Roof	↓	

Notes:

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ENVIRONMENTAL CONSULTING SERVICES, INC.

Bulk Sampling Form

☐ Stop at First Positive ☒ 24 Hour turn around ☐ Rush turn around (4 Hours)
X Do Not Layer Samples

CLIENT: Saddleback College	PROJECT NO.: 12822 10 AS
PROJECT ID: Classroom Complex Bldg #10	DATE: 1/18/10 — PAGE 3 OF 3
PROJECT LOCATION: 800 Marguerite Pkwy, Mission Viejo CA 92692	INSPECTOR: Alberto S., Marco C.

GRP. NO.	SAMP. NO	MATERIAL DESCRIPTION	LOCATION OF SAMPLE	QTY	% POS
15	43	Roofing patches Metal	North - end of Roof	160 SF	
↓	44	w/ Black/Silver foil	East - end of Roof	↓	
↓	45	Color	South end of Roof	↓	
16	46	Brown Color	North - end of CCC Kn closet	10 LF	
↓	47	4" in Cove base	West - end of CCC Kn closet	↓	
↓	48	closet Kn.	South - end of CCC Kn closet	↓	
17	49	Brown Color	North - end of CCC Kn closet	↓	
↓	50	glue under	West end of CCC Kn closet	↓	
↓	51	4" in Cove base	South end of CCC Kn closet	↓	

Notes:

* Assumed ACM on Mastic behind Chalkboards.

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13122 6th Street
Chino, CA 91710-9008
Office: 909-628-0369 Fax: 909-613-5845

LEAD XRF SURVEY RESULTS

Client Name Saddleback College	**Project Number** 12822 10 AS
Project Name Classroom Complex Building # 10	**Inspector(s)** M. Ch. A. S.
Project Location / Address 28000 Marguerite Pkwy, Mission Viejo Ca, 92692	**Date** 1-18-10

The list materials and their components where LBP is detected at or in excess of the HUD/EPA standards of (1.0 mg/cm²) by XRF method which is listed in the table below or by 0.50% by weight of paint chip sample method.

Shot #	QTY (SF)	Unit	Room Tested	Wall	Color	Component	Substrate	Paint Condition	Result mg/cm²	Neg / Pos
01	9 EA	Bldg # 10	CC 6	D	red	Door	metal	(D) / D	-0.1	(N) / P
02	9 EA			D	red	Door Frame	metal	(I) / D	0.2	(N) / P
03	3 EA			C	white	Door	wood	(I) / D	-0.0	(N) / P
04	7 EA			C	Brn.	Door Frame	wood	(I) / D	-0.1	(N) / P
05	13 EA			A	Brn.	window	metal	(I) / D	-0.2	(N) / P
06	2 EA			B	Brn.	window	wood	(I) / D	-0.1	(N) / P
07	8,420 ft			B	white	wall paper	Drywall	(I) / D	-0.0	(N) / P
08	3 EA		CC 7	A	Gray	elec. panel	metal	(I) / D	-0.2	(N) / P
09	40 ft		CC 8	D	offwhite	elec. pipe	metal	(I) / D	-0.0	(N) / P
10	3 EA		CC 5	C	Brn.	window	wood	(I) / D	0.2	(N) / P
11	9 EA		CC 4	B	red	Door	metal	(I) / D	-0.0	(N) / P
12	9 EA		CC 4	B	red	Door Frame	metal	(I) / D	-0.0	(N) / P
13	13 EA		CC 4	B	Blk	window Frame	metal	(I) / D	-0.1	(N) / P
14	7,548 ft		CC 2	A	red	I-beam	metal	(I) / D	0.1	(N) / P
15	9 EA		CC 2	C	red	Door	metal	(I) / D	-0.1	(N) / P
16	9 EA		CC 2	C	red	Door Frame	metal	(I) / D	-0.0	(N) / P
17	8,420 ft		CC 2	C	white	wall paper	Drywall	(I) / D	-0.1	(N) / P

Paint Condition: I- Intact D- Deteriorated

Reading: N-Negative (Less than 1.0 mg/cm² not classified as LBP)
P-Positive (Greater than or equal 1.0 mg/cm² classified as LBP)

mg/cm²: Milligram Per Square Centimeter

CONSULTING SERVICES, INC.

13122 6th Street
Chino, CA 91710-9008
Office: 909-628-0369 Fax: 909-613-5845

LEAD XRF SURVEY RESULTS

Client Name Saddleback College	**Project Number** 128221CAS
Project Name Classroom Complex Building #10	**Inspector(s)** M.Ch., A.S.
Project Location / Address 28000 Marguerite Pkwy/Mission Viejo, Ca. 92692	**Date** 1-18-10

The list materials and their components where LBP is detected at or in excess of the HUD/EPA standards of (1.0 mg/cm²) by XRF method which is listed in the table below or by 0.50% by weight of paint chip sample method.

Shot #	QTY (SF)	Unit	Room Tested	Wall	Color	Component	Substrate	Paint Condition	Result mg/cm²	Neg / Pos
18	9 EA	Bldg #10	Ext of Bldg.	D	red	Door	metal	I / D	0.2	N / P
19	9 EA	↓	↓	D	red	Door Frame	metal	I / D	0.1	N / P
20	4,560 ft			D	white	wall	wood	I / D	0.0	N / P
21	13 EA			D	Brn.	window	wood	I / D	0.0	N / P
22	5 EA.			D	Brn.	Downspout	metal	I / D	-0.0	N / P
23	60 ft			D	Brn.	wall molding strip	wood	I / D	-0.2	N / P
24	352 ft			B	Brn.	Fascia	wood	I / D	0.1	N / P
25	1,390 ft			B	white	soffit	wood	I / D	0.1	N / P
26	926 L.F.			B	white	pipe	metal	I / D	-0.1	N / P
27	1 EA.			C	red	Fire extinguisher Box	metal	I / D	-0.0	N / P
28	9 EA			C	red	Door	metal	I / D	-0.1	N / P
29	9 EA			C	red	Door Frame	metal	I / D	-0.1	N / P
30	20 ft	↓	↓	C	red/white	wall	wood	I / D	-0.1	N / P
31	2 EA	Bldg #10	Roof	B	TAN	AC/unit	metal	I / D	-0.6	N / P
32	8 EA			B	Gray	AC/unit	metal	I / D	-0.3	N / P
33	1 EA			A	white	Door Frame	metal	I / D	-0.1	N / P
34	1,320 ft	↓	↓	A	white	wall	wood	I / D	0.0	N / P

Paint Condition: I- Intact D- Deteriorated

Reading: N-Negative (Less than 1.0 mg/cm² not classified as LBP)
P-Positive (Greater than or equal 1.0 mg/cm² classified as LBP)

Milligram Per Square Centimeter

APPENDICES

APPENDIX 1

INSPECTOR'S CERTIFICATES

In an effort to save paper and per some repeat clients request to reduce the size of the reports, H2 Environmental has reduced the size of the inspector's certifications to make them fit on one page. If you feel the need to receive a full size set of certifications, feel free to call our office (909) 628-0369 and request the copies you need. Thank you for your assistance in this matter.

CALIFORNIA

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OS CONSULTANT and TRAINER APPROVAL UNIT

May 05, 2009

nvironmental Consulting Services, Inc.
nn Thomas Haley
2 5th St
CA 91710-1908

Certified Asbestos Consultant or Technician

ed is your certification card. To maintain your certification, please abide rules printed on the back of the certification card.

ertification is valid for a period of one year. If you wish to renew your ation, you must apply for renewal at least 60 days before the expiration hown on your card. [8 CCR 341.15(h)(1)].

hold and do not send copies of your required AHERA refresher renewal ates to our office until you apply for renewal of your certification. ates must be kept current if you are actively working as a CAC or CSST. nce period is only for those who are not actively working as a CAC or

inform our office of the above address, fax number or schuffelr.ca.gov of anges in your contact/mailing information within 15 days of the change.

ely,

rrell
Industrial Hygienist

nent Certification Card

State of California
Division of Occupational Safety and Health
Qualified Asbestos Consultant

William Thomas Haley

Certification No. CC-[redacted]

Expires on 05/11/10

Global Environmental Training

This is to certify that

W. Thomas Haley

SS# 4362

Has completed course work that meets the criteria required for EPA/AHERA (TSCA Title II) Approved Reaccreditation and NESHAP's Regulations Training

Asbestos in Buildings: Abatement Contractor Supervisor Refresher

April 4, 2009 — Course Date

29080-CSR — Certificate Number

April 4, 2010 — Expiration Date

CA-023-04 — Course Approval Number

Mark Wray, Course Director

Global Environmental Training

This is to certify that

W. Thomas Haley

SS# 4362

Has completed course work that meets the criteria required for EPA/AHERA (TSCA Title II) Approved Reaccreditation and NESHAP's Regulations Training

Asbestos in Buildings: Building Inspector Refresher

April 5, 2009 — Course Date

29064-BIR — Certificate Number

April 5, 2010 — Expiration Date

CA-023-06 — Course Approval Number

Mark Wray, Course Director

Global Environmental Training

This is to certify that

W. Thomas Haley

SS# 4362

Has completed course work that meets the criteria required for EPA/AHERA (TSCA Title II) Approved Reaccreditation and NESHAP's Regulations Training

Asbestos in Buildings: Abatement Project Designer Refresher

January 9, 2009 — Course Date

29017-PDR — Certificate Number

January 9, 2010 — Expiration Date

CA-023-10 — Course Approval Number

Mark Wray, Course Director

Global Environmental Training

This is to certify that

W. Thomas Haley

SS# 4362

Has completed course work that meets the criteria required for EPA/AHERA (TSCA Title II) Approved Reaccreditation and NESHAP's Regulations Training

Asbestos in Buildings: Management Planner Refresher

January 8, 2009 — Course Date

29018-MPR — Certificate Number

January 8, 2010 — Expiration Date

CA-023-08 — Course Approval Number

Mark Wray, Course Director

This is to certify that
W. Thomas Haley
has successfully completed
the NIOSH sponsored course
Sampling and Evaluating Airborne Asbestos Dust
conducted by
Hall-Kimbrell ENVIRONMENTAL SERVICES
in Lawrence, Kansas on June 27-30, 1989

American IAQ Council

hereby certifies that

W. Thomas Haley

has met all the specific standards and qualifications of the council's certification program, including continued professional development, and is hereby recognized as a

Council-certified Indoor Environmental Consultant

CIEC

Certificate Number

Mr. William T. Haley
H2 Environmental Consulting Services, Inc.
13172 6th Street
Chino, California 91710

State of California Department of Public Health
Lead-Related Construction
Certificate

State of California
California Environmental Protection Agency
Department of Toxic Substances Control

THE STATE OF CALIFORNIA

Thomas Haley

Asbestos Building Inspector

Department of Toxic Substances Control

CERTIFICATE OF ATTENDANCE

This certificate is awarded to

W. Thomas Haley

n recognition of attendance to

Basic AeroSeminar

February 13, 2004
Sponsored by Aerotech Laboratories, Inc.

Environmental Assessment Association

EAA

hereby certifies that

W. Thomas Haley, CEI

has been qualified for membership in the

Environmental Assessment Association

and has been admitted by the Board of Directors and declared to be a

CEI

Certified Environmental Inspector

and is hereby granted this certificate under the conditions prescribed in its by-laws.

Signed and presented this 15th day of March, 2001

Robert G. Johnson

ENVIRONMENTAL ASSESSMENTS
QUALITATIVE FIT TEST

Employee Name: W. Thomas Haley
Employee Signature: Date: 3/16/
Location: NO Environmental
Respirator Specifications:
Brand: North
Size: Large
Model: 7700
Type: Half Face
Test Results
Negative Pressure Tests: Yes OPAS
Positive Pressure Tests: Yes OPAS
Bitrex Smoke Tastes: Yes OPAS
Trainer Name: Michael Fischer
Trainer Signature: Date: 3/16/
Comments:

Certificate of Attendance

The Individual named below attended the 2007 Annual Meeting & Exposition of the Indoor Air Quality Association held October 14 – October 17, 2007 in Las Vegas, NV

Presented to

Thomas Haley

Robert G. Johnson, President

Gordon Tillman, Executive Director

INDOOR AIR QUALITY ASSOCIATION

Membership Certificate

THIS DOCUMENT IS TO CERTIFY THAT

Thomas Haley

membership no. 0184

IS A MEMBER IN GOOD STANDING AND ENTITLED TO ALL RIGHTS & PRIVILEGES OF ASSOCIATION MEMBERSHIP

DATED 12/10/10

DEPARTMENT OF FOOD AND AGRICULTURE
DIVISION OF ENVIRONMENTAL ANALYSIS PROGRAMS
1220 N Street, P.O. Box 942871, Sacramento, CA 94271-0001
(916) 324-5482

INSPECTION FOR INSECT

DATE: APRIL 26, 2000
AMOUNT RECEIVED: $100

W. Thomas Haley
NO Environmental
1234 Elm Street
Chico, CA 95926

RECEIVED

IAQA-AmIAQ-IESO 2005

The Unification Conference

Certificate of Attendance

W. Thomas Haley, Indoor Air Quality Association (IAQA), President
Dr. Jeffrey Siegel, American Indoor Air Quality Council (AmIAQ), President
Mr. Gordon Connell, Indoor Environmental Society of Australia (IESO), President

Hereby certify that W. Thomas Haley has attended October 9-11, 2005 in Chatsworth, CA, and has received more than 20 hours of educational credit.

Presented to

W. Thomas Haley

Thomas Haley, President, Indoor Air Quality Association

Jeffrey Siegel, President, American Indoor Air Quality Council

Gordon Connell, President, Indoor Environmental Society of Australia

For verify the validity of this document, please contact the Indoor Air Quality Association (IAQA) at (800) 267-4264, or 1-(916) 441-4449

Certificate of Attendance

certifies that

W. Thomas Haley

has successfully completed the

Basic Strategies for Conducting Meaningful Microbial IAQ Investigations

2.0 IH CM Points or 1.8 CEUs AIHA Approval #12687 16 CPDs from BOMI

November 10 – November 11, 2003
Date

Executive Director

Environmental Assessment Association

EAA

hereby certifies that

W. Thomas Haley, CES

has been qualified for membership in the

Environmental Assessment Association

and has been admitted by the Board of Directors and declared to be a

CES

Certified Environmental Specialist

and is hereby granted this certificate under the conditions prescribed in its by-laws.

Signed and sealed this 6th day of March, 2001

Robert G. Johnson

LA TESTING, INC.

certifies that

Tom Haley

IAQ and INDUSTRIAL HYGIENE WORKSHOP

IMBL Certificate No. 94-5111-CA
Course Date March 31, 1994
Lomitas Anaheim, CA

COURSE INSTRUCTORS:

CREDITS & CONTINUING EDUCATION:

LA Testing, Inc.
10722 Noel Street
Los Alamitos, CA 90720
Phone (800) 359-1794
Fax (714) 761-5714
www.lamtlab.com

Jason Dubowski, Ph.D.
Technical Director of Microbiology

Environmental, Mold, Asbestos, IAQ, Airborne, Lead, Pesticide and Metabolic Testing Since 1981

Certificate of Training

Thomas Haley

Has completed an endorsement course in general compliance with 29 CFR 1910.1200 and applicable provisions of 29 CFR 1910.120.

Clandestine Methamphetamine Labs

Presented on this Date January 19, 2002
Course Date January 19, 2002
Certificate Number 2012-1013

DeLisle Associates LTD
3064 E. Sprinkle Road
Portage, Michigan 49002
(269) 373-4900

Theodore M. Spaeffner, Instructor

DEPARTMENT OF INDUSTRIAL RELATIONS
DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
ASBESTOS CONSULTANT and TRAINER APPROVAL UNIT
2211 Park Towne Circle, Suite 1
Sacramento, CA 95825
Tel: (916) 574-2993 Fax: (916) 483-0272

3122433117 241 243

H2 Environmental Consulting Services, Inc.
Alberto P Sanchez
13122 6th Street
Chino CA 91710-9008

January 12, 2009

Dear Certified Asbestos Consultant or Technician:

Enclosed is your certification card. To maintain your certification, please abide by the rules printed on the back of the certification card.

Your certification is valid for a period of one year. If you wish to renew your certification, you must apply for renewal at least 60 days before the expiration date shown on your card. [8 CCR 341.15(h)(1)].

Please hold and do not send copies of your required AHERA refresher renewal certificates to our office until you apply for renewal of your certification. Certificates must be kept current if you are actively working as a CAC or CSST. The grace period is only for those who are not actively working as a CAC or CSST.

Please inform our office at the above address, fax number or actu@dir.ca.gov of any changes in your contact/mailing information within 15 days of the change.

Sincerely,

Jeff Ferrell
Senior Industrial Hygienist

JF/ms

Attachment: Certification Card
cc: File

State of California
Division of Occupational Safety and Health
Certified Site Industrial Hygienist

Global Environmental Training

This is to certify that

Alberto Sanchez

SS# 7746

Has completed course work that meets the criteria required for EPA/AHERA (TSCA Title II) Approved Reaccreditation and NESHAPs Regulations Training *

Asbestos in Buildings: Building Inspector Refresher

April 5, 2009
Course Date

29065-B1R
Certificate Number

April 5, 2010
Expiration Date

CA - 023 - 06
Course Approved Number

Marie Virgen
Course Director

*This course meets California requirements

Global Environmental Training

This is to certify that

Alberto Sanchez

SS# 7746

Has completed course work that meets the criteria required for EPA/AHERA (TSCA Title II) Approved Reaccreditation and NESHAPs Regulations Training *

Asbestos in Buildings: Abatement Contractor Supervisor Refresher

April 4 2009
Course Date

29081-CSR
Certificate Number

April 4, 2010
Expiration Date

CA - 023 - 04
Course Approved Number

Marie Virgen
Course Director

*This course meets California requirements

H2 Environmental Consulting Services, Inc.

This is to certify that

ALBERTO SANCHEZ

HAS SUCESSFULLY COMPLETED A

NIOSH 582 EQUIVILANCY COURSE

The course included: Airborne Fiber Sampling, Temperature & Pressure Corrections of Air Sample Flow Rates, Calibration & Alignment of Optical Microscopy, Evaluation of Air Sampling Data and NIOSH Method 7400 Fiber Counting Rules

ON

June 5, 2002
Course Date

710506
Certificate Number

W. Thomas Haley
REA, CAC # 95-1702

2370 Schaefer Avenue, Suite A1, Chino, CA 91710 Phone (909) 628-0368 Fax (909) 613-0845

Mr. Alberto P. Sanchez
H2 Environmental Consulting Services, Inc.
13122 6th Street
Chino, California 91710

State of California Department of Public Health
Lead-Related Construction Certificate
Expiration Date

Certificate of Achievement

This is to certify that

Alberto Sanchez

on the 11th day of April 2007 successfully completed the factory training for

RMD's LPA-1 Lead Paint Inspection System

Including, but not limited to the topics of Protection Safety, DOT Regulations, and the Proper Use of the Instrument.

Jacob Fenster, Vice President, RMD
44 Hunt St., Watertown, Massachusetts

H2 ENVIRONMENTAL CONSULTING SERVICES, INC.

QUALITATIVE FIT TEST

Employee Name: Alberto Sanchez S.S. #: 7748

Employee Signature: Date: 5/20/09

Location: H2 Environmental

Respirator Specifications:

Brand: North

Size: Large

Model: 7700

Type: Half Face

Test Results

Negative Pressure Tests: ☒ Pass ☐ Fail

Positive Pressure Tests: ☒ Pass ☐ Fail

Irritant Smoke Tests: ☒ Pass ☐ Fail

Trainer Name: Victor Ruiz

Trainer Signature: Date: 05-26-09

Comments:

13122 6th Street • Chino, CA 91710
(909) 628-0369 • Fax (909) 613-5845 • H2Environmental.com

Certificate of Training

Alberto Sanchez

Has completed an awareness course in general compliance with 29 CFR 1910.1200 and applicable provisions of 29 CFR 1910.1126.

Clandestine Methamphetamine Labs

DeLisle Associates LTD
3050 S Systems Road
Portage, Michigan 49002
(269) 323-5369

Thomas E. Beecher, Instructor

Presented on this date: January 15, 2008
Course Date: January 10, 2008
Certificate Number: MLA-1015

CERTIFIED INDOOR ENVIRONMENTALIST COURSE

This certificate of completion documents that the following individual has completed the 32 hour "IAQA Certified Indoor Environmentalist Course" on 5/20/2009 in Los Angeles, CA.

Alberto Sanchez

This course is certified by IAQA and is designed to impart individuals with expertise in the fundamental principles of indoor environmental quality which may be utilized in the practice of data collection, application of specific building products, and observation of conditions which may affect occupant acceptability of the indoor environment. This document does not bestow professional credentials or certification to the individual named above.

Glenn E. Fortman
Executive Director, IAQA

Document # 11254

IAQA ASSOCIATION

SHINNEY

This certifies that Alberto Sanchez

Certificate of Training ANSI Z82 April 1996 Safety

CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

November 20, 2006

Mr. W. Thomas Haley
H2 Environmental Consulting Services, Inc.
3370 Schaefer Ave., Suite J
Chino, CA 91710-9008

Reference: Mr. Albert Sanchez

Dear Mr. Haley,

I would like to take this opportunity to commend Mr. Albert Sanchez for the excellent job performance on behalf of the University. As the project hygienist assigned by your firm, Mr. Sanchez has provided valuable assistance to me in monitoring the hazardous materials abatement on the University Library Renovation Project. I have appreciated his detailed daily logs which has informed me of the day to day activities. On many occasions, he has been proactive in informing me of unforeseen conditions prior to receiving official notification from the General Contractor.

I look forward to working with Mr. Sanchez on the remaining portion of the hazardous material removal as well as future construction projects.

Sincerely,

Ted K. Nakanji
Senior Inspector of Record

CAPE

June 1, 2005

W. Thomas Haley, REA, CAC
H2, Vice President
3370 Schaefer Avenue
Chino, California 91710

Mr. Haley:

Throughout the, months of April and May 2005, I had the pleasure of working with H2 Project Manager, Albert Sanchez, for the ACM Abatement Project at March Air Reserve Base in Riverside, California. Mr. Sanchez held the position of Third Party Air Monitor for this CAPE project.

On a daily basis and like clockwork, Mr. Sanchez performed air monitoring tasks, managed detailed daily logs, conducted numerous bulk surveys throughout the Base, and enforced safety and regulation oversight in accordance with the work plan. During this project, it became clear that Mr. Sanchez is proficient in maintaining high quality interaction during team activities and reliability relating to individual tasks.

Because CAPE requires background monitoring prior to abatement activities, on numerous occasions Mr. Sanchez would voluntarily report to work hours prior to scheduled work activities and/or remain at the work site after scheduled work hours to ensure that abatement could continue to commence in a timely manner.

Mr. Sanchez is responsible, polite, dedicated, and comprehensive. Without hesitation, I would recommend Mr. Sanchez be recognized as an excellent leader representing your company. And, in the future I hope that I have the opportunity to work with him again.

If you would like additional information or have any questions, please contact me at (210) 163-9314.

Sincerely,

JoEl Mais, C.E.A.
Staff Scientist

PCM

Memorandum

To: Ernie Robles (via hand delivery 1 page(s))
H2 Environmental Consulting Services
From: Raj Kapil - PCM PM
Date: 05/26/04
My Fax: # 310-383-0097
My Phone: # 818-261-5412 Cell

Subject: H2 Environmental Job Performance Review @ Hoover St.-6 Unit Apt for Hazmat Monitoring

Ernie-My review of your employee Albert Sanchez at the above mentioned project is as follows:

(1) Diligent in producing positive solutions to resolve unforeseen site conditions.
(2) Very proactive
(3) Team player with all participants
(4) On-arrival-always earlier than required
(5) Maintaining good daily observation records
(6) Open to criticism and suggestions with the willingness to produce positive feed back
(7) I thoroughly recommend Albert Sanchez for future projects with PCM and any other projects that H2 Environmental undertake with other clients

Sincerely

Raj Kapil

MILLER BROOKS Environmental, Inc.

To: Ernie Robles – H2 Environmental

August 30, 2004

From: Doug Maclean / Miller Brooks

Project: Fallon USARC- Ball, Ca.

Subject: Abatement Of Roofing Mastic Bldg. # 321

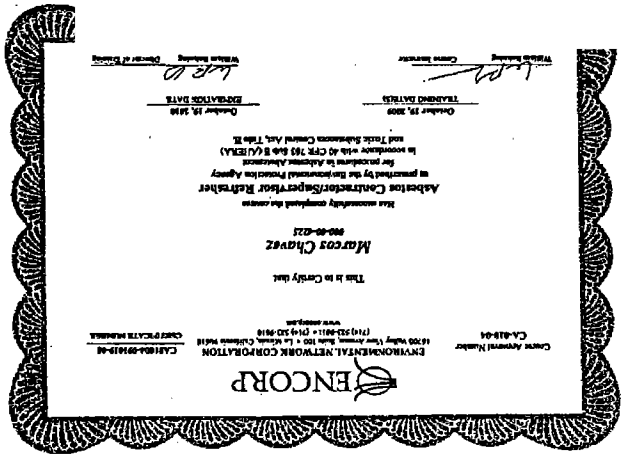
I would like to thank you for accommodating my request to have Alberto Sanchez as your technician on such short notice on the abatement that was performed on Thursday, August 26th at this project.

As I conveyed to you on August 3rd after the abatement of Bldg. # 1, it was indeed a pleasure to have Albert here to work with the Miller Brooks personnel on site as his assistance was indeed an asset to us on those four days.

Should the need arise in the future, I would hope that you could arrange to have him available once again.

Cc: Scott Pousard
Tom Haley
Alberto Sanchez

2121 Main Street, Ste. 202 • Huntington Beach, CA 92648-4610 • Telephone (714) 960-4286 • Fax (714) 960-2468



ENCOR

ENVIRONMENTAL NETWORK CORPORATION

Course Approval Number CA-019-04

This is to Certify that

Marcos Chavez

808-60-6215

Has successfully completed the course

Asbestos Contractor/Supervisor Refresher

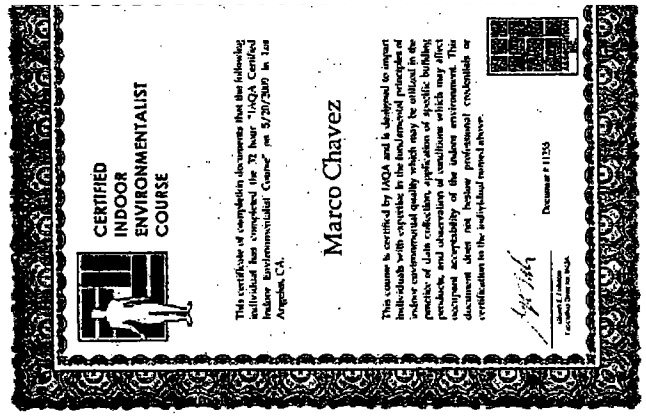
as prescribed by the Environmental Protection Agency for procedures in Asbestos Abatement in accordance with 40 CFR 763 Sub E (AHERA) and Toxic Substances Control Act, Title II.

October 19, 2009 — TRAINING DATE(S)

October 19, 2010 — EXPIRATION DATE

Course Instructor

Director of Training



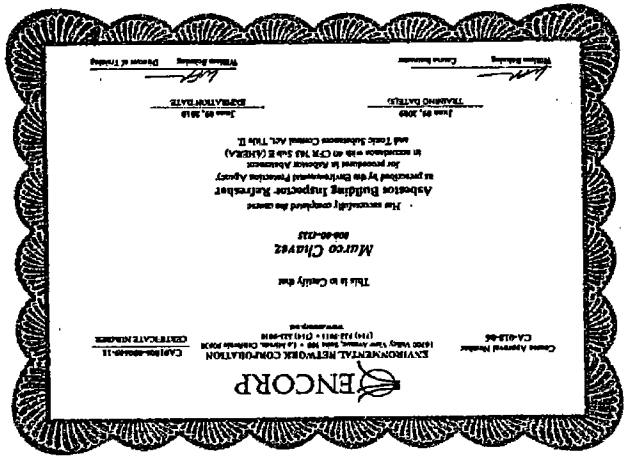
CERTIFIED INDOOR ENVIRONMENTALIST COURSE

This certificate of completion documents that the following individual has completed the 32 hour "IAQA Certified Indoor Environmentalist Course" on 5/20/2009 in Los Angeles, CA.

Marco Chavez

This course is certified by IAQA and is designed to impart individuals with expertise in the fundamental principles of indoor environmental quality which may be utilized in the practice of data collection, application of specific building products, and observation of conditions which may affect occupant acceptability of the indoor environment. This document does not bestow professional credentials or certification to the individual named above.

Director # 11256



ENCOR

ENVIRONMENTAL NETWORK CORPORATION

Course Approval Number CA-019-04

This is to Certify that

Marcos Chavez

808-60-6215

Has successfully completed the course

Asbestos Building Inspector Refresher

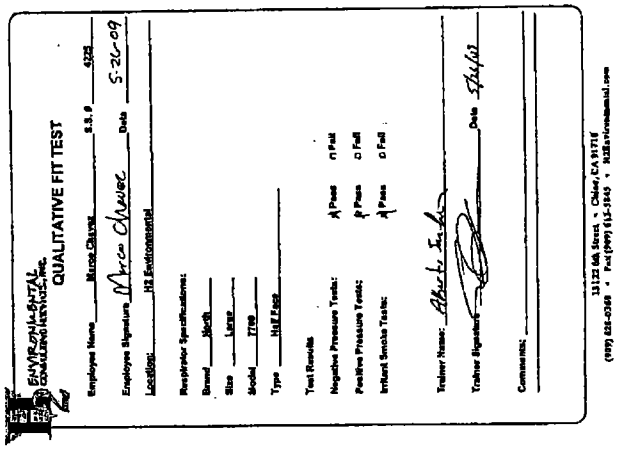
as prescribed by the Environmental Protection Agency for procedures in Asbestos Abatement in accordance with 40 CFR 763 Sub E (AHERA) and Toxic Substances Control Act, Title II.

June 09, 2009 — TRAINING DATE(S)

June 09, 2010 — EXPIRATION DATE

Course Instructor

Director of Training



ENVIRONMENTAL CONSULTING SERVICES, INC.

QUALITATIVE FIT TEST

Employee Name: Marco Chavez S.S.# 4225

Employee Signature: Marco Chavez Date: 5-20-09

Location: HS Environmental

Respirator Specifications:

Brand: North

Size: Large

Model: 7700

Type: Half Face

Test Results

Negative Pressure Tests: ☑ Pass ☐ Fail

Positive Pressure Tests: ☑ Pass ☐ Fail

Infrared Smoke Tests: ☑ Pass ☐ Fail

Trainer Name: Albert Inda

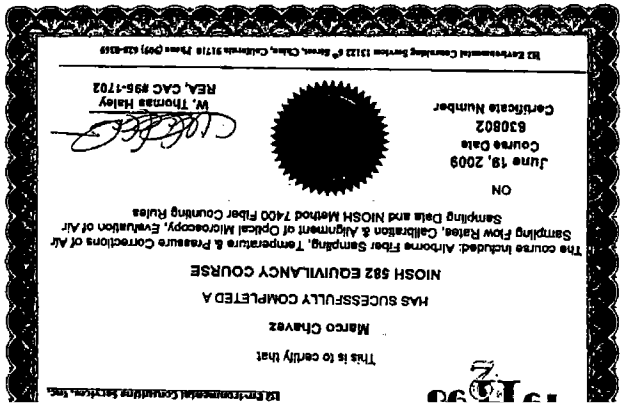
Trainer Signature: [signature] Date: [illegible]

Comments:

13123 6th Street • Chino, CA 91710

(909) 628-0369 • Fax (909) 613-5845 • HSEnvironmental.com

Fr. Marco A. Chavez
2 Environmental Consulting Services, Inc.
1123 6th Street
hino, California 91710



This is to certify that

Marco Chavez

HAS SUCCESSFULLY COMPLETED A

NIOSH 582 EQUIVALANCY COURSE

The course included: Airborne Fiber Sampling, Temperature & Pressure Corrections of Air Sampling Flow Rates, Calibration & Alignment of Optical Microscopy, Evaluation of Air Sampling Data and NIOSH Method 7400 Fiber Counting Rules

ON

June 19, 2009

Course Date

530802

Certificate Number

W. Thomas Haley

REA, CAC #95-1702

HS Environmental Consulting Services, Inc.

HS Environmental Consulting Services 13123 6th Street, Chino, California 91710 Phone (909) 628-0369

American Council for Accredited Certification

hereby certifies that

Marco Chavez

has met all the specific standards and qualifications of the certification process and is hereby certified as a

CIE

Council-certified Indoor Environmentalist

This certificate is valid for 2 years, expiring December 31, 2011.

0919002

APPENDIX 2

NVLAP CERTIFICATION

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200232-0

LA Testing
S. Pasadena, CA

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

BULK ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2009-07-01 through 2010-06-30
Effective dates

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-19)

AIHA

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

LA Testing
[illegible]
Laboratory ID: [illegible]

has fulfilled the requirements of the AIHA Laboratory Accreditation Program (AIHA-LAP), LLC thereby, conforming to the ISO/IEC 17025:2005 international standard, General Requirements for the Competence of Testing and Calibration Laboratories. The above named laboratory, along with all previous fees which lay activities are performed, as listed above, have been accredited by AIHA-LAP, LLC in the following:

ACCREDITATION PROGRAMS

☐	INDUSTRIAL HYGIENE	Accreditation Expires:
☐	ENVIRONMENTAL LEAD	Accreditation Expires:
☑	ENVIRONMENTAL MICROBIOLOGY	Accreditation Expires: [illegible]
☐	FOQS	Accreditation Expires:

Specific Fee(s) of Testing (Fee/Method(s)) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached Scope of Accreditation. Continued accreditation is contingent upon successful on-going compliance with AIHA-LAP, LLC requirements. This certificate is not valid without the attached Scope of Accreditation. Please review the AIHA-LAP, LLC website (www.allianceaccreditation.com) for the most current status of the scope of accreditation.

Pamela A. Kaetz, CIH
Chairperson, Analytical Accreditation Board

Date Issued: 06/24/2009

NVLAP® National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

LA Testing
159 Pasadena Avenue
S. Pasadena, CA 91030
Mr. Derrick Tanner
Phone: (323) 254-9900 Fax: (323) 254-9942
E-Mail: dtanner@latesting.com
URL: http://www.latesting.com

AIRBORNE ASBESTOS FIBER ANALYSIS (TEM) — **NVLAP LAB CODE 200232-0**

NVLAP Code	*Designation / Description*
18/A02	U.S. EPA's "Asbestos Transmission Electron Microscopy Analytical Method-mandatory and Nonmandatory-and Mandatory Sections to Determine Completion of Response Actions", as found in 40 CFR, Part 763, Subpart E, Appendix A.

NVLAP® National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

LA Testing
159 Pasadena Avenue
S. Pasadena, CA 91030
Mr. Derrick Tanner
Phone: (323) 254-9900 Fax: (323) 254-9942
E-Mail: dtanner@latesting.com
URL: http://www.latesting.com

BULK ASBESTOS FIBER ANALYSIS (PLM) — **NVLAP LAB CODE 200232-0**

NVLAP Code	*Designation / Description*
18/A01	EPA-600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples

---

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200232-0

LA Testing
S. Pasadena, CA

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

AIRBORNE ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2008).

2009-07-01 through 2010-06-30
Effective dates

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-19)

APPENDIX 3

METHODOLOGY

SURVEY METHODOLOGY

ASSESSMENT STUDY GENERAL ORGANIZATION

Prior to beginning the actual inspection, the inspector met with Mr. Louis Sessler to discuss the facility inspection and gain access.

Inspection Procedures

Access was obtained from Mr. Louis Sessler. The Asbestos and Lead Survey was performed by Mr. W. Thomas Haley a California Licensed Consultant/Lead Inspector/Assessor/Project Monitor and Mr. Albert Sanchez, a Certified Site Surveillance Technician and Lead Inspector and Mr. Marco Chavez a Lead Technician(See Appendix 1). An initial building walkthrough was conducted to determine the presence of suspect materials, which were accessible and/or exposed. Materials, which were similar in general appearance, were grouped into homogeneous sampling areas.

Homogeneous Material Classifications

A preliminary walkthrough of the spaces was conducted to determine areas of materials, which were visually similar in color, texture, general appearance, and which appeared to have been installed at the same time. Such materials are termed "homogeneous materials" by the EPA. During this walkthrough, the approximate locations of these homogeneous materials were also noted. Only materials, which were and/or exposed and suspected to contain asbestos, were identified.

Following the EPA, California State and local protocol, each identified suspect homogeneous material may be placed in one of the following EPA classifications:

- **Surfacing Materials** (spray or trowel applied materials)
- **Thermal System Insulation** (materials applied to various mechanical systems)
- **Miscellaneous Materials** (any material which do not fit either of the above categories, such as vinyl floor tiles...etc.)

Sampling Procedures

EPA guidelines were used to determine the sampling protocol. Sampling locations that were chosen are representative of the homogeneous sampling area. While an effort was made to collect samples randomly, samples were taken preferentially from damaged areas or areas which were the least visible to minimize disturbance of the material. After each sample was extracted, a spray encapsulant was applied to the sampled area to prevent potential fiber release.

LEAD

The inspector performs a visual walk-thru of the building noting all substrates, building, and painting histories. Upon completion the inspector takes a paint chip sample of each noted area and paint down to the substrate. This is to ensure that all layers of paint are tested. When this is done, the sample is placed in an individual container with a unique sample number denoting the building and sample number. At the same time, the inspector fills out a log giving the sample number, color, physical description of the substrate, and the building and what area it was extracted from. Also, the inspector plots the sample on a diagram. The inspector then transports the samples and log to an accredited laboratory along with a chain of custody form that are signed by both the inspector and the laboratory. The laboratory analyzed it by Atomic Absorption Spectrometry (AAS).

When the results from the laboratory are given, a sample log is created and a positive material log is prepared for the report. The positive samples are also plotted on a CAD drawing of the building(s).

QUANTIFICATION

Quantities of accessible and/or exposed building materials that were suspected of containing asbestos were estimated. This estimation was performed by taking approximate measurements in the field and/or estimating quantities based on drawings provided by the client. Materials such as pipe insulation and associated mudded joint packing (MJP) were categorized according to the outside diameter of the insulation. Pipe lagging was quantified by linear footage while the actual numbers of MJPs were counted. Insulation on mechanical equipment such as boilers and ductwork were quantified by the square footage of the surface area of suspect insulation. Similarly, fireproofing, plasters, ceiling and floor tiles, and transite panels were measured in square feet of surface area.

Quantities are estimated and should be confirmed by an engineering survey if renovation or demolition is contemplated. The level of detail provided by an engineering survey, which is required for a construction estimate, is beyond the scope of this survey.

LABORATORY METHODOLOGY

Method of Analysis (Asbestos)

Analysis was performed by using the bulk sample for visual observation and slide preparation(s) for microscopic examination and identification. The samples were mounted on slides and then analyzed for asbestos (chrysotile, amosite, crocidolite, anthophyllite, and actinolite/tremolite), fibrous non-asbestos constituents (mineral wool, paper, etc.), and non-fibrous constituents. Asbestos was identified by refractive indices, morphology, color, pleochroism, birefringence, extinction characteristics, and signs of elongation. The same characteristics were used to identify the non-asbestos constituents.

The microscopist visually estimated relative amounts of each constituent by determining the volume of each constituent in proportion to the total volume of the sample, using a stereoscope.

Method of Analysis (Lead)

Atomic Absorption Spectroscopy (AAS)
A wide variety of inorganic elements and matrices are analyzed by atomic absorption spectroscopy (AAS). AAS is the method of choice for precise quantitative determination of single elements in air, water, soil, paint and other matrices. The laboratory's primary instruments are equipped with flame and graphite furnace analytical capability. Flame analysis is suitable for most analytes and matrices including paint, wipes, soils, and air samples. Graphite furnace procedures dramatically decrease detection limits and are appropriate when testing lead in drinking eater and personal air monitoring samples. The laboratory also maintains a mercury analyzer with excellent detection limits for mercury in variety of matrices.

Laboratory Quality Control Program

LA Testing Environmental Laboratory, a licensed (NVLAP# 200232-0) a licensed California State Laboratory, maintains an in-house quality control program that consists of blind reanalysis of ten percent of all samples. There is also voluntary quality control reanalysis and mandatory source material dependent quality control reanalysis for sample types that are particularly difficult to analyze.

REPORT FORMAT

The laboratory results were analyzed and the results presented using the H2 Environmental management program and are presented in the analytical results section of this report. Since the results are oriented to data only, a short explanation of each element contained therein is given below. It explains the content of each data column and its relationship with other items on the page.

ASBESTOS

Report Number - This line represents the assigned laboratory report number for each particular set of samples submitted to the laboratory.

Client Identification (sample number) - This column represents the homogenous material number followed by the field sample number assigned in the field.

Area Sampled - This column describes the area where the actual sample was collected as described by the inspector at the time of the survey.

Type of Material - This column describes the material submitted and analyzed.

Asbestos Results (type & percent) - This column provides the specific type of asbestos found in each sample.

Composition - This column provides a description of the materials found during the analytical process that was not found to be asbestos (i.e. binders, other fibrous materials, etc.)

LEAD

Material Number - This line represents the assigned laboratory report number for each particular set of samples submitted to the laboratory.

Area Sampled - This column describes the area where the actual sample was collected as described by the inspector at the time of the survey.

Substrate - This column describes the material submitted and analyzed.

Lead Results – Lead Containing Paint or Ceramic Tiles is defined as paint, tile or other surface coatings, that contain an amount of lead that is greater than or equal to:

1.0 mg/cm^2 By XRF Method

Sampled Building Materials – Section 1 *Survey Summary*

Homogeneous Material Number - This number is the field sample number.

Material Description – Indicates size and type of suspect sampled material.

Location(s) of Material - This column provides the general location of the suspect material.

F/NF - Describes whether the material is friable or non-friable.

Condition – Indicates current appearance of the material during the inspection.

% ACM – Percentage of Asbestos found after analysis.

Samp. – Number of samples taken.

Quantity – Square or linear measurement of suspect materials sampled.

APPENDIX 4

WARRANTY

WARRANTY

H2 Environmental Consulting Services warrants that the findings contained herein have been promulgated in general accordance with accepted professional practices at the time of its preparation as applied by professionals in the community. Changes in the state of the art or in applicable regulations cannot be anticipated and have not been addressed in this report.

The field and laboratory results reported herein are considered sufficient in detail and scope to determine the presence, condition and hazard potential of accessible and/or exposed suspect asbestos/lead containing building materials on the property at the time of inspection. Test results are valid only for the material tested.

There is a possibility that conditions may exist which could not be identified within the scope of the survey or which were not apparent during the site visit.

This inspection covered only those areas, which were exposed and/or physically accessible to the inspector as outlined by the scope of work. The study is also limited to the information available from the client at the time it was conducted.

No other warranties are implied or expressed.

H2 ENVIRONMENTAL

South Orange County Community College District
Special Annex & Classroom Complex
Building Specifications
28000 Marguerite Pkwy.
Mission Viejo, CA 92692
Project # 1282110 AS

Prepared By:
H2 Environmental Consulting Services, Inc.
800-524-3578

DIVISION 1 - GENERAL REQUIREMENTS

01013	Summary of Work - Asbestos Abatement
01043	Project Coordination - Asbestos Abatement
01046	Cutting & Patching - Asbestos-Containing Materials
01091	Definitions and Standards - Asbestos Abatement
01092	Codes, Regulations, and Standards - Asbestos Abatement
01220	Project Meetings
01301	Submittals
01410	Air Monitoring - Test Laboratory Services
01503	Temporary Facilities - Asbestos Abatement
01513	Temporary Negative Pressure & Air Circulation System
01526	Temporary Enclosures
01560	Worker Protection - Asbestos Abatement
01562	Respiratory Protection
01563	Decontamination Units
01601	Materials and Equipment - Asbestos Abatement
01632	Product Substitutions - Asbestos Abatement
01701	Project Closeout- Asbestos Abatement
01711	Project Decontamination
01712	Cleaning & Decontamination Procedures
01714	Work Area Clearance

DIVISION 2 - SITE WORK

02081	Removal of Asbestos-Containing Materials
02084	Disposal of Asbestos-Containing Waste Material

DIVISION 3 - GENERAL REQUIREMENTS

03810	Inorganic Lead Specification

SECTION 01013

SUMMARY OF WORK-ASBESTOS ABATEMENT

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings, general provisions of Contract, including General and Supplementary Conditions, and other Division-1 Specification Sections, apply to work of this section.

1.2 PROJECT/WORK IDENTIFICATION

1.2.1 General: Project name is, ***South Orange County Community College District Special Annex & Classroom Complex Building's, 28000 Marguerite Pkwy., Mission Viejo,* CA 92692** as shown on Contract Documents prepared by Owner's Representative, H2 Environmental Consulting Services, and Specifications are dated February 19th, 2008.

1.2.2 Contract Documents: Indicate the work of the Contract and related requirements and conditions that have an impact on the project. Related requirements and conditions that are indicated on the Contract Documents include, but are not necessarily limited to the following:

A. Applicable codes and regulations.
B. Notices and permits.
C. Existing site conditions and restrictions on use of the site.
D. Work performed prior to work under this Contract.
E. Alterations and coordination with existing work.
F. Work to be performed concurrently by the Owner.
G. Work to be performed concurrently by separate contractors.
H. Work to be performed subsequent to work under this Contract.
I. Requirements for partial Owner occupancy prior to substantial completion of the Contract Work.

1.2.3 Abbreviated Written Summary: Briefly and without force and effect upon the contract documents, the work of the Contract can be summarized as follows:

A. The work includes the removal of asbestos-containing materials according to the requirements of the following specification sections in the sequence indicated:

Special Annex Building

Asbestos Containing Material	Location	Quantity*	Section Number
Brown Cove Base Glue	Throughout Building	79 SF	02081
4" Brown Cove Base Associated With Cove Base Glue (ACM)	Throughout Building	79 SF	02081
White/Tan Exterior Skim Coat	Throughout Exterior of Building	4,000 SF	02081
Red/Black Ext. Window Mastic	Throughout Building	60 SF	02081
Roof Mastic	Throughout Building	160 SF	02081
Mastic Behind Chalkboard	Assume	Unknown Qty.	02081

SECTION 01013

SUMMARY OF WORK-ASBESTOS ABATEMENT

Classroom Complex Building

Asbestos Containing Material	Location	Quantity	Section Number
Mastic Behind Chalkboard	Assume	Unknown Qty.	02081

* Quantities are approximate it is the contractor's responsibility to verify these quantities prior to submitting a proposal.

1.1 OTHER HAZARDOUS MATERIALS

1.1.1 Recommendations For Removal And Disposal

A. H2 Environmental observed hazardous materials that may be impacted during the scheduled demolition activities. Those materials should be removed by a hazardous waste removal contractor under the guidelines as defined by Local, State, and Federal regulations prior to the start of demolition activities.

These items include: **PCB's, Mercury Vapor Light Tubes and T-Stats, Freon, (HID) High Intensity Discharge, Stored Cleaning Chemicals** and miscellaneous. other items.

- **Stored cleaning chemicals to be removed by owner prior to the start of demolition activities.**
-

Special Annex Building

Hazardous Materials	Location	Quantity
Fluorescent Light Tubes / Mercury	Throughout Building	116
Ballasts / PCB	Throughout Building	58
Thermostat / Mercury	Throughout Building	1
Air Conditioning Units/Freon	Throughout Exterior of Building/Roof	7
Fire Extinguisher/Pressurized	Throughout Building	2
Outside Lighting/HID/Mercury	Throughout Exterior of Building	6
Electronics/E-waste/Mercury/Lead	Throughout Building	Unknown Qty.

Classroom Complex Building

Hazardous Materials	Location	Quantity
Fluorescent Light Tubes / Mercury	Throughout Building	260
Ballasts / PCB	Throughout Building	130
Transformer	Exterior of Building	1
Air Conditioning Units/Freon	Throughout Roof	10
Fire Extinguisher/Pressurized	Throughout Building	1
Outside Lighting/HID/Mercury	Throughout Exterior of Building	10
Electronics/E-waste/Mercury/Lead	Throughout Building	Unknown Qty.

1.2.4 General and Administrative Requirements: Are set forth in the following specification sections:

A. Summary of the Work - Asbestos Abatement
B. Project Coordination - Asbestos Abatement
C. Definitions and Standards - Asbestos Abatement
D. Submittals
E. Materials and Equipment - Asbestos Abatement
F. Product Substitutions
G. Project Closeout - Asbestos Abatement

1.2.5 Abatement Work: Requirements are set forth in the following specification sections, listed here according to the sequence of the work:

A. 01092 Codes, Regulations and Standards - Asbestos Abatement: sets forth governmental regulations and industry standards which are included and incorporated herein by reference and made a part of the specification. This section also sets forth those notices and permits which are known to the Owner and which either must be applied for and received, or which must be given to governmental agencies before start of work.

B. 01503 Temporary Facilities - Asbestos Abatement: sets forth the support facilities needed such as electrical and plumbing connections for the decontamination unit and office space for the Project Administrator.

C. 01526 Temporary Enclosures: details the requirements for the sheet plastic barriers isolating the work area from the balance of the building.

D. 01410 Test Laboratory Services: describes air monitoring by Owner so that the building beyond the work area will remain uncontaminated. Air monitoring to determine required respiratory protection is the responsibility of the Contractor.

E. 01563 Decontamination Units: explains the setup and operation of the personnel and material decontamination units.

F. 01513 Negative Pressure System: sets forth the procedures to set up pressure differential isolation and ventilation of the work area.

G. 01560 Worker Protection - Asbestos Abatement: describes the equipment and procedures for protecting workers against asbestos contamination and other workplace hazards except for respiratory protection.

H. 01562 Respiratory Protection: sets forth the procedures and equipment required for adequate protection against inhalation of airborne asbestos fibers.

1.2.6 Asbestos Removal Work Procedures: Are described in the following specification sections:

A. 01046 - Cutting and Patching - Asbestos-Containing Materials
B. 02063 - Demolition of Asbestos-Contaminated Materials
C. 02081 - Removal of Asbestos-Containing Materials
D. 02082 - Removal of Asbestos-Contaminated Soil
E. 02083 - Disposal of Asbestos Containing Waste Material
F. 02084 - Removal of Interior Non-Friable Asbestos-Containing Materials

1.2.7 Decontamination of the Work Area: After completion of abatement work is described in the following sections:

A. 01712 Cleaning and Decontamination Procedures: sets forth procedures to be used on contaminated objects and rooms which are not part of an abatement work area.

B. 01711 Project Decontamination: describes the sequence of cleaning and decontamination procedures to be followed during removal of the sheet plastic barriers isolating a work area.

C. 01714 Work Area Clearance: describes the analytical methods used to determine if the work area has been successfully cleaned of contamination.

D. 01701 Project Closeout: details the closeout procedures to end the project once abatement work is complete including final paperwork requirements.

1.3 PLAN OF ACTION

1.3.1 At pre-construction conference, submit a detailed plan of the procedures proposed for use in complying with the requirements of this specification. Include in the plan the location and layout of decontamination areas, the sequencing of asbestos work, the interface of trades involved in the performance of work, methods to be used to assure the safety of building occupants and visitors to the site, disposal plan including location of approved disposal site, and a detailed description of the methods to be employed to control pollution. Expand upon the use of portable HEPA ventilation system, closing out of the building's HVAC system, method of removal to prohibit visible emissions in work area, and packaging of removed asbestos debris. The plan must be approved by the Owner's Representative prior to commencement of work.

1.4 INSPECTION

1.4.1 Prior to commencement of work: Inspect areas in which work will be performed. Prepare a listing of damage to structure, surfaces and finishes, equipment or of surrounding properties which could be misconstrued as damage resulting from the work. Photograph or videotape existing conditions as necessary to document conditions. Submit to Owner's Representative prior to starting work.

1.5 POTENTIAL ASBESTOS HAZARD

1.5.1 The disturbance or dislocation of asbestos-containing materials may cause asbestos fibers to be released into the building's atmosphere, thereby creating a potential health hazard to workmen and building occupants. Apprise all workers, supervisory personnel, subcontractors and consultants who will be at the job site of the seriousness of the hazard and of proper work procedures which must be followed.

1.5.2 Where in the performance of the work, workers, supervisory personnel, subcontractors, or consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified asbestos-containing materials, take appropriate continuous measures as necessary to protect all building occupants from the potential hazard of exposure to airborne asbestos. Such measures shall include the procedures and methods described herein, and compliance with regulations of applicable federal, state, and local agencies.

1.6 STOP WORK

1.6.1 If the Owner or the Project Administrator presents a written stop work order immediately and automatically stop all work. Do not recommence work until authorized in writing by Owner's Representative.

1.7 CONTRACTOR USE OF PREMISES

1.7.1 General: The Contractor shall limit his use of the premises to the work and area indicated, so as to allow for Owner occupancy and use by the public.

1.7.2 Use of the Site: Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project construction.

A. Keep existing driveways and entrances serving the premises clear and available to the Owner and his employees at all times. Do not use these areas for parking or storage of materials.

B. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated. If additional storage is necessary obtain and pay for such storage off site.

C. Lock automotive type vehicles, such as passenger cars and trucks and other mechanized or motorized construction equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such

vehicles or equipment unattended with the motor running or the ignition key in place or accessible to unauthorized persons.

1.7.3 Contractor's Use of the Existing Building: Maintain existing building in a safe and weathertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.

A. Keep public areas such as hallways, stairs, elevator lobbies and toilet rooms free from accumulation of waste, rubbish or construction debris.

B. Smoking or open fires will not be permitted within the building enclosure or on the premises.

C. Except for Toilet Rooms designated by Owner at Pre Construction Meeting use of existing toilets within the building, by the Contractor and his personnel, will not be permitted.

1.8 OWNER OCCUPANCY

1.8.1 Full Owner Occupancy: The Owner will occupy the site and the existing building during the entire period of construction. Cooperate fully with the Owner or his representative during construction operations to minimize conflicts and to facilitate Owner usage. Perform the work so as not to interfere with the Owner's operation.

1.9 SUBMITTALS FOR SUMMARY OF WORK

1.9.1 Before the Start of Work: Submit the following to the Owner's Representative for review. Do not begin work until these submittals are returned with Owner's Representative's action stamp indicating that the submittal is returned for unrestricted use or final-but-restricted use.

1.9.2 Plan of Action: Submit as a written report in the same manner as product data.

1.9.3 Inspection: Report on inspection carried out as required by this section. Include copies of all photographs, video tapes, etc. Submit in the same manner as product data.

2 PART 2 - PRODUCTS (Not Applicable)

3 PART 3 - EXECUTION (Not Applicable)

END OF SECTION - 01013

SECTION 01043

PROJECT COORDINATION-ASBESTOS ABATMENT

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this section.

1.2 SUMMARY

1.2.1 This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:

A. Administrative and supervisory personnel
B. Progress Meetings
C. Pre-Construction Conference
D. Daily Log
E. Special Reports
F. Contingency Plans
G. Notifications to other entities at job site

1.2.2 Requirements for the Contractor's Construction Schedule are included in Section 1301 "Submittals".

1.3 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

1.3.1 General Superintendent: Provide a full-time General Superintendent who is experienced in administration and supervision of asbestos abatement projects including work practices, protective measures for building and personnel, disposal procedures, etc. This person is the Contractors Representative responsible for compliance with all applicable federal, state and local laws and regulations, particularly those relating to asbestos-containing materials.

1.3.2 Experience and Accreditation: The General Superintendent is to be accredited as an Asbestos Abatement Supervisor in accordance with the AHERA regulation 40 CFR 763, Subpart E, Appendix C, and have had a minimum of two (2) years on-the-job training in asbestos abatement procedures.

1.3.3 Competent Person: The General Superintendent is to be a Competent Person as required by OSHA in 29 CFR 1926.1101. The superintendent must be present at all times when response actions are being performed. In the absence of the superintendent, the Contractor shall designate a similarly qualified individual who will perform all required project superintendent duties. The project superintendent shall remain until the project is complete; if removed from the job, contractor shall notify Owner immediately.

1.4 PROGRESS MEETINGS

1.4.1 General: In addition to specific coordination and pre-installation meetings for each element of work, and other regular project meetings held for other purposes, Owner's Representative will hold general progress meetings as required. These

meetings will be scheduled, where possible, at time of preparation of payment request. Require each entity then involved in planning, coordination or performance of work to be properly represented at each meeting.

1.5 PRE-CONSTRUCTION CONFERENCE

1.5.1 An initial progress meeting, recognized as "Pre-Construction Conference" will be convened by the Owner's Representative prior to start of any work. Meet at project site, or as otherwise directed with General Superintendent, Owner, Owner's Representative, Project Administrator, and other entities concerned with the asbestos abatement work.

1.5.2 72 hours advance notice will be provided to all participants prior to convening Pre-Construction Conference.

1.5.3 This is an organizational meeting, to review responsibilities and personnel assignments and to locate the containment and decontamination areas and temporary facilities including power, light, water, etc.

1.6 DAILY LOG

1.6.1 Daily Log: Maintain within Clean Room of the Decontamination Unit a daily log documenting the dates and time of but not limited to, the following items:

1.6.2 Meetings; purpose, attendees, brief discussion.

1.6.3 Visitations; authorized and unauthorized.

1.6.4 Personnel; by name, entering and leaving the work area.

1.6.5 Special or unusual events, i.e., barrier breaching, equipment failures, accidents.

1.6.6 Air monitoring tests and test results

1.6.7 Documentation of Contractor's completion of the following:

A. Inspection of work area preparation prior to start of removal and daily thereafter

B. Removal of any sheet plastic barriers

C. Contractor's inspections prior to spray back, lock back, encapsulation, enclosure or any other operation that will conceal the condition of asbestos-containing materials or the substrate from which such materials have been removed

D. Removal of waste materials from work area

E. Decontamination of equipment (list items)

F. Contractor's final inspection/final air test analysis.

1.6.8 Provide two (2) copies of this log to Project Administrator on a daily basis.

1.6.9 Submit copies of this log at final closeout of project as a project close-out submittal.

1.7 SPECIAL REPORTS

1.7.1 General: Except as otherwise indicated, submit Special Reports directly to Owner within one day of occurrence requiring Special Report, with copy to Owner's Representative and others affected by occurrence. This requirement is separate from any change order procedures. Compliance with change order procedures is required regardless of any reports proposed pursuant to this section.

1.7.2 Reporting Unusual Events: When an event of unusual and significant nature occurs at site (examples: failure of negative pressure system, rupture of temporary enclosures), prepare and submit a Special Report listing chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. When such events are known or predictable in advance, advise Owner in advance at earliest possible date.

1.7.3 Reporting Accidents: Prepare and submit Special Reports of significant accidents, at site and anywhere else work is in progress. Record and document data and actions; comply with industry standards. For this purpose, a significant accident is defined to include events where personal injury is sustained, property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

1.7.4 Report Discovered Conditions:

A. When an unusual condition of the building is discovered during the work (e.g. leaks, termites, corrosion) prepare and submit a Special Report indication condition discovered.

B. Where suspect asbestos-containing materials not otherwise described in the specifications are discovered, prepare, and submit a Special Report.

1.8 CONTINGENCY PLAN

1.8.1 Contingency Plan: Prepare a contingency plan for emergencies including fire, accident, power failure, negative pressure system failure, supplied air system failure, or any other event that may require modification or abridgement of decontamination or work area isolation procedures. Include in plan specific procedures for decontamination or work area isolation. Note that nothing in this specification should impede safe exiting or providing of adequate medical attention in the event of an emergency.

1.8.2 Post: in clean room of Personnel Decontamination Unit telephone numbers and locations of emergency services including but not limited to fire, ambulance, doctor, hospital, police, power company, Telephone Company.

1.9 NOTIFICATIONS

1.9.1 Notify other entities at the job site in compliance with 29 CFR 1926.1101 of the nature of the asbestos abatement activities, of the existence of and requirements pertaining to regulated areas, of the measures taken to ensure that these entities are not exposed to asbestos, and any other requirements relative to asbestos set forth in these specifications and applicable regulations.

1.9.2 Notify emergency service agencies including fire, ambulance, police or other agency that may service the abatement work site in case of an emergency. Notification is to include methods of entering work area, emergency entry and exit locations, modifications to fire notification or fire fighting equipment, and other information needed by agencies providing emergency services.

1.9.3 Notifications of Emergency: Any individual at the job site may notify emergency service agencies if necessary without effect on this Contract or the Contract Sum.

1.10 SUBMITTALS RELATIVE TO PROJECT COORDINATION

1.10.1 Before the Start of Work: Submit the following to the Owner's Representative for review. No work shall begin until these submittals are returned with Owner's Representative's approval indicating that the submittal is returned for unrestricted use or final-but-restricted use.

1.10.2 Contingency Plans: for emergency actions.

1.10.3 Telephone Numbers: and location of emergency services.

1.10.4 Notifications: sent to other entities at the work site.

1.10.5 Notifications: sent to emergency service agencies.

1.10.6 Resume: of General Superintendent.

1.10.7 Accreditation: submit evidence in form of training course certificate of accreditation of General Superintendent as an asbestos abatement supervisor.

1.10.8 Staff Names: Within 5 days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list addresses and telephone numbers of key personnel.

2 PART 2 - PRODUCTS (Not Applicable)

3 PART 3 - EXECUTION (Non-Applicable)

END OF SECTION - 01043

SECTION 01046

CUTTING & PATCHING-ASBESTOS-CONTAINING MATERIALS

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division - 1 Specification Sections, apply to work of this section.

1.2 SUBMITTALS

1.2.1 Before the Start of Work: Submit the following to the Owner's Representative for review. Begin no work until these submittals are returned with Owner's Representative's approval indicating that the submittal is returned for unrestricted use or final-but-restricted use.

1.2.2 Tools: Equipped with HEPA vacuum dust collection attachments.

2 PART 2 - PRODUCTS

2.1.1 Provide local exhaust ventilation systems that comply with ANSI 29.2-1971.

3 PART 3 - EXECUTION

3.1.1 Before beginning work of this section, comply with:

A. Section 01503 - Temporary Facilities - Asbestos Abatement
B. Section 01513 - Negative Pressure and Air Circulation System
C. Section 01526 - Temporary Enclosures
D. Section 01560 - Worker Protection - Asbestos Abatement
E. Section 01562 - Respiratory Protection
F. Section 01563 - Decontamination Units

3.1.2 Perform cutting, drilling, abrading, or otherwise penetrating any asbestos-containing material in a manner that will minimize the dispersal of asbestos fibers into the air.

3.1.3 Provide adequate local exhaust to capture fibers produced by cutting, drilling, or abrading by means of an approved High Efficiency Particulate Absolute (HEPA) filter vacuum. Use specialized equipment such as drills or saws having integral ventilation hoods which are connected to a HEPA vacuum with a flexible hose. Handle and dispose of HEPA filters as contaminated material. See Section 02084.

3.1.4 Thoroughly saturate absorbent surfaces of asbestos-containing material to be penetrated with a penetrating type encapsulant. Allow encapsulant to penetrate to substrate before working on materials.

3.1.5 Seal edges of asbestos-containing material exposed by cutting, drilling, or abrading, etc. with two (2) coats of an approved penetrating encapsulant applied in accordance with manufacturers' printed instruction for use of the encapsulant as an asbestos coating.

END OF SECTION - 01046

SECTION 01091

DEFINITIONS AND STANDARDS-ASBESTOS ABATEMENT

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

1.2.1 General Explanation: A substantial amount of specification language constitutes definitions for terms found in other contract documents, including the drawings. (Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated thereon.) Certain terms used in Contract Documents are defined in this article.

1.3 DEFINITIONS

1.3.1 General: Definitions contained in this Article are not necessarily complete, but are general to the extent that they are not defined more explicitly elsewhere in the Contract Documents.

1.3.2 Indicated: This term refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in Specifications, and similar requirements in Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help locate the reference; no limitation on location is intended except as specifically noted.

1.3.3 Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by the Owner's Representative", "requested by the "Owner's Representative", and similar phrases. However, no implied meaning shall be interpreted to extend the Owner's Representative's responsibility into the Contractor's area of construction supervision.

1.3.4 Approve: The term "approved," where used in conjunction with the Owner's Representative's action on the Contractor's submittals, applications, and requests, is limited to the responsibilities and duties of the Architect stated in General and Supplementary Conditions. Such approval shall not release the Contractor from responsibility to fulfill Contract Document requirements, unless otherwise provided in the Contract Documents.

1.3.5 Regulation: The term "Regulations" includes laws, statutes, ordinances, patents, royalties and lawful orders issued by authorities having jurisdiction, as well as rules, conventions and agreements within the construction industry that control performance of the Work, whether they are lawfully imposed by authorities having jurisdiction or not.

1.3.6 Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations."

1.3.7 Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying,

working to dimension, finishing, curing, and protecting, cleaning and similar operations."

1.3.8 Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

1.3.9 Installer: An "Installer" is an entity engaged by the Contractor, either as an employee, subcontractor or sub-subcontractor for performance of a particular construction activity, including installation, erection, application and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1.3.10 Project Site is the space available to the Contractor for performance of the work, either exclusively or in conjunction with others performing other construction as part of the project.

1.3.11 Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, both at the project site or elsewhere, and to report on, and, if required, to interpret results of those inspections or tests.

1.3.12 Owner's Representative: This is the entity described as the "Architect" in AIA Document A201 "General Conditions of the Contract for Construction," or is the entity described as "Engineer" in Engineers Joint Contract Document Committee (EJCDC) Document 1910-8 "Standard General Conditions of the Construction Contract." All references to Architect or Engineer in the Contract Documents in all cases refer to the Owner's Representative. The Owner's Representative will represent the Owner during construction and until final payment is due. The Owner's Representative will advise and consult with the Owner. The Owner's instructions to the Contractor will be forwarded through the Owner's Representative.

1.3.13 Project Administrator: This is the entity described as the "Project Representative" in AIA Document A201 "General Conditions of the Contract for Construction," or is the entity described as "Engineer" in Engineers Joint Contract Document Committee (EJCDC) Document 1910-8 "Standard General Conditions of the Construction Contract." The Project Administrator is a full time representative of the Owner at the job site with authority to stop the work upon verbal order if requirements of the Contract Documents are not met, or if in the sole judgment of the Project Administrator, Owner's Representative, Owner, the interests of the Owner, safety of any person or the Owner's property are jeopardized by the work. The Project Administrator is different from the position of Owner's Representative as used in these documents, the latter having more limited authority in general and specifically not having authority to stop the work.

1.3.14 General Superintendent: This is the Contractor's Representative at the work site. This person will generally be the Competent Person required by OSHA in 29 CFR 1926.

1.4 DEFINITIONS RELATIVE TO ASBESTOS ABATEMENT

1.4.1 Accredited or Accreditation: (when referring to a person or laboratory): A person or laboratory accredited in accordance with section 206 of Title II of the Toxic Substances Control Act (TSCA).

1.4.2 Aerosol: A system consisting of particles, solid or liquid, suspended in air.

1.4.3 Air Cell: Insulation normally used on pipes and duct work that is comprised of corrugated cardboard which is frequently comprised of asbestos combined with cellulose or refractory binders.

1.4.4 Air Monitoring: The process of measuring the fiber content of a specific volume of air.

1.4.5 Amended Water: Water to which a surfactant has been added to increase the ability of the liquid to penetrate ACM.

1.4.6 Asbestos: The asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite.

1.4.7 Asbestos-Containing Material (ACM): Any material containing more than one percent asbestos of any type or mixture of types.

1.4.8 Asbestos-Containing Building Material (ACBM): Surfacing ACM, thermal system insulation ACM, or miscellaneous ACM that is found in or on interior structural members or other parts of a building.

1.4.9 Asbestos-Containing Waste Material: Any material which is or is suspected of being or any material contaminated with an asbestos-containing material which is to be removed from a work area for disposal.

1.4.10 Asbestos debris: Pieces of ACBM that can be identified by color, texture, or composition, or means dust, if the dust is determined by an accredited inspector to be ACM.

1.4.11 Authorized Visitor: The Owner, the Owner's Representative, testing lab personnel, the Architect/Engineer, emergency personnel or a representative of any federal, state and local regulatory or other agency having authority over the project.

1.4.12 Barrier: Any surface that seals off the work area to inhibit the movement of fibers.

1.4.13 Breathing Zone: A hemisphere forward of the shoulders with a radius of approximately 6 to 9 inches.

1.4.14 Ceiling Concentration: The concentration of an airborne substance that shall not be exceeded.

1.4.15 Certified Industrial Hygienist (C.I.H.): An industrial hygienist certified in Comprehensive Practice by the American Board of Industrial Hygiene.

1.4.16 Class I Asbestos Work: Activities involving the removal of TSI and surfacing ACM or PACM.

1.4.17 Class II Asbestos Work: Activities involving the removal of ACM which is not TSI or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.

1.4.18 Competent Person: One who meets the definition in 29 CFR 1926.32(f) and is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take

prompt corrective measures to eliminate them, and is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan for project designer or supervisor.

1.4.19 Critical Barriers: One or more layers of plastic sealed over all openings into a work area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a work area from migrating to an adjacent area.

1.4.20 Decontamination Area: An enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for decontamination of workers, materials and equipment that are contaminated with asbestos.

1.4.21 Demolition: The wrecking or taking out of any building component, system, finish or assembly of a facility together with any related handling operations.

1.4.22 Disposal Bag: A 6 mil thick leak-tight plastic bag, properly marked with the OSHA Asbestos DANGER legend, used for transporting asbestos waste from work and to disposal site.

1.4.23 Encapsulant: A material that surrounds or embeds asbestos fibers in an adhesive matrix, to prevent release of fibers.

1.4.24 Bridging encapsulant: an encapsulant that forms a discrete layer on the surface of an in situ asbestos matrix.

1.4.25 Penetrating encapsulant: an encapsulant that is absorbed by the in situ asbestos matrix without leaving a discrete surface layer.

1.4.26 Removal encapsulant: a penetrating encapsulant specifically designed to minimize fiber release during removal of asbestos-containing materials rather than for in situ encapsulation.

1.4.27 Encapsulation: Treatment of asbestos-containing materials, with an encapsulant.

1.4.28 Enclosure: The construction of an air-tight, impermeable, permanent barrier around asbestos-containing material to control the release of asbestos fibers into the air.

1.4.29 Filter: A media component used in respirators to remove solid or liquid particles from the inspired air.

1.4.30 Friable Asbestos Material: Material that contains asbestos and that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

1.4.31 Glovebag: An impervious plastic bag-like enclosure affixed around ACM with glove-like appendages through which materials and tools may be handled.

1.4.32 HEPA Filter: A High Efficiency Particulate Air (HEPA) filter capable of trapping and retaining 99.97% of asbestos fibers greater than 0.3 microns in diameter.

1.4.33 HEPA Filter Vacuum Collection Equipment (or vacuum cleaner): High efficiency particulate air filtered vacuum collection equipment with a filter system capable of collecting and retaining asbestos fibers. Filters should be of 99.97% efficiency for retaining fibers of 0.3 microns or larger.

1.4.34 High-efficiency particulate air filter: (HEPA) refers to a filtering system capable of trapping and retaining 99.97 percent of all monodispersed particles 0.3 um in diameter or larger.

1.4.35 Negative Pressure Respirator: A respirator in which the air pressure inside the respiratory-inlet covering is positive during exhalation in relation to the air pressure of the outside atmosphere and negative during inhalation in relation to the air pressure of the outside atmosphere.

1.4.36 Negative Initial Exposure Assessment: A demonstration by the contractor which complies with the criteria specified in 29 CFR 1926.1101 that employee exposure during an operation is expected to be consistently below the PELs.

1.4.37 Negative Pressure System: A pressure differential and ventilation system, consisting of a local exhaust system, utilizing HEPA filtration capable of maintaining a pressure differential with the inside of the Work Area at a lower pressure than any adjacent area, and which cleans re-circulated air or generates a constant air flow from adjacent areas into the Work Area.

1.4.38 Personal Monitoring: Sampling of the asbestos fiber concentrations within the breathing zone of an employee.

1.4.39 Permissible Exposure Limits (PELs): Not in excess of 0.1 f/cc airborne asbestos fiber concentration as a 8-hour time weighted average (TWA) or 1.0 f/cc over a sampling period of 30 minutes as measured by NIOSH method 7400.

1.4.40 Presumed Asbestos-Containing Material (PACM): Thermal system insulation and surfacing material found in buildings constructed no later than 1980.

1.4.41 Protection Factor: The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the wearer. The protection factor is a measure of the degree of protection provided by a respirator to the wearer.

1.4.42 Repair: Returning damaged ACBM to an undamaged condition or to an intact state so as to prevent fiber release.

1.4.43 Regulated Area: An area established to demarcate areas where Class I, II, and III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work accumulate; and a work area within which airborne concentrations of asbestos exceed or there is a reasonable possibility they may exceed the permissible exposure limit.

1.4.44 Respirator: A device designed to protect the wearer from the inhalation of harmful atmospheres.

1.4.45 Surfacing Material: Material that is sprayed, troweled-on or otherwise applied to surfaces.

1.4.46 Surfactant: A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.

1.4.47 Thermal System Insulation (TSI): ACM applied to pipes, fittings, boilers, breeching, tanks, ducts or other structural components to prevent heat loss or gain.

1.4.48 Time Weighted Average (TWA): The average concentration of a contaminant in air during a specific time period.

1.4.49 Visible Emissions: Any emissions containing particulate asbestos material that are visually detectable without the aid of instruments. This does not include condensed uncombined water vapor.

1.4.50 Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning utensils which have been dampened with amended water or diluted removal encapsulant and afterwards thoroughly decontaminated or disposed of as asbestos-contaminated waste.

1.4.51 Work Area: The area where asbestos-related work or removal operations are performed which is defined and/or isolated to prevent the spread of asbestos dust, fibers or debris, and entry by unauthorized personnel. Work area is a Regulated Area as defined by 29 CFR 1926.

1.5 SPECIFICATION FORMAT AND CONTENT EXPLANATION

1.5.1 This Article is provided to help the user of these Specifications understand the format, language, implied requirements, and similar conventions. None of the explanations shall be interpreted to modify the substance of Contract requirements.

1.5.2 Specification Format: These Specifications are organized into Divisions, Sections or Trade Headings based on the Construction Specifications Institute's 16-Division format and the MASTERFORMAT numbering system. This organization conforms generally to recognized construction industry practice.

1.5.3 Specification Content: This Specification has been produced employing conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

A. Language used in the Specifications and other Contract Documents is the abbreviated type. Implied words and meanings will be appropriately interpreted. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and where the full context of the Contract Documents so indicates.

B. Imperative language is used generally in the Specifications. Requirements expressed imperatively are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities which must be fulfilled indirectly by the Contractor, or by others when so noted.

1.5.4 Assignment of Specialists: The Specification requires that certain specific construction activities shall be performed by specialists who are recognized experts in the operations to be performed. The specialists must be engaged for those activities, and the assignments are requirements over which the Contractor has no choice or option. Nevertheless, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.

1.5.5 This requirement should not be interpreted to conflict with enforcement of building codes or regulations governing the work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.

1.5.6 Trades: Use of titles such as "carpentry" is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

1.6 INDUSTRY STANDARDS

1.6.1 Applicability of Standards: Except where Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into Contract Documents. Such standards are made a part of the Contract Documents by reference. Individual Sections indicate which codes and standards the Contractor must keep available at the Project Site for reference.

1.6.2 Referenced industry standards take precedence over standards that are not referenced but recognized in the construction industry as applicable.

1.6.3 Unreferenced industry standards are not directly applicable to the work, except as a general requirement of whether the work complies with recognized construction industry standards.

1.6.4 Publication Dates: Where compliance with an industry standard is required, comply with standard in effect as of date of execution of the work.

1.6.5 Updated Standards: At the request of the Owner's Representative, Contractor may submit a Change Order proposal where applicable code or standard has been revised and reissued after the date of the Contract Documents and before performance of Work affected. The Owner's Representative will decide whether to issue a Change Order to proceed with the updated standard.

1.6.6 Conflicting Requirements: Where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Owner's Representative for a decision before proceeding.

1.6.7 Minimum Quantities or Quality Levels: In every instance the quantity or quality level shown or specified shall be the minimum to be provided or performed. The actual installation may comply exactly, within specified tolerances, with the minimum quantity or quality specified, or it may exceed that minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum values, as noted, as appropriate for the context of the requirements. Refer instances of uncertainty to the Owner's Representative for decision before proceeding.

1.6.8 Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entities' construction activity. Copies of applicable standards are not bound with the Contract Documents.

A. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.

B. Although copies of standards needed for enforcement of requirements may be part of required submittals, the Owner's Representative reserves the right to require the Contractor to submit additional copies as necessary for enforcement of requirements.

1.6.9 Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where acronyms or abbreviations are used in the Specifications or other Contract Documents they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

1.6.10 Trade Union Jurisdictions: Assign and subcontract construction activities, and employ tradesmen and laborers in a manner that will not unduly risk jurisdictional disputes that could result in conflicts, delays, claims and losses.

1.7 SUBMITTALS REQUIRED BY STANDARDS

1.7.1 Permits, Licenses and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

2 PART 2 - PRODUCTS (Not Applicable)

3 PART 3 - EXECUTION (Not Applicable)

END OF SECTION - 01091

SECTION 01092

CODES, REGULATIONS, AND STANDARDS-ASBESTOS ABATEMENT

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this section.

1.2 SUMMARY

1.2.1 This section sets forth governmental regulations and industry standards which are included and incorporated herein by reference and made a part of the specification. This section also sets forth those notices and permits which are known to the Owner and which either must be applied for and received, or which must be given to governmental agencies before start of work.

1.2.2 Requirements include adherence to work practices and procedures set forth in applicable codes, regulations and standards.

1.2.3 Requirements include obtaining permits, licenses, inspections, releases and similar documentation, as well as payments, statements and similar requirements associated with codes, regulations, and standards.

1.3 CODES AND REGULATIONS

1.3.1 General Applicability of Codes and Regulations, and Standards: Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable codes, regulations, and standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith.

1.3.2 Contractor Responsibility: The Contractor shall assume full responsibility and liability for the compliance with all applicable Federal, State, and local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable Federal, State, and local regulations. The Contractor shall hold the Owner and Owner's Representative harmless for failure to comply with any applicable work, hauling, disposal, safety, health or other regulation on the part of himself, his employees, or his subcontractors.

1.3.3 Federal Requirements: Which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

1.3.4 OSHA: U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA), including but not limited to:

Asbestos
29 CFR 1910.1001 and
29 CFR 1926.1101
Respiratory Protection
29 CFR 134

Access to Employee Exposure and Medical Records
29 CFR 20

Hazard Communication
29 CFR 1910.1200

Specifications for Accident Prevention Signs and Tags
29 CFR 1910.145

1.3.5 DOT: U. S. Department of Transportation, including but not limited to:

Hazardous Substances
49 CFR 171 and 172

1.3.6 EPA: U. S. Environmental Protection Agency (EPA), including but not limited to:

Asbestos Abatement Projects; Worker Protection Rule
40 CFR 763, Sub-part G

Asbestos Hazard Emergency Response Act (AHERA) Regulation
Asbestos Containing Materials in Schools Final Rule & Notice
40 CFR 763, Sub-part E

Training Requirements of (AHERA) Regulation
Asbestos Containing Materials in Schools Final Rule & Notice
40 CFR 763, Sub-part E, Appendix C

National Emission Standard for Hazardous Air Pollutants (NESHAP)
National Emission Standard for Asbestos
40 CFR 61, Sub-part A and M

1.3.7 State Requirements: Which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

California Department of Industrial Relations, Division of Occupational Safety and Health

Title 8, Section 1529	Asbestos, Construction Safety Orders
Title 8, Section 341	Registration Requirements, Notification of Work Area
Title 8, Section 5156	Confined Space Entry
Title 8, Section 5194	Hazard Communication, "Prop. 65"
Title 22	Minimum Standards for Management of Hazardous Waste

1.3.8 Local Requirements: Abide by all local requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials.

South Coast Air Quality Management District

Rule 1403
Rule 206

1.4 STANDARDS

1.4.1 General Applicability of Standards: Except to the extent that more explicit or more stringent requirements are written directly into the Contract Documents, all applicable standards have the same force and effect (and are made a part of the Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies are bound herewith.

1.4.2 Contractor Responsibility: The Contractor shall assume full responsibility and liability for the compliance with all standards pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor shall hold the Owner and Owner's Representative harmless for failure to comply with any applicable standard on the part of himself, his employees, or his subcontractors.

1.4.3 Standards: Which apply to asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

American National Standards Institute (ANSI)
1430 Broadway
New York, New York 10018
(212)354-3300

Fundamentals Governing the Design and Operation of Local Exhaust Systems, Publication Z9.2-79

Practices for Respiratory Protection, Publication Z88.2-80

American Society for Testing and Materials (ASTM)
1916 Race Street
Philadelphia, PA 19103
(215)299-5400

Safety and Health Requirements Relating to Occupational Exposure to Asbestos, E 849-82

Standard Practice for Visual Inspection of Asbestos Abatement Projects, E 1368-90

Specification for Encapsulants for Friable Asbestos Containing Building Materials, Proposal P-189

1.5 EPA GUIDANCE DOCUMENTS

1.5.1 EPA Guidance Documents: Discuss asbestos abatement work or hauling and disposal of asbestos waste materials listed below for the Contractor's information only. These documents do not describe the work and are not a part of the work of this contract.

A. Guidance for Controlling Asbestos-Containing Materials in Buildings (Purple Book) EPA 560/5-85-024

B. Evaluation of the EPA Asbestos-in-Schools Identification and Notification Rule. EPA 560/5-84-005.

C. Asbestos in Buildings: Guidance for Service and Maintenance Personnel. EPA 560/5-85-018.

D. Asbestos Waste Management Guidance. EPA 530-SW-85-007.

E. Managing Asbestos In Place. A Building Owner's Guide to Operations and Maintenance Programs for Asbestos-Containing Materials. EPA 2OT-2003

F. A Guide to Respiratory Protection for the Asbestos Abatement Industry. EPA-560-OPTS-86-001

1.6 NOTICES

1.6.1 U.S. ENVIRONMENTAL PROTECTION AGENCY

A. Send Written Notification as required by USEPA National Emission Standards for Hazardous Air Pollutants (NESHAP) Asbestos Regulations (40 CFR 61, Subpart M) to the regional Asbestos NESHAP Contact at least 10 days prior to beginning any work on asbestos-containing materials. Send notification to the following address:

B. Notification: Complete the notification form provided in 40 CFR 61 and send to the NESHAP contact.

1.7 STATE AND LOCAL AGENCIES

1.7.1 NOTIFICATIONS: Send written notification as required by state and local regulations prior to beginning any work on asbestos-containing materials.

1.7.2 PERMITS AND LICENSES: Obtain and maintain current permits and licenses as required by applicable state or local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the work of this contract.

1.8 POSTING AND FILING OF REGULATIONS

1.8.1 Posting and Filing of Regulations: Post all notices required by applicable federal, state and local regulations. Maintain at least one (1) copy of applicable federal, state and local regulations and standard.

1.9 SUBMITTALS RELATED TO REGULATORY REQUIREMENTS

1.9.1 Before Start of Work: Submit the following to the Owner's Representative for review. No work shall begin until these submittals are returned with Owner's Representative's approval indicating that the submittal is returned for unrestricted use or final-but-restricted use.

1.9.2 Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work including:

A. Notices: Submit notices required by federal, state and local regulations together with proof of timely transmittal to agency requiring the notice.

B. Permits: Submit copies of current valid permits required by state and local regulations.

C. Licenses: Submit copies of all State and local licenses and permits necessary to carry out the work of this contract.

2 PART 2 - PRODUCTS (Not Applicable)

3 PART 3 - EXECUTION (Not Applicable)

END OF SECTION - 01092

SECTION 01220

PROJECT MEETINGS

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION

1.2.1 This section describes procedures for scheduling and administration of project progress meetings, including the preconstruction conference.

1.3 RELATED SECTIONS

1.3.1 Agreement between the Owner and Contractor
1.3.2 Section 01043 - Project coordination
1.3.3 Section 01301 - Submittals

1.4 PRECONSTRUCTION CONFERENCE

1.4.1 The Preconstruction Conference covers assignment of responsibilities and personnel, location of contained work areas and temporary facilities for electric and water services, etc.

1.4.2 The Preconstruction Conference will be held at a time and place selected by the Owner or Owner's Representative prior to commencing project work.

1.4.3 At minimum the following personnel shall attend:

A. Contractor and Contractor's superintendent and assistants

B. Owner's Representative

C. Project Manager

D. Project Inspector

E. Building Manager and/or representative

F. Other personnel as indicated by the Owner

1.4.4 Pre-work submittals are to be presented at the Preconstruction Conference. No work shall commence prior to approval of required Pre-work submittals.

1.4.5 The Contractor shall present for approval the Contractor's Schedule and Building Coordination Plan.

1.4.6 The Preconstruction Conference will be chaired by the Owner's Representative or other owner designee.

1.5 WEEKLY PROGRESS MEETINGS

SECTION 01220

PROJECT MEETINGS

1.5.1 The Contractor shall attend weekly progress meetings and other called meetings throughout the duration of the project.

1.5.2 The Contractor shall provide and present materials as required for each progress meeting as delineated herein.

1.5.3 Weekly progress meetings shall be held at the time and place as delineated by the Owner.

1.5.4 The following personnel shall attend the weekly progress meetings:

A. Contractor and Contractor's superintendent and assistants

B. Owner's Representative

C. Project Manager

D. Project Inspector

E. Building Manager and/or representative

F. Other personnel as indicated by the Owner

1.5.5 Agenda shall consist of the review of the following at minimum:

A. Minutes of previous meeting

B. Work progress, field observations of operations, problems, etc.

C. Identified problems which will delay project schedule or adversely affect coordination with other parts of the project

D. Methods employed to comply with project schedule

E. Submittal schedule and status of submittals and re-submittals

F. Means of expediting work to comply with project schedule

G. Revised schedule for next work period, if necessary

H. Coordination of scheduled work progress

I. Issues related to quality of work

J. Proposed changes in work and their effect on schedule and coordination

K. Unsettled Contractor claims

L. Unresolved items and discussion of means of settling them; adoption of such means if possible

M. Other items of discussion as approved by the Owner or Owner's Representative

N. Weekly progress meetings will be chaired by the Owner's Representative or other owner designee.

2 PART 2 - PRODUCTS (Not Applicable)

3 PART 3 - EXECUTION(Not Applicable)

END OF SECTION - 01220

SECTION 01301

SUBMITTALS

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 General provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

1.2.1 This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:

A. Contractor's construction schedule

B. Submittal schedule

C. Daily construction reports

D. Product Data

E. Samples

F. Miscellaneous Submittals

1.2.2 Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:

A. Permits

B. Applications for payment

C. Performance and payment bonds

D. Insurance certificates

E. List of Subcontractors

1.3 SUBMITTAL PROCEDURES

1.3.1 Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

A. Coordinate transmittal of different types of submittals for related elements of the work so processing will not be delayed by the need to review submittals concurrently for coordination.

B. The Owner's Representative reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

1.3.2 Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for re-submittals.

A. No extension of Contract Time will be authorized because of failure to transmit submittals to the Owner's Representative sufficiently in advance of the work to permit processing.

1.3.3 Submittal Transmittal: Submittals received from sources other than the Contractor will be returned without action.

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

1.4.1 Schedule: Provide proposed detailed schedule including work dates, work shift time, number of employees, dates of start and completion including dates of preparation work, removals and final inspection dates. Submit within five days of the date established for "Commencement of the Work."

A. Provide a separate line item for each significant construction activity. Identify the first working day of each week.

B. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.

C. Secure time commitments for performing critical elements of the work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the work.

D. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.

E. Indicate Clearance of each Work Area in advance of the dates established for Clearance. Allow time for testing and other Owner's Representative's procedures necessary for certification of Clearance.

1.4.2 Phasing: Provide notations on the schedule to show how the sequence of the work is affected by requirements for phased completion to permit work by separate Contractors and partial occupancy by the Owner prior to Substantial Completion.

1.4.3 Work Stages: Indicate important stages of construction for each major portion of the work, including testing and installation. Include indication of start and finish times for the following:

A. Preparation of the Work Area

B. Asbestos removal

C. Clearance testing

D. Completion (beneficial occupancy is acceptable with punch list.)

1.4.4 Area Separations: Provide a separate time bar to identify each Work Area or major construction area for each major portion of the work. Indicate where each element in an area must be sequenced or integrated with other activities.

1.4.5 Distribution: Following response to the initial submittal, print and distribute copies to the Owner's Representative, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the project meeting room and temporary field office.

1.4.6 When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

1.4.7 Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.5 SUBMITTAL SCHEDULE

1.5.1 Listing: At the end of this section is a listing of the principal submittals required for the work. This listing is not necessarily complete, nor does the listing reflect the significance of each submittal requirement. The listing is included only for the convenience of users of the Contract Documents.

1.5.2 Distribution: Following response to initial submittal, print and distribute copies to the Owner's Representative, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.

1.5.3 When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in construction activities.

1.5.4 Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.6 MISCELLANEOUS SUBMITTALS

1.6.1 Material Safety Data Sheets: Process material safety and data sheets as "product data."

1.6.2 Closeout Submittals: Refer to section "Project Closeout" and to individual sections of these specifications for specific submittal requirements of project closeout information.

1.6.3 Record Documents: Furnish set of original documents as maintained on the project site.

END OF SECTION 01301

SECTION 01301

SUBMITTALS

SUBMITTAL CHECKLIST

The submittals required from the Contractor include, but are not limited to the following. Refer to each section for required submittals.

01013 Summary of Work - Asbestos Abatement
- Before Start of Work:
  - Plan of Action
  - Pre-construction Inspection

01043 Project Coordination - Asbestos Abatement
- Before Start of Work:
  - Construction Schedule
  - Contingency Plans
  - Telephone Numbers
  - Notifications sent to other entities at the work site
  - Notifications sent to emergency service agencies
  - Resume: of general superintendent
  - Accreditation: of accreditation of general superintendent
  - Staff Names:
- Periodically During Work:
  - Daily Logs
  - Event Reports
  - Accident Reports
  - Discovered Condition Reports

01220 Project Meetings
- Before Start of Work:
  - Building Coordination Plan

01301 Submittals
- Before Start of Work:
  - Contractors Construction Schedule
- Project closeout:
  - Record Documents

01503 Temporary Facilities - Asbestos Abatement
- Before Start of Work:
  - Approved Scaffolding Plan
  - Hot water heater
  - Decontamination Unit Sub-panel
  - Ground Fault Circuit Interrupters (GFCI)
  - Lamps and Light Fixtures
  - Temporary Heating Units
  - Temporary Cooling Units
  - Self Contained Toilet Units: Product Data, Sub-contractor
  - First Aid Supplies
  - Fire Extinguishers: product data, location schedule
- Periodically During Work: None

01513 Temporary Negative Pressure & Air Circulation System
- Before Start of Work:
  - Negative Pressure System Design
  - HEPA Filtered Fan Units: Product data
  - Monitoring Equipment: Product data
  - Auxiliary Generator: Product data
  - Power Switch: Product data
  - Auxiliary Power System: Shop Drawing
- Periodically During Work:
  - Pressure Differential Monitoring Results

01526 Temporary Enclosures
- Before Start of Work:
  - Signs: Samples
- Periodically During Work:

01560 Worker Protection - Asbestos Abatement
- Before Start of Work:
  - AHERA Accreditation: for each worker
  - State and Local License: for each worker
  - Certificate Worker Acknowledgement: for each worker
  - Statement of Physician's opinion for each worker
- Periodically During Work:
  - Updated workers' information for all new workers, as above

01562 Respiratory Protection
- Before Start of Work:
  - NIOSH and MSHA Certifications
  - Respiratory Protection Program, Negative Exposure Assessment
- Periodically During Work:
  - None

01563 Decontamination Units
- Before Start of Work:
  - Personnel Decontamination Unit: Sketch showing location
  - Equipment Decontamination Unit: Sketch showing location
  - Filters: product data
- Periodically During Work:
  - None

01601 Materials and Equipment - Asbestos Abatement
- Before Start of Work:
  - Product List Schedule

01701 Project Closeout - Asbestos Abatement
- Before Start of Work:
  - None
- Periodically During Work:
  - Refer to section.

01711 Project Decontamination
- Before Start of Work:
  - None

After Contractor's Final Testing:
- Certification of Visual Inspection

02081 Removal of Asbestos-Containing Materials

Before Start of Work:
- Surfactant: product data
- Removal Encapsulant: product data
- NESHAP Certification: on surfactant or removal encapsulant
- Material Safety Data Sheet: for each surfactant and encapsulant

Periodically During Work:
- None

02084 Disposal of Asbestos-Containing Waste Material

Before Start of Work:
- Waste Hauler State License
- Waste Hauler Local License
- Name and address of landfill
- Landfill contact person and telephone number
- Name and address of processor
- Processor contact person and telephone number
- Product data on process to be used
- Process parameters or operating conditions
- Chain of Custody form
- Waste Manifest Form
- Disposal Bag: samples
- Label Samples

Periodically During Work:
- Copies of manifests and disposal site receipts

END OF SUBMITTAL CHECKLIST

SECTION 01410

AIR MONITORING - TEST LABORATORY SERVICES

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division - 1 Specification Sections, apply to work of this section.

1.1.2 Air Monitoring: during work area clearance is described in Section 01714 Work Area Clearance.

1.2 DESCRIPTION OF THE WORK

1.2.1 Not in Contract Sum: This section describes work being performed by the Owner. This work is not in the Contract Sum.

1.2.2 This section describes air monitoring carried out by the Owner to verify that the building beyond the work area and the outside environment remains uncontaminated. This section also sets forth airborne fiber levels both inside and outside the work area as action levels, and describes the action required by the Contractor if an action level is met or exceeded.

1.2.3 Air monitoring required by OSHA is work of the Contractor and is not covered in this section.

1.3 AIR MONITORING

1.3.1 Work Area Isolation: The purpose of the Owner's air monitoring is to detect faults in the work area isolation such as:

A. Contamination of the building outside of the work area with airborne asbestos fibers

B. Failure of filtration or rupture in the negative pressure system

C. Contamination of air outside the building envelop by airborne asbestos fibers

1.3.2 Should any of the above occur, immediately cease asbestos abatement activities until the fault is corrected. Do not recommence work until authorized by the Owner's Representative.

1.3.3 Work Area Airborne Fiber Count: The Owner will monitor airborne fiber counts in the Work Area. The purpose of this air monitoring will be to detect airborne asbestos concentrations which may challenge the ability of the Work Area isolation procedures to protect the balance of the building or outside of the building from contamination by airborne fibers.

1.3.4 Work area clearance: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to an acceptable level, the Owner will sample and analyze air per Section 01714 Work Area Clearance.

1.3.5 The Owner will be conducting air monitoring throughout the course of the project.

1.4 STOP ACTION LEVELS

1.4.1 Inside Work Area: Maintain an airborne count in the work area of less than 0.1 f/cc. If a fiber count for any work shift or 8 hour period exceeds the Stop Action Level, stop all work except corrective action, leave negative pressure and air circulation system in operation and notify Owner's Representative. After correcting cause of high fiber levels, do not recommence work for 24 hours unless otherwise authorized, in writing, by Owner's Representative.

1.4.2 Outside Work Area: If any air sample taken outside of the Work Area exceeds the base line established prior to start of work, immediately and automatically stop all work except corrective action. The Owner's Representative will determine the source of the high reading and so notify the Contractor in writing.

1.4.3 If the high reading was the result of a failure of Work Area isolation measures initiate the following actions:

A. Immediately erect new critical barriers as set forth in Section 01526 Temporary Enclosures to isolate the affected area from the balance of the building. Erect Critical Barriers at the next existing structural isolation of the involved space (eg. wall, ceiling, floor).

B. Decontaminate the affected area in accordance with Section 01712 Cleaning & Decontamination Procedures.

C. Require that respiratory protection as set forth in Section 01562 Respiratory Protection be worn in affected area until area is cleared for re-occupancy in accordance with Section 01714 Work Area Clearance.

D. Leave Critical Barriers in place until completion of work and insure that the operation of the negative pressure system in the Work Area results in a flow of air from the balance of the building into the affected area.

E. If the exit from the clean room of the personnel decontamination unit enters the affected area, establish a decontamination facility consisting of a Shower Room and Clean Room as set forth in Section 01563 Decontamination Units at entry point to affected area.

F. After Certification of Visual Inspection in the Work Area, remove critical barriers separating the work area from the affected area. Final air samples will be taken within the entire area as set forth in Section 01714 Work Area Clearance.

1.4.4 If the high reading was the result of other causes, initiate corrective action as determined by the Owner's Representative.

1.4.5 Effect on Contract Sum

A. Complete corrective work with no change in the Contract Sum if high airborne fiber counts were caused by Contractor's activities; TEM charges will be borne by Contractor.

B. The Contract Sum and schedule will be adjusted for additional work caused by high airborne fiber counts beyond the Contractor's control.

1.4.6 Fibers Counted: TEM analysis will be used to resolve any disputes regarding fiber types when a project has been stopped due to excessive airborne fiber counts.

1.5 ANALYTICAL METHODS

1.5.1 The following methods will be used by the Owner in analyzing filters used to collect air samples. The filters used shall be in accordance with the referenced methods.

1.5.2 Samples collected for PCM analysis shall be analyzed by NIOSH 7400 method.

1.5.3 Samples collected for TEM analysis shall be analyzed by the method set forth in the AHERA Regulations, 40 CFR 763, Appendix A.

1.6 SAMPLE VOLUMES

1.6.1 General: The number and volume of air samples taken by the Owner will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical method used.

1.7 SCHEDULE OF AIR SAMPLES

1.7.1 Sample cassettes: Samples will be collected on 25 mm. cassettes with 50 mm. extension cowl as follows:

A. PCM: 0.8 micrometer mixed cellulose ester.

B. TEM: 0.45 micrometer mixed cellulose ester

1.8 BASELINE

1.8.1 Before Start of Work

A. The Owner will secure the following Air Samples to establish a base line before start of work.

LOCATION SAMPLED	NUMBER OF SAMPLES MINIMUM	MINIMUM VOLUME (LITERS)	RATE LPM
Each Work Area	5 for up to 5,000 SF; 1 extra per each additional 5,000 SF	1,800	1-12
Outside Each Work Area	3	1,800	1-12

1.9 DAILY

1.9.1 From start of work of Section 01526 Temporary Enclosures through the work of Section 01711 Project Decontamination, the Owner may be taking the following samples on a daily basis.

LOCATION SAMPLED	NUMBER SAMPLES	MINIMUM VOLUME	RATE LPM
Each Work Area	3/shift	480	1-12
Outside each Work Area at Critical Barrier adjacent to occupied space or space which will be occupied later.	1	1,800	1-12
Clean Room	1	1,800	1-12
Equipment Decontamination Unit	1	1,800	1-12
Output, Negative Pressure System	1	1,800	1-12

1.9.2 *OR AS REQUIRED BY CONDITIONS. LOWER VOLUMES REQUIRED BY TIME CONSTRAINTS OR FILTER LOADING WILL RAISE THE DETECTION LIMIT, REDUCING SAMPLING SENSITIVITY.

1.9.3 Additional samples may be taken at Owner's or Owner's Representative's discretion. If airborne fiber counts exceed allowed limits, additional samples will be taken as necessary to monitor fiber levels.

1.10 LABORATORY TESTING

1.10.1 The services of a testing laboratory will be employed by the Owner to obtain air samples as indicated and to perform laboratory analyses of the air samples. A technician will obtain samples daily. Samples will be analyzed on site at a suitable location as provided by the Owner so that verbal reports on air samples can be obtained within 2-4 hours of collection.

1.10.2 The Contractor will have access to all air monitoring tests and results.

1.10.3 A complete record of all air monitoring and results will be furnished to the Owner's Representative and the Owner.

1.10.4 Written Reports: Of all air monitoring tests will be posted at the job site on a daily basis.

2 PART 2 - PRODUCTS (NOT APPLICABLE)

3 PART 3 - EXECUTION

3.1 PERSONAL EXPOSURE MONITORING:

3.1.1 Owner will not be performing air monitoring to meet Contractor's OSHA requirements for personnel sampling or any other purpose.

END OF SECTION - 01410

SECTION 01503

TEMPORARY FACILITIES-ASBESTOS ABATEMENT

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF REQUIREMENTS

1.2.1 General: Provide temporary connection to existing building utilities or provide temporary facilities as required herein or as necessary to carry out the work.

1.3 SUBMITTALS

1.3.1 Before the Start of Work: Submit the following to the Owner's Representative for review. Begin no work until these submittals are returned with Owner's Representative's approval indicating that the submittal is returned for unrestricted use or final-but-restricted use.

1.3.2 Scaffolding: Scaffolding plan must be submitted for all scaffolding to be used on this project. The plan should show layout and construction of the structure and must be approved by a registered professional engineer.

1.3.3 The following information must be made available to the Owner or Owner's Representative upon request.

A. Hot water heater: Submit manufacturers name, model number, size in gallons, heating capacity, power requirements

B. Decontamination Unit Sub-panel: Product data

C. Ground Fault Circuit Interrupters (GFCI): Product data

D. Lamps and Light Fixtures: Product data

E. Temporary Heating Units: Product data

F. Temporary Cooling Units: Product data and installation instructions

G. Self Contained Toilet Units: Product data and name of sub-contractor to be used for servicing self contained toilets. Submit method to used for servicing

H. First Aid Supplies: List of contents of first aid kit. Submit in form of check list

I. Fire Extinguishers: Product data. Submit schedule indicating location at job site.

2 PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 General: Provide new or used materials and equipment that are undamaged and in serviceable condition. Provide only materials and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards.

2.2 SCAFFOLDING

2.2.1 Provide all scaffolding, ladders and/or staging, etc., as necessary to accomplish the work of this contract. Scaffolding may be of suspension type or standing type such as metal tube and coupler, tubular welded frame, pole or outrigger type or cantilever type and must be implemented by a professional scaffolding company. The type, erection and use of all scaffolding shall comply with all applicable OSHA regulations. The contractor shall be responsible for any damage which occurs as a result from improper scaffolding use.

2.2.2 Equip rungs of all metal ladders, etc., with an abrasive non-slip surface.

2.2.3 Provide a non-skid surface on all scaffold surfaces subject to foot traffic.

2.3 WATER SERVICE

2.3.1 Temporary Water Service Connection: All connections to the Owner's water system shall include backflow protection. Valves shall be temperature and pressure rated for operation of the temperatures and pressures encountered. After completion of use, connections and fittings shall be removed without damage or alteration to existing water piping and equipment. Leaking or dripping valves shall be piped to the nearest drain or located over an existing sink or grade where water will not damage existing finishes or equipment.

2.3.2 Water Hoses: Employ heavy-duty abrasion-resistant hoses with a pressure rating greater than the maximum pressure of the water distribution system to provide water into each Work Area and to each Decontamination Unit. Provide fittings as required to allow for connection to existing wall hydrants or spouts, as well as temporary water heating equipment, branch piping, showers, shut-off nozzles, and equipment.

2.3.3 Hot Water Heater: Provide UL rated 40 gallon electric hot water heater to supply hot water for the Decontamination Unit shower. Activate from 30 amp circuit breaker located within the Decontamination Unit sub-panel. Provide with relief valve compatible with water heater operation; pipe relief valve down to drip pan on floor with type L copper. Drip pans shall consist of a 12" X 12" X 6" deep pan, made of 19 gauge galvanized steel, with handles. A 3-quart kitchen saucepan may be substituted for this purpose. Drip pan shall be securely fastened to the hot water heater with bailing wire or similar material. Wiring of the hot water heater shall be in compliance with NEMA, NECA, and UL standards.

2.4 ELECTRICAL SERVICE

2.4.1 General: Comply with applicable NEMA, NECA and UL standards and governing regulations for materials and layout of temporary electric service.

2.4.2 Temporary Power: Provide service to Decontamination Unit sub-panel with minimum 60 amp, 2 pole circuit breaker or fused disconnect connected to the buildings main distribution panel. Sub-panel and disconnect shall be sized and equipped to accommodate all electrical equipment required for completion of the work.

2.4.3 Voltage Differences: Provide identification warning signs at power outlets which are other than 110-120 volt power. Provide polarized outlets for plug-in type outlets, to prevent insertion of 110-120 volt plugs into higher voltage outlets. Dry type transformers shall be provided where required to provide voltages necessary for work operations.

2.4.4 Ground Fault Protection: Equip all circuits for any purpose entering Work Area with ground fault circuit interrupters (GFCI). Locate GFCI's exterior to Work Area so that all circuits are protected prior to entry to Work Area. Provide circuit breaker type ground fault circuit interrupters (GFCI) equipped with test button and reset switch for all circuits to be used for any purpose in work area, decontamination units, exterior, or as otherwise required by national electrical code, OSHA or other authority. Locate in panel exterior to Work Area.

2.4.5 Electrical Power Cords: Use only grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Use single lengths or use waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas of work.

2.4.6 Lamps and Light Fixtures: Provide general service incandescent lamps or fluorescent lamps of wattage indicated or required for adequate illumination as required by the work of this section. Protect lamps with guard cages or tempered glass enclosures, where fixtures are exposed to breakage by construction operations. Provide vapor tight fixtures in work area and decontamination units. Provide exterior fixtures where fixtures are exposed to the weather or moisture.

2.5 TEMPORARY HEAT

2.5.1 Heating Units: Temporary heating units must have been tested and labeled by UL, FM or another recognized trade association related to the fuel being consumed. Use steam or hot water radiant heat where available, and where not available use electric resistant fin radiation supplied from a branch circuit with ground fault circuit interrupter.

2.6 TEMPORARY COOLING

2.6.1 Cooling Units: Temporary cooling units must consist of a fan coil unit inside the work area with a compressor and heat rejection coil outside.

2.7 SELF-CONTAINED TOILETS

2.7.1 Self-Contained Toilet Units: Provide single-occupant self-contained toilet units of the chemical type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar non-absorbent material.

2.8 FIRST AID

2.8.1 First Aid Supplies: Comply with governing regulations and recognized recommendations within the construction industry.

2.9 FIRE EXTINGUISHERS

2.9.1 Fire Extinguishers: Provide Type "A" fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical or grease-oil-flammable liquid fires. In other locations provide type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.

3 PART 3 - EXECUTION

3.1 SCAFFOLDING

3.1.1 During the erection and/or moving of scaffolding, care must be exercised so that the polyethylene floor covering is not damaged.

3.1.2 Clean as necessary debris from non-slip surfaces.

3.1.3 At the completion of abatement work clean all construction aids within the work area. Either wrap in one layer of 6 mil polyethylene sheet and seal before removal from the Work Area or decontaminate thoroughly through the equipment decontamination unit.

3.2 INSTALLATION, GENERAL

3.2.1 General: Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with the performance of the Work.

A. Require that tradesmen accomplishing this work be licensed as required by local authority for the work performed.

B. Relocate, modify and extend services and facilities as required during the course of work so as to accommodate the entire work of the project.

3.3 WATER SERVICE

3.3.1 General: Water connection (without charge) to Owner's existing potable water system is limited to one 3/4" pipe-size connection, and a maximum flow of 10 gpm each to hot and cold water supply. Install using vacuum breakers or other backflow preventer as required by local authority. Hot water shall be supplied at a minimum temperature of 100 F. Supply hot and cold water to the Decontamination Unit.

A. Maintain hose connections and outlet valves in leakproof condition. Where finish work below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize the possibility of water damage. Drain water promptly from pans as it accumulates.

3.4 ELECTRICAL SERVICE

3.4.1 General: Provide a weatherproof, grounded temporary electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of work during the construction period. Install temporary lighting adequate to provide sufficient illumination for safe work and traffic conditions in every area of work.

3.4.2 Lockout: Lockout all existing power to or through the work area as described below. Unless specifically noted otherwise existing power and lighting circuits to the Work Area are not to be used. All power and lighting to the Work Area and Decontamination facilities are to be provided from temporary electrical panel described below.

A. Lockout power to Work Area by switching off all breakers serving power or lighting circuits in work area. Label breakers with tape over breaker with notation "DANGER circuit being worked on." Lock panel and have all keys under control of Contractor's Superintendent or Owner's designated Representative.

B. Lockout power to circuits running through Work Area wherever possible by switching off all breakers serving these circuits. Label breakers with tape over breaker with notation "DANGER circuit being worked on." Sign and date danger tag. Lock panel and supply keys to Contractor, Owner and Owner's Representative. If circuits cannot be shut down for any reason, label at intervals 4'-0" on center with tags reading, "DANGER live electric circuit. Electrocution hazard."

3.4.3 Temporary Electrical Panel: Provide temporary electrical panel sized and equipped to accommodate all electrical equipment and lighting required by the work. Connect temporary panel to existing building electrical system. Protect with circuit breaker or fused disconnect. Locate temporary panel as directed by Owner or Owner's Representative.

3.4.4 Power Distribution System: Provide circuits of adequate size and proper characteristics for each use. In general run wiring overhead, and rise vertically where wiring will be at least exposed to damage from construction operations.

3.4.5 Circuit Protection: Protect each circuit with a ground fault circuit interrupter (GFCI) of proper size located in the temporary panel. Do not use outlet type GFCI devices.

3.4.6 Temporary Wiring: in the Work Area shall be type UF non-metallic sheathed cable located overhead and exposed for surveillance. Do not wire temporary lighting with plain, exposed (insulated) electrical conductors. Provide liquid tight enclosures or boxes for wiring devices.

3.4.7 Number of Branch Circuits: Provide sufficient branch circuits as required by the work. All branch circuits are to originate at temporary electrical panel. At minimum provide the following:

A. One Circuit for each HEPA filtered fan unit

B. For power tools and task lighting, provide one temporary 4-gang outlet in the following locations. Provide a separate 110-120 Volt, 20 Amp circuit for each 4-gang outlet (4 outlets per circuit).

C. One outlet in the work area for each 2500 square feet of work area

D. One outlet at each decontamination unit, located in equipment room

E. 110-120 volt 20 amp branch circuits with 4-gang outlet for Owner's exclusive use while conducting air sampling during the work as follows:

F. One in each work area

G. One at clean side of each Decontamination Unit.

H. One at each exhaust location for HEPA filtered fan units

I. 110-120 volt 20 amp branch circuits with 4-gang outlet for Owner's exclusive use for conducting final air sampling as set forth in Section 01714 Work Area Clearance as follows:

J. Five inside work area

K. Two outside work area in location designated by Owner's Representative

3.5 TEMPORARY LIGHTING

3.5.1 Lockout: Lock out all existing power to lighting circuits in Work Area as described in section 01526 Temporary Enclosures. Unless specifically noted otherwise existing lighting circuits to the Work Area are not to be used. All lighting to the Work Area and Decontamination facilities is to be provided from temporary electrical panel described above.

3.5.2 Provide the following or equivalent where natural lighting or existing building lighting does not meet the required light level:

A. One 200-watt incandescent lamp per 1000 square feet of floor area, uniformly distributed, for general construction lighting, or equivalent illumination of a similar nature. In corridors and similar traffic areas provide one 100-watt incandescent lamp every 50 feet. In stair ways and at ladder runs, provide one lamp minimum per story, located to illuminate each landing and flight. Provide sufficient temporary lighting to ensure proper workmanship everywhere; by combined use of daylight, general lighting, and portable plug-in task lighting.

B. Provide lighting in areas where work is being performed as required to supply a 100 foot candle minimum light level.

C. Provide lighting in any area being subjected to a visual inspection as required to supply a 100 foot candle minimum light level.

D. Provide lighting in the Decontamination Unit as required to supply a 50 foot candle minimum light level.

3.5.3 Number of Lighting Circuits: Provide sufficient lighting circuits as required by the work. All lighting circuits are to originate at temporary electrical panel.

3.5.4 Circuit Protection: Protect each circuit with a ground fault circuit interrupter (GFCI) of proper size located in the temporary panel.

3.6 TEMPORARY HEAT

3.6.1 General: Provide temporary heat where indicated or needed for performance of the Work.

3.6.2 Maintain a minimum temperature of 75 degrees F in the shower of the decontamination unit.

3.7 .SANITARY FACILITIES

3.7.1 Toilets: Use of the Owner's existing toilet facilities, as indicated, will be permitted, so long as these facilities are properly cleaned and maintained in a condition acceptable to the Owner. At substantial completion, restore these facilities to the condition prevalent at the time of initial use. Written permission from the Owner must be obtained, and all provisions of these specifications regarding leaving the work area are met.

3.8 FIRE EXTINGUISHERS

3.8.1 Fire Extinguishers: Comply with the applicable recommendations of NFPA Standard 10 "Standard for Portable Fire Extinguishers" and local fire regulations. Locate fire extinguishers where they are most convenient and effective for their intended purpose, but provide not less than one extinguisher in each Work Area in Equipment Room and One outside Work Area in Clean Room.

END OF SECTION - 01503

SECTION 01513

TEMPORARY NEGATIVE PRESSURE & AIR CIRCULATION SYSTEM

1 PART 1 - GENERAL

1.1 Negative pressure machines and the process of setting up a negative pressure space may be subject to patent rights (e.g. Patent No. 4,604,111). Contractor shall pay all license fees and royalties and assume all costs incidental to the use, in the performance of the work or the incorporation into the work of any invention, design, process, product or device which is the subject of any rights, including but not limited to patents or copyrights, held by others. Contractor shall defend, indemnify and hold harmless

South Orange County Community College District
and
H2 Environmental Consulting Services, Inc.

and anyone directly or indirectly employed by either of them from and against any and all claims, damages, losses and expenses (including attorney's fees and court and arbitration expenses) arising out of any alleged infringement of such rights of others.

1.2 RELATED DOCUMENTS

1.2.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to work of this section.

1.3 MONITORING

1.3.1 Continuously monitor and record the pressure differential between the work area and the outside of the work area with a monitoring device incorporating a continuous recorder. For containments greater than 20,000 square feet, two monitoring devices, with recorder, shall be required. Meters shall be equipped with a warning buzzer which will sound if pressure differential drops below 0.02 inches of water.

1.3.2 The monitoring device(s) shall produce a continuous print out of the pressure differential between the work area and the outside of the work area. The Contractor shall date, initial and indicate the beginning and the end of each shift on the printout. Maintain records of pressure differential in the project data binder.

1.4 SUBMITTALS

1.4.1 Before Start of Work: Submit design of negative pressure system to the Owner's Representative for review. Do not begin work until submittal is returned with the Owner's Representative's approval indicating that the submittal is returned for unrestricted use. Include in the submittal at a minimum:

A. Number of HEPA filtered fan units required and the calculations necessary to determine the number of machines

B. Description of projected air flow within Work Area and methods required to provide adequate air flow in all portions of the work area

C. Anticipated pressure differential across Work Area enclosures

D. Description of methods of testing for correct air flow and pressure differentials

E. Manufacturer's product data on the HEPA filtered fan units to be used

F. Location of the machines in the Work Area

G. Method of supplying adequate power to the machines and designation of building electrical panel(s) which will be supplying the power

H. Description of work practices to insure that airborne fibers travel away from workers

I. Manufacturer's product data on equipment used to monitor pressure differential between inside and outside of Work Area

J. Manufacturer's product data on auxiliary generator to be used

1.4.2 On a weekly basis: Submit printout from pressure differential monitoring equipment. Mark printout with date and start of time for each day. Use printout paper that indicates elapsed time in intervals no greater than hours. Indicate on each day's record times of starting and stopping abatement work, type of work in progress, breaks for lunch or other purposes, periods of stop work, and filter changes. Cut printout into segments by day, attach to 8 1/2" by 11" paper. Label with project name, contractor's name and date.

1.5 QUALITY ASSURANCE

1.5.1 Monitor pressure differential at Personnel and Equipment Decontamination Units with a differential pressure meter equipped with a continuous recorder. Meter shall be equipped with a warning buzzer which will sound if pressure differential drops below 0.01" of water.

2 PART 2 - PRODUCTS

2.1 HEPA FILTERED FAN UNITS

2.1.1 General: Supply the required number of HEPA filtered fan units to the site in accordance with these specifications. Use units that meet the following requirements.

2.1.2 Cabinet: Constructed of durable materials able to withstand damage from rough handling and transportation. The width of the cabinet should be less than 30 inches to fit through standard-size doorways. Provide units whose cabinets are:

A. Factory-sealed to prevent asbestos-containing dust from being released during use, transport, or maintenance

B. Arranged to provide access to and replacement of all air filters from intake end

C. Mounted on casters or wheels

2.1.3 Fans: Rate capacity of fan according to usable air-moving capacity under actual operating conditions.

2.1.4 HEPA Filters: Provide units whose final filter is the HEPA type with the filter media (folded into closely pleated panels) completely sealed on all edges with a structurally rigid frame.

A. Provide units with a continuous rubber gasket located between the filter and the filter housing to form a tight seal.

B. Provide HEPA filters that are individually tested and certified by the manufacturer to have an efficiency of not less than 99.97 percent when challenged with 0.3 um dioctylphthalate (DOP) particles when tested in accordance with Military Standard Number 282 and Army Instruction Manual 136-300-175A. Provide filters that bear a UL586 label to indicate ability to perform under specified conditions.

C. Provide filters that are marked with: the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.

2.1.5 Prefilters, which protect the final filter by removing the larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. Provide units with the following pre-filters:

A. First-stage pre-filter: low-efficiency type (e.g., for particles 100 um and larger)

B. Second-stage (or intermediate) filter: medium efficiency (eg., effective for particles down to 5 um)

C. Provide units with pre-filters and intermediate filters installed either on or in the intake grid of the unit and held in place with special housings or clamps.

2.1.6 Instrumentation: Provide units equipped with:

A. Magnehelic gauge or manometer to measure the pressure drop across filters and indicate when filters have become loaded and need to be changed

B. A table indicating the usable air-handling capacity for various static pressure readings on the Magnehelic gauge affixed near the gauge for reference, or the Magnehelic reading indicating at what point the filters should be changed, noting Cubic Feet per Minute (CFM) air delivery at that point

C. Elapsed time meter to show the total accumulated hours of operation

2.1.7 Safety and Warning Devices: Provide units with the following safety and warning devices:

A. Electrical (or mechanical) lockout to prevent fan from operating without a HEPA filter

B. Automatic shutdown system to stop fan in the event of a rupture in the HEPA filter or blocked air discharge

C. Warning lights to indicate normal operation (green), too high a pressure drop across the filters (i.e., filter overloading) (yellow), and too low of a pressure drop (i.e., rupture in HEPA filter or obstructed discharge) (red)

D. Audible alarm if unit shuts down due to operation of safety systems

2.1.8 Electrical components: Provide units with electrical components approved by the National Electrical Manufacturers Association (NEMA) and Underwriter's Laboratories (UL). Each unit is to be equipped with overload protection sized for the equipment. The motor, fan, fan housing, and cabinet are to be grounded.

2.2 AUXILIARY GENERATOR

2.2.1 Provide auxiliary gasoline powered generator located outside of the building in a location protected from the weather. Arrange so that if a power failure occurs the generator automatically starts and supplies power to a minimum of 50% of the negative air machines in operation.

2.3 AUXILIARY POWER SWITCH

2.3.1 Auxiliary Power Switch: Provide a switching relay which will automatically start auxiliary generator and switch over power supplied to HEPA filtered fan units to auxiliary generator.

3 PART 3 - EXECUTION

3.1 NEGATIVE PRESSURE SYSTEM ISOLATION

3.2 Isolate the Work Area from all adjacent areas or systems of the building with a pressure differential that will cause a movement of air from outside to inside at any breach in the physical isolation of the Work Area ("Negative Air").

3.2.1 Relative Pressure in Work Area: Continuously maintain the Work Area at an air pressure that is lower than that in any surrounding space in the building, or at any location in the immediate proximity outside of the building envelope. This pressure differential when measured across any physical or critical barrier must equal or exceed a static pressure of 0.02 inches of water.

A. Accomplish the pressure differential by exhausting a sufficient number of HEPA filtered fan units from the Work Area. The number of units required will depend on machine characteristics, the seal at barriers, and required air circulation. The number of units will increase with increased make-up air or leaks into the Work Area. Determine the number of units required for pressure isolation by the following procedure:

B. Establish required air circulation in work area, personnel and equipment decontamination units. Exhaust a sufficient number of units from the work area to develop the required pressure differential.

C. The required number of units is the number determined above plus one additional unit.

3.2.2 Vent HEPA filtered fan units to outside of building unless authorized in writing by Owner's Representative.

3.2.3 Vent each HEPA filtered fan to inlet of second unit. Vent second unit to a controlled area in building. Insure that controlled area is isolated from balance of building by critical barriers at all times that units are in operation.

A. Mount units to exhaust directly or through disposable ductwork

B. Use only new ductwork except for sheet metal connections and elbows

C. Use ductwork and fittings of same diameter or larger than discharge connection on fan unit

D. Use inflatable, disposable plastic ductwork in lengths not greater than 100 feet

E. Use spiral wire-reinforced flex duct in lengths not greater than 50 feet

F. Arrange exhaust as required to inflate duct to a rigidity sufficient to prevent flapping

G. If direction of discharge from fan unit is not aligned with duct use sheet metal elbow to change direction. Use six feet of spiral wire reinforced flex duct after direction change

3.2.4 Isolation of elevators, stair towers, and return air intakes: Erect seals with an air space at doors to elevators and stair towers.

A. Fabricate seal by first sealing door with duct tape and 6 mil polyethylene. Construct a barrier from ½" CDX plywood or ½" gypsum board supported by wood studs at 16" on centers. Space face of barrier a minimum of 3" from face of door. Seal barrier with 6 mil sheet plastic and duct tape.

B. Use plywood and framing lumber that is treated to be fire resistant

3.2.5 Isolation of return air ductwork: Return air duct work which must be kept operating is to be isolated from the Work Area.

A. Wrap the duct with 2 layers of 6 mil polyethylene. Seal all polyethylene seams with spray glue and duct tape.

3.3 AUXILIARY GENERATOR

3.3.1 Provide auxiliary gasoline-powered generator located outside of the building in a location which is protected from the weather. Arrange so that if a power failure occurs the generator automatically starts and supplies power to a minimum of 50% of the HEPA filtered fan units in operation.

3.4 AIR CIRCULATION IN THE WORK AREA

3.4.1 Air Circulation: For purposes of this section air circulation refers to either the introduction of outside air to the Work Area or the circulation and cleaning of air within the Work Area.

3.4.2 Determining the Air Circulation Requirements: Provide a fully operational air circulation system supplying a minimum of four (4) air changes per hour.

3.4.3 Determine Number of Units needed to achieve required air circulation according to the following procedure:

A. Determine the volume in cubic feet of the work area by multiplying floor area by ceiling height. Determine total air circulation requirement in cubic feet per minute (CFM) for the work area by multiplying this volume by the air change rate and dividing by 60.

Air Circulation Required in Cubic Feet of Air per Minute (CFM) =

$$\frac{\text{Volume of work area (cu. ft.)} \times \text{Number of air changes per hour}}{\text{60 (minutes per hour)}}$$

B. Divide the air circulation requirement (CFM) above by capacity of HEPA filtered fan unit(s) used. Capacity of a unit for purposes of this section is the capacity in cubic feet per minute with fully loaded filters (pressure differential which causes loaded filter warning light to come on) in the machine's labeled operating characteristics.

$$\text{Number of Units Needed} = \frac{\text{Air circulation Requirement (CFM)}}{\text{Capacity of Unit with Loaded Filters (CFM)}}$$

C. Add one (1) additional unit as a backup in case of equipment failure or machine shutdown for filter changing.

3.5 EXHAUST SYSTEM

3.5.1 Negative pressure isolation and air circulation in the Work Area are to be accomplished by an exhaust system as described below.

3.5.2 Exhaust all units from the Work Area to meet air circulation requirement of this section.

3.5.3 Location of HEPA Filtered Fan Units: Locate fan unit(s) so that makeup air enters work area primarily through decontamination facilities and traverses Work Area as much as possible. This may be accomplished by positioning the HEPA filtered fan unit(s) at a maximum distance from the worker access opening or other makeup air sources.

3.5.4 Vent to Outside of Building, unless authorized in writing by the Owner's Representative.

3.5.5 Window Openings: Window panes which have to be removed temporarily shall be reinstalled by a qualified tradesman at the completion of the work.

3.5.6 Decontamination Units: Arrange Work Area and decontamination units so that the majority of make up air comes through the Decontamination Units. Use only personnel or equipment Decontamination Unit at any time and seal the other so that make up air passes through unit in use.

3.5.7 Supplemental Makeup Air Inlets: Provide where required for proper air flow through the Work Area in location approved by the Owner's Representative by making openings in the plastic sheeting that allow air from outside the building into the Work Area. Locate auxiliary makeup air inlets as far as possible from the fan unit(s) (e.g., on an opposite wall), off the floor (preferably near the ceiling), and away from barriers that separate the Work Area from occupied clean areas. Cover with flaps to reseal automatically if the negative pressure system should shut down for any reason. Spray flap and around opening with spray adhesive so that if flap closes meeting surfaces are both covered with adhesive. Use adhesive that forms contact bond when dry. If makeup air is coming from an asbestos-fiber-contaminated source or potentially contaminated then it should pass through a HEPA filter before entering work area. If air is contaminated with other materials it may also require filtering. If this is done, supply air fans will be necessary to overcome the resistance of the filters. A HEPA filtered fan unit may be used to accomplish this. Caution must be used to insure that work area remains under negative pressure.

3.6 RECIRCULATION SYSTEM

3.6.1 Pressure differential isolation and air circulation in the Work Area are to be accomplished by a recirculation system as described below.

A. Recirculate air in the Work Area through HEPA filtered fan units to accomplish air circulation requirements of this section.

B. Location of Fan Units: Locate HEPA filtered fan units so that air is circulated through all parts of the Work Area, and so that required pressure is maintained at all parts of Work Area geometry. Move units as necessary so that in any location where asbestos-containing materials are being disturbed the discharge from one HEPA filtered fan unit is blowing contamination away from workers. Direct air flow in these locations so that it is predominantly toward workers' backs at the breathing zone elevation.

3.7 AIR CIRCULATION IN DECONTAMINATION UNITS

3.7.1 Pressure Differential Isolation: Continuously maintain the pressure differential required for the work area in the:

A. Personnel Decontamination Unit: across the Shower Room with the Equipment Room at a lower pressure than the Clean room.

B. Equipment Decontamination Unit: Across the Holding Room with the Wash Room at a lower pressure than the Clean Room.

3.7.2 Air Circulation: Continuously maintain air circulation in Decontamination Units at same level as required for Work Area.

3.7.3 Air Movement: Arrange air circulation through the Personnel Decontamination Unit so that it produces a movement of air from the Clean Room through the Shower Room into the Equipment Room.

3.8 USE OF THE NEGATIVE AIR SYSTEM

3.8.1 General: Each unit shall be serviced by dedicated circuits with overload device. If an existing building electrical panel is being used it must have sufficient spare capacity to accommodate the load of all negative pressure units connected. Dedication of existing circuits may be accomplished by shutting down existing loads on the circuits.

3.8.2 Testing the System: Test negative pressure system before any asbestos-containing material is wetted or removed. After the Work Area has been prepared, the decontamination facility set up, and the fan unit(s) installed, start the unit(s) (one at a time). Demonstrate operation and testing of negative pressure system to Owner's Representative.

3.8.3 Demonstrate Condition of Equipment for each HEPA filtered fan unit and negative pressure monitoring equipment including proper operation of the following:

A. Squareness of HEPA Filter

B. Condition of Seals

C. Proper operation of all lights

D. Proper operation of automatic shut down if exhaust is blocked

E. Proper operation of alarms

F. Proper operation of magnehelic gauge

G. Proper operation and calibration on pressure monitoring equipment

3.8.4 Demonstrate Operation of the negative pressure system to the Owner's Representative to include, but not be limited to, the following:

A. Plastic barriers and sheeting move lightly in toward Work Area

B. Curtain of decontamination units move lightly in toward Work Area

C. There is a noticeable movement of air through the Decontamination Unit

D. Use smoke tube to demonstrate air movement from Clean Room through Shower Room to Equipment Room

E. Use smoke tubes to demonstrate a definite motion of air across all areas in which work is to be performed

3.8.5 Modify the Negative Pressure System as necessary to demonstrate successfully the above.

3.8.6 Use of System During Abatement Operations

A. Start fan units before beginning work (before any asbestos-containing material is disturbed). After abatement work has begun, run units continuously to maintain constant negative pressure and air circulation until decontamination of the work area is complete. Do not turn off units at the end of the work shift or when abatement operations temporarily stop.

B. Do not shut down negative pressure system during encapsulating procedures, unless authorized by the Owner's Representative in writing. Supply sufficient pre-filters to allow frequent changes.

C. Start abatement work at a location farthest from the fan units and proceed toward them. If an electric power failure occurs, immediately stop all abatement work and do not resume until power is restored and fan units are operating again.

D. At completion of abatement work, allow fan units to run as specified under section 01711, to remove airborne fibers that may have been generated during abatement work and cleanup and to purge the Work Area with clean makeup air. The units may be required to run for a longer time after decontamination, if dry or only partially wetted asbestos material was encountered during any abatement work.

3.8.7 Dismantling the System

A. When a final inspection and the results of final air tests indicate that the area has been decontaminated, fan units may be removed from the Work Area. Before removal from the Work Area, remove and properly dispose of pre-filter, decontaminate exterior of machine and seal intake to the machine with 6 mil polyethylene to prevent environmental contamination from the filters.

END OF SECTION - 01513

SECTION 01526

TEMPORARY ENCLOSURES

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to work of this section.

1.2 SUBMITTALS

1.2.1 Before Start of Work submit the following to the Owner's Representative for review. Do not begin work until these submittals are returned with the Owner's Representative's approval indicating that the submittal is returned for unrestricted use.

1.2.2 Strippable Coatings: Submit following:

A. Product description including major components and solvents.

B. Test report on ASTM E84 test of surface burning characteristics.

C. Manufacturer's installation instructions. Indicate portions applicable to the project and selected assemblies where the manufacturer offers alternatives.

D. Material Safety Data Sheet: Submit the Material Safety Data Sheet, or equivalent, in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200) for strippable coating material proposed for use on the work. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.

1.2.3 Spray Cement: Submit following:

A. Product description including major components and solvents.

B. Manufacturer's installation instructions. Indicate portions applicable to the project.

C. Material Safety Data Sheet: Submit the Material Safety Data Sheet, or equivalent, in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200) for spray cement material proposed for use on the work. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.

1.2.4 Sheet Plastic: For fire retardant plastic submit test reports on NFPA 701 test.

1.2.5 Signs: Submit samples of signs to be used.

2 PART 2 - PRODUCTS

2.1 SHEET PLASTIC

2.1.1 Polyethylene Sheet: A single polyethylene film in the largest sheet size possible to minimize seams, 4 or 6 mils thick as indicated, clear, frosted, or black as indicated.

2.1.2 Polyethylene Sheet: Provide flame-resistant polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-Resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mils thick as indicated, frosted or black as indicated.

2.1.3 Reinforced Polyethylene Sheet: Where plastic sheet constitutes the only barrier between the work area and the building exterior, provide translucent, nylon reinforced or woven polyethylene, laminated, flame resistant, polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mil thick as indicated, frosted or black as indicated.

2.2 STRIPPABLE COATINGS

2.2.1 Provide strippable coatings in aerosol cans or premixed for spray application formulated to adhere gently to surfaces and remove cleanly by peeling off at the completion of the work.

2.2.2 Provide only water-based latex materials.

2.2.3 Provide materials manufactured for the specific application required.

2.2.4 Wall coating: designed to be easy to remove

2.2.5 Floor coating: designed to provide a tough film which resists spread of water beneath plastic layer

2.2.6 Window coating: recommended by the manufacturer for use on windows. Supply materials that are designed to be stable on glass in sunlight and resist the transmission of ultraviolet radiation

2.2.7 Fire Safety: Provide materials that meet the following requirements:

A. When wet or while being installed:

A.(1) Do not create combustible vapors

A.(2) Have no flash point

A.(3) Are not noxious

A.(4) Department of Transportation category of non-flammable

B. When dry, material must have a Class A rating as a building material and meet the following requirements when tested in accordance with ASTM E-84:

B.(1) Flame Spread no greater than 20

B.(2) Fuel Contributed 0

B.(3) Smoke Developed no more than 110

2.2.8 Deliver materials to the job site in unopened, factory-labeled containers.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Duct Tape: Provide duct tape in 2" or 3" widths as indicated, with an adhesive which is formulated to stick aggressively to sheet polyethylene.

2.3.2 Spray Cement: Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene.

3 PART 3 - EXECUTION

3.1 SEQUENCE OF WORK

3.1.1 Carry out work of this section sequentially. Complete each activity before proceeding to the next.

3.2 GENERAL

3.2.1 Work Area: One contiguous work location. A "Work Area" is considered contaminated during the work, and must be isolated from the balance of the building, and decontaminated at the completion of the asbestos-control work.

3.2.2 Completely isolate the Work Area from other parts of the building so as to prevent asbestos-containing dust or debris from passing beyond the isolated area. Should the area beyond the Work Area(s) become contaminated with asbestos-containing dust or debris as a consequence of the work, clean those areas in accordance with the procedures indicated in Section 01711. Perform all such required cleaning or decontamination at no additional cost to owner.

3.2.3 Place all tools, scaffolding, staging, etc. necessary for the work in the area to be isolated prior to completion of Work Area isolation.

3.2.4 Remove all removable furniture that has been designated uncontaminated by the Contract Documents or Owner's Representative. Also remove uncontaminated equipment, and/or supplies from the Work Area before commencing work, or completely cover with two (2) layers of polyethylene sheeting, at least 6 mil in thickness, securely taped in place with duct tape. Such furniture and equipment shall be considered outside the work area unless covering plastic or seal is breached.

3.2.5 Disable ventilating systems or any other system bringing air into or out of the Work Area. Disable system by disconnecting wires, removing circuit breakers, by

lockable switch or other positive means that will prevent accidental premature restarting of equipment.

3.2.6 Lockout power to Work Area by switching off all breakers serving power or lighting circuits in work area. Label breakers with tape over breaker with notation "DANGER circuit being worked on". Lock panel and have all keys under control of Contractor's Superintendent or Owner's designated Representative.

3.2.7 Lockout power to circuits running through work area wherever possible by switching off all breakers or removing fuses serving these circuits. Label breakers with tape over breaker with notation "DANGER circuit being worked on". Lock panel and have all keys under control of Contractor's Superintendent or Owner's designated Representative. If circuits cannot be shut down for any reason, label at intervals 4'-0" on center with tags reading, "DANGER live electric circuit. Electrocution hazard." Label circuits in hidden locations but which may be affected by the work in a similar manner.

3.2.8 Inspection Windows: Install inspection windows in locations shown on the plans or as directed by the Owner's Representative. Each inspection window is to have a 24" X 24" viewing area fabricated from 1/4" acrylic or polycarbonate sheet. Install window with top at 6'-6" above floor height in a manner that provides unobstructed vision from outside to inside of the Work Area. Protect window from damage from scratching, dirt or any coatings used during the work. A sufficient number of windows are to be installed to provide observation of all portions of the Work Area that can be made visible from adjacent areas. Inspection windows that open into uncontrolled area are to be covered with a removable plywood hatch secured by lock and key. Provide keys to Owner's Representative for all such locks.

3.3 EMERGENCY EXITS

3.3.1 Provide emergency exits and emergency lighting as set forth below:

3.3.2 Emergency Exits: At each existing exit door from the Work Area provide the following means for emergency exiting:

A. Arrange exit door so that it is secure from outside the Work area but permits exiting from the Work Area.

B. Mark outline of door on Primary and Critical Barriers with luminescent paint at least 1" wide. Hang a razor knife on a string beside outline. Arrange Critical and Primary barriers so that they can be easily cut with one pass of razor knife. Paint words "EMERGENCY EXIT" inside outline with luminescent paint in letters at least one foot high and 2" thick.

C. Provide EXIT sign at each exit.

D. Provide battery-operated emergency lighting that switches on automatically in the event of a power failure.

E. Mark arrows on poly barriers to indicate direction to exit.

3.4 CONTROL ACCESS

3.4.1 Isolate the Work Area to prevent entry by building occupants into Work Area or surrounding controlled areas. Accomplish isolation by the following:

A. Modify elevator controls to prevent elevators from stopping at doors in Work Areas. This work is to be performed by a qualified elevator technician.

3.4.2 Locked Access: Arrange Work Area so that the only access into Work Area is through lockable doors to personnel and equipment decontamination units.

3.4.3 Visual Barrier: Where the Work Area is immediately adjacent to or within view of occupied areas, provide a visual barrier of opaque polyethylene sheeting at least 6 mil in thickness so that the work procedures are not visible to building occupants. Where this visual barrier would block natural light, substitute frosted or woven rip-stop sheet plastic in locations approved by the Owner's Representative.

3.4.4 Provide Warning Signs at each locked door leading to Work Area reading as follows:

A. Immediately inside door and outside critical barriers post an approximately 20 inch by 14 inch manufactured caution sign displaying the following legend with letter sizes and styles of a visibility required by 29 CFR 1926.1101:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED
IN THIS AREA

B. Provide spacing between respective lines at least equal to the height of the respective upper line.

3.4.5 Alternate Methods of Enclosure

A. Alternate methods of containing the Work Area may be submitted to the Owner's Representative for approval in accordance with procedures set forth in Section 01632 Product Substitution. Before Class I work which involves the removal of more than 25 linear or 10 square feet of TSI or surfacing material is begun using an alternate method to those specified in 29 CFR 1926.1101, a copy of the required evaluation and certification must be submitted to the national office of OSHA. Do not proceed with any such method(s) without prior written approval of the Owner's Representative.

3.5 RESPIRATORY AND WORKER PROTECTION

Before proceeding beyond this point in providing Temporary Enclosures:

3.5.1 Provide Worker Protection per Section 01560

3.5.2 Provide Respiratory Protection per Section 01562

3.5.3 Provide Personnel Decontamination Unit per Section 01563

3.6 CRITICAL BARRIERS

3.6.1 Completely Separate the Work Area from other portions of the building and the outside by closing all openings with sheet plastic barriers at least 6 mil in thickness, or by sealing cracks leading out of Work Area with duct tape.

3.6.2 Individually seal all ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, convectors and speakers, and other openings into the Work Area with duct tape alone or with polyethylene sheeting at least 6 mil in thickness, taped securely in place with duct tape. Maintain seal until all work including Project Decontamination is completed. Take care in sealing of lighting fixtures to avoid melting or burning of sheeting.

3.6.3 Provide Sheet Plastic barriers at least 6 mil in thickness as required to seal openings completely from the Work Area into adjacent areas. Seal the perimeter of all sheet plastic barriers with duct tape or spray cement.

3.6.4 Mechanically Support sheet plastic independently of duct tape or spray cements seals so that seals do not support the weight of the plastic.

3.6.5 Provide Negative Pressure System per Section 01513.

3.6.6 Clean housings and ducts of all overspray materials prior to erection of any Critical Barrier that will restrict access.

3.7 PREPARE AREA

3.7.1 Scaffolding: If fixed scaffolding is to be used to provide access, HEPA vacuum and wet clean area prior to scaffolding installation.

3.7.2 Remove all electrical and mechanical items, such as lighting fixtures, clocks, diffusers, registers, escutcheon plates, etc. which cover any part of the surface to be worked on with the work.

3.7.3 Remove all general construction items such as cabinets, casework, door and window trim, moldings, ceilings, trim, etc., which cover the surface of the work as required to prevent interference with the work. Clean, decontaminate and reinstall all such materials, upon completion of all removal work with materials, finishes, and workmanship to match existing installations before start of work.

3.7.4 Clean all contaminated furniture, equipment, and or supplies with a HEPA filtered vacuum cleaner or by wet cleaning, as specified in Section 01712 Cleaning and Decontamination Procedures, prior to being moved or covered. All equipment, furniture, etc., is to be deemed contaminated unless specifically declared as uncontaminated on the drawings or in writing by the Owner's Representative.

3.7.5 Clean All Surfaces In Work Area with a HEPA filtered vacuum or by wet wiping prior to the installation of primary barrier.

3.8 PRIMARY BARRIER

3.8.1 Protect building and other surfaces in the Work Area from damage from water and high humidity or from contamination from asbestos-containing debris, slurry or high airborne fiber levels by covering with a primary barrier as described below.

3.8.2 Sheet Plastic: Protect surfaces in the Work Area with two (2) layers of plastic sheeting on floor and walls, or as otherwise directed on the Contract Drawings or in writing by the Owner's Representative. Perform work in the following sequence.

A. Cover Floor of Work Area with 2 individual layers of clear polyethylene sheeting, each at least 6 mil in thickness, turned up walls at least 12 inches. Forms a sharp right angle bend at junction of floor and wall so that there is no radius which could be stepped on causing the wall attachment to be pulled loose. Both spray-glue and duct tape all seams in floor covering. Locate seams in top layer six feet from, or at right angles to, seams in bottom layer. Install sheeting so that top layer can be removed independently of bottom layer.

B. Cover Carpeting with three (3) layers of polyethylene sheeting at least 6 mil in thickness. Place corrugated cardboard sheets between the top and middle layers of polyethylene.

C. .Cover Sheet Plastic in areas where scaffolding is to be used with a single layer of 1/2" CDX plywood or 1/4" tempered hardboard. Wrap edges and corners of each sheet with duct tape. At completion of abatement work wrap plywood or hardboard with 2 layers of 6 mil polyethylene and move to next Work Area or dispose of as an asbestos-contaminated waste material in accordance with section 02084 of this specification.

D. Cover all walls in Work Area including "Critical Barrier" sheet plastic barriers with one layer of polyethylene sheeting, at least 6 mil in thickness, mechanically supported and sealed with duct tape or spray-glue in the same manner as "Critical Barrier" sheet plastic barriers. Tape all joints including the joining with the floor covering with duct tape or as otherwise indicated on the Contract Documents or in writing by the Owner's Representative. Install sheeting so that inner layer can be removed independently of bottom layer.

E. Stairs and Ramps: Do not cover stairs or ramps with unsecured sheet plastic. Where stairs or ramps are covered with plastic, provide 3/4" exterior grade plywood treads securely held in place, over plastic. Do not cover rungs or rails with any type of protective materials.

F. Repair of Damaged Polyethylene Sheeting: Remove and replace plastic sheeting which has been damaged by removal operations or where seal has failed allowing water to seep between layers. Remove affected sheeting and wipe down entire area. Install new sheet plastic only when area is completely dry.

3.9 STOP WORK

3.9.1 If the Critical or Primary barrier falls or is breached in any manner stop work immediately. Do not start work until authorized in writing by the Owner's Representative.

3.10 EXTENSION OF WORK AREA

3.10.1 Extension of Work Area: If the Critical Barrier is breached in any manner that could allow the passage of asbestos debris or airborne fibers, then add affected area to the Work Area, enclose it as required by this Section of the specification and decontaminate the affected area as described in Section 01711 Project Decontamination.

3.11 SECONDARY BARRIER

3.11.1 Secondary layer of plastic as a drop cloth to protect the primary layer from debris generated by the asbestos abatement work is specified in the appropriate work sections.

3.12 EXTERIOR ENCLOSURES

3.12.1 Construct exterior enclosures as a Critical Barrier as necessary to completely enclose the work. Fabricate from reinforced polyethylene sheeting and wood framing with appropriate sized lumber. Attach to existing building components or brace as necessary for lateral stability. Construct walls to meet all state and local regulations for construction of temporary buildings. Construct to resist a wind of 30 MPH, slope ceiling to permit drainage of rain water.

END OF SECTION - 01526

SECTION 01560

WORKER PROTECTION-ASBESTOS ABATEMENT

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

1.2.1 This section describes the equipment and procedures required for protecting workers against asbestos contamination and other workplace hazards except for respiratory protection.

1.3 RELATED WORK SPECIFIED ELSEWHERE

1.3.1 Respiratory Protection: is specified in Section 01562.

1.4 WORKER TRAINING

1.4.1 AHERA Accreditation: All workers are to be accredited as Abatement Workers as required by the Asbestos Model Accreditation Plan, 40 CFR 763 Appendix C to Subpart E.

1.4.2 State and Local License: All workers are to be trained, certified and accredited as required by state or local code or regulation.

1.4.3 Training: In accordance with 29 CFR 1926.1101 and any applicable state and local regulations, train all workers shall be trained in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures.

1.5 MEDICAL EXAMINATIONS

1.5.1 Provide medical examinations for all workers who may encounter an airborne fiber level of 0.1 f/cc or greater for an 8 hour Time Weighted Average. In the absence of specific airborne fiber data provide medical examinations for all workers who will enter the Work Area for any reason. Examination shall as a minimum meet OSHA requirements as set forth in 29 CFR 1926.1101. In addition, provide an evaluation of the individual's ability to work in environments capable of producing heat stress in the worker.

1.6 SUBMITTALS

1.6.1 Before Start of Work: Submit the following to the Owner's Representative for review. Do not start work until these submittals are returned with Owner's Representative's approval indicating that the submittal is returned for unrestricted use.

1.6.2 Asbestos Worker Accreditation: Submit copies of certificates from an EPA-approved Asbestos Abatement Workers course for each worker as evidence that each asbestos abatement worker is accredited as required by 40 CFR 763 Appendix C to Subpart E.

1.6.3 State and Local License: Submit evidence that all workers have been trained, certified and accredited as required by state or local code or regulation.

1.6.4 Certificate Worker Acknowledgement: Submit an original signed copy of the Certificate of Worker's Acknowledgement found at the end of this section, for each worker who is to be at the job site or enter the Work Area.

1.6.5 Report from Medical Examination: conducted within last 12 months as part of compliance with OSHA medical surveillance requirements for each worker who is to enter the Work Area. Submit, at a minimum, for each worker the following:

A. Name and Social Security Number

B. Physician's Written Opinion from examining physician including at a minimum the following:

B.(1) Whether worker has any detected medical conditions that would place the worker at an increased risk of material health impairment from exposure to asbestos.

B.(2) Any recommended limitations on the worker or on the use of personal protective equipment such as respirators.

B.(3) Statement that the worker has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos exposure.

C. Statement that worker is able to wear and use the type of respiratory protection proposed for the project, and is able to work safely in an environment capable of producing heat stress in the worker.

1.6.6 Notarized Certifications: Submit certification signed by an officer of the abatement contracting firm and notarized that exposure measurements, medical surveillance, and worker training records are being kept in conformance with 29 CFR 1926.1101.

2 PART 2 - EQUIPMENT

2.1 PROTECTIVE CLOTHING

2.1.1 Coveralls: Provide disposable full-body coveralls and disposable head covers, and require that they be worn by all workers in the Work Area. Provide a sufficient number for all required changes, for all workers in the Work Area.

2.1.2 Boots: Provide work boots with non-skid soles, and where required by OSHA, foot protection, for all workers. Provide boots at no cost to workers. Do not allow boots to be removed from the Work Area for any reason, after being contaminated with asbestos-containing material. Dispose of boots which have not been decontaminated as asbestos-contaminated waste at the end of the work.

2.1.3 Hard Hats: Provide head protection (hard hats) as required by OSHA for all workers, and provide 4 spares for use by Owner's Representative, Project Administrator, and Owner. Label hats with same warning labels as used on

disposal bags. Require hard hats to be worn at all times that work is in progress that may potentially cause head injury. Provide hard hats of type with plastic strap type suspension. Require hats to remain in the Work Area throughout the work. Thoroughly clean, decontaminate and bag hats before removing them from Work Area at the end of the work.

2.1.4 Goggles: Provide eye protection (goggles) as required by OSHA for all workers involved in scraping, spraying, or any other activity which may potentially cause eye injury. Thoroughly clean, decontaminate and bag goggles before removing them from Work Area at the end of the work.

2.1.5 Gloves: Provide work gloves to all workers and require that they be worn at all times in the Work Area. Do not remove gloves from Work Area and dispose of as asbestos-contaminated waste at the end of the work.

2.2 ADDITIONAL PROTECTIVE EQUIPMENT

2.2.1 Respirators, disposable coveralls, head covers, and footwear covers shall be provided by the Contractor for the Owner, Owner's Representative, Project Administrator, and other authorized representatives who may inspect the job site.

3 PART 3 - EXECUTION

3.1 GENERAL

3.1.1 Provide worker protection as required by the most stringent OSHA and/or EPA standards applicable to the work. The following procedures are minimums to be adhered to regardless of fiber count in the Work Area.

3.1.2 Each time Work Area is entered remove all street clothes in the Clean Room of the Personnel Decontamination Unit and put on new disposable coverall, or reusable coverall (to be donned in Equipment Room), new head cover, and a clean respirator. Proceed through shower room to equipment room and put on work boots.

3.2 DECONTAMINATION PROCEDURES

3.2.1 Require all workers to adhere to the following personal decontamination procedures whenever they leave the Work Area:

3.2.2 When using Type C Supplied Air or Powered Air-Purifying Respirators: Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the Work Area:

A. When exiting area, remove coveralls, disposable head covers, and disposable footwear covers or boots in the Equipment Room.

B. Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator to avoid asbestos fibers while showering. The following procedure is required as a minimum:

C. Thoroughly wet body including hair and face. If using a Powered Air-Purifying Respirator (PAPR) hold blower unit above head to keep canisters dry.

D. With respirator still in place thoroughly wash body, hair, respirator face piece, and all parts of the respirator except the blower unit and battery pack on a PAPR. Pay particular attention to seal between face and respirator and under straps.

E. Take a deep breath; hold it and/or exhale slowly, completely wet hair, face, and respirator. While still holding breath, remove respirator and hold it away from face before starting to breath.

F. Carefully wash face piece of respirator inside and out.

G. If using PAPR, shut down in the following sequence: first cap inlets to filter cartridges, then turn off blower unit (this sequence will help keep debris which has collected on the inlet side of filter from dislodging and contaminating the outside of the unit). Thoroughly wash blower unit and hoses. Carefully wash battery pack with wet rag. Be extremely cautious of getting water in battery pack as this will short out and destroy battery.

H. Shower completely with soap and water.

I. Rinse thoroughly.

J. Rinse shower room walls and floor prior to exit.

K. Proceed from shower to Clean Room and change into street clothes or into new disposable work items.

3.2.3 When using Air Purifying-Negative Pressure Respirators: Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the Work Area with a half or full face cartridge type respirator:

A. When exiting area, remove coveralls, disposable head covers, and disposable footwear covers or boots in the Equipment Room.

B. Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator and filters to avoid asbestos fibers while showering. The following procedure is required as a minimum:

C. Thoroughly wet body from neck down.

D. Wet hair as thoroughly as possible without wetting the respirator filter if using an air purifying type respirator.

E. Take a deep breath, hold it and/or exhale slowly, complete wetting of hair, thoroughly wetting face, respirator and filter (air purifying respirator). While still holding breath, remove respirator and hold it away from face before starting to breath.

F. Dispose of wet filters from air purifying respirator.

G. Carefully wash face piece of respirator inside and out.

H. Shower completely with soap and water.

I. Rinse thoroughly.

J. Rinse shower room walls and floor prior to exit.

K. Proceed from shower to Clean Room and change into street clothes or into new disposable work items.

3.2.4 Remote Shower: The procedures above are to be used if the decontamination facility is used as a remote shower. If a worker cannot gain direct access to the Equipment Room require that he enter Decontamination Unit and proceed directly through Shower Room to Equipment Room. Decontamination procedure is then completed as required above.

3.2.5 Within Work Area

A. Require that workers NOT eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the Work Area. To eat, chew, drink or smoke, workers shall follow the procedure described above, then dress in street clothes before entering the non-Work Areas of the building.

3.3 CERTIFICATE OF WORKER'S ACKNOWLEDGEMENT

3.3.1 Following this section is a Certificate of Worker Training. After each worker has been included in the Contractor's Respiratory Protection Program, completed the training program and medical examination, secure a fully executed copy of this form.

END OF SECTION - 01560

SECTION 01560

WORKER PROTECTION-ASBESTOS ABATEMENT

CERTIFICATE OF WORKER'S ACKNOWLEDGEMENT

DATE:

PROJECT NAME:
PROJECT ADDRESS:
CONTRACTOR'S NAME:
WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCER. IF YOU SMOKE AND INHALE ASBESTOS FIBERS THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the Owner for the above project requires that: You be supplied with the proper respirator and be trained in its use. You be trained in safe work practices and in the use of the equipment found on the job. You receive a medical examination. These things are to have been done at no cost to you.

RESPIRATORY PROTECTION: You must have been trained in the proper use of respirators, and informed of the type respirator to be used on the above referenced project. You must be given a copy of the written respiratory protection manual issued by your employer. You must be equipped at no cost with the respirator to be used on the above project.

TRAINING COURSE: You must have been trained in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. The topics covered in the course must have included the following:

Physical characteristics of asbestos
Health hazards associated with asbestos
Respiratory protection
Use of protective equipment
Negative Pressure Systems
Work practices including hands on or on-job training
Personal decontamination procedures
Air monitoring, personal and area

MEDICAL EXAMINATION: You must have had a medical examination within the past 12 months at no cost to you. This examination must have included: health history, pulmonary function tests and may have included an evaluation of a chest x-ray.

By signing this document you are acknowledging only that the Owner of the building you are about to work in has advised you of your rights to training and protection relative to your employer, the Contractor.

Signature
Social Security No
Printed Name
Witness

END OF CERTIFICATE OF WORKER'S ACKNOWLEDGEMENT - 01560

SECTION 01563

DECONTAMINATION UNITS

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

1.2.1 Instruct and train each worker involved in asbestos abatement or maintenance and repair of friable asbestos-containing materials in proper respiratory use and require that each worker always wear a respirator, properly fitted on the face, in the Work Area from the start of any operation which may cause airborne asbestos fibers until the Work Area is completely decontaminated. Use respiratory protection appropriate for the fiber level encountered in the work place or as required for other toxic or oxygen-deficient situations encountered.

1.3 STANDARDS

1.3.1 Except to the extent that more stringent requirements are written directly into the Contract Documents, the following regulations and standards have the same force and effect (and are made a part of the Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies were bound herewith. Where there is a conflict in requirements set forth in these regulations and standards, meet the more stringent requirement.

OSHA - U.S. Department of Labor Occupational Safety and Health Administration, Safety and Health Standards 29 CFR 1910.1001, 1910.134. and 1926.1101.

CGA - Compressed Gas Association, Inc., New York, Pamphlet G-7, "Compressed Air for Human Respiration", and Specification G-7.1 "Commodity Specification for Air"

ANSI - American National Standard Practices for Respiratory Protection, ANSI Z88.2-1980

NIOSH - National Institute for Occupational Safety and Health

MSHA - Mine Safety and Health Administration

Other Federal, state and/or local regulations as required

1.4 SUBMITTALS

1.4.1 Before Start of Work submit the following to the Owner's Representative for review. Do not begin work until these submittals are returned with the Owner's Representative's approval indicating that the submittal is returned for unrestricted use.

1.4.2 Product Data: Submit manufacturer's product information for each component used, including NIOSH and MSHA Certifications for each component in an assembly and/or for entire assembly.

1.4.3 System Diagram: When a Type "C" supplied air respiratory system is required by the work, submit drawing showing assembly of components into a complete supplied air respiratory system. Include diagram showing location of compressor, filter banks, backup air supply tanks, hose line connections in Work Area(s), routing of air lines to Work Area(s) from compressor.

1.4.4 Operating Instruction: Submit complete operating and maintenance instructions for all components and systems as a whole. Submittal is to be in bound manual form suitable for field use.

1.4.5 Respiratory Protection Program: Submit Contractor's written respiratory protection program manual as required by OSHA 1926.1101.

1.4.6 Resume information: Submit resume and information on training for individual monitoring the operation of supplied air respiratory systems. Submit training certifications where applicable.

1.5 AIR QUALITY FOR SUPPLIED AIR RESPIRATORY SYSTEMS

1.5.1 Provide air used for breathing in Type "C" supplied air respiratory systems that meets or exceeds standards set for C.G.A. type 1 (Gaseous Air) Grade D.

1.6 DELIVERY

1.6.1 Deliver replacement parts, etc., not otherwise labeled by NIOSH or MSHA to job site in manufacturer's containers.

2 PART 2 - EQUIPMENT

2.1 AIR PURIFYING RESPIRATORS

2.1.1 Respirator Bodies: Provide half face or full face type respirators. Equip full face respirators with a nose cup or other anti-fogging device as would be appropriate for use in air temperatures less than 32 degrees fahrenheit.

2.1.2 Filter Cartridges: Provide, at a minimum, HEPA type filters labeled with NIOSH and MSHA Certification for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing Dusts and Mists" and color coded in accordance with ANSI Z228.2 (1980). In addition, a chemical cartridge section may be added, if required, for solvents, etc., in use. In this case, provide cartridges that have each section of the combination canister labeled with the appropriate color code and NIOSH/MSHA Certification.

2.1.3 Non-permitted respirators Do not use single use, disposable or quarter face respirators.

2.2 SUPPLIED AIR RESPIRATOR SYSTEMS

SECTION 01563

DECONTAMINATION UNITS

2.2.1 Provide equipment capable of producing air of the quality and volume required by the above referenced standards applied to the job site conditions and crew size. Comply with provisions of this specification if more stringent than the governing standard.

2.2.2 Face Piece and Hose: Provide full face piece and hose by same manufacturer that has been certified by NIOSH/MSHA as an approved Type "C" respirator assembly operating in pressure demand mode with a positive pressure face-piece.

2.2.3 Backup air supply: Provide a reservoir of compressed air located outside the Work Area which will automatically maintain a continuous uninterruptable source of air automatically available to each connected face piece and hose assembly in the event of compressor shut-down, contamination of air delivered by compressor, power loss or other failure. Provide sufficient capacity in the back-up air supply to allow a minimum escape time of one-half hour times the number of connections available to the Work Area. Air requirement at each connection is the air requirement of the respirators in use plus the air requirement of an average-sized adult male engaged in moderately strenuous activity.

2.2.4 Warning device: Provide a warning device that will operate independently of the building's power supply. Locate so that alarm is clearly audible above the noise level produced by equipment and work procedures in use in all parts of the Work Area and at the compressor. Connect alarm to warn of:

A. Compressor shut down or other fault requiring use of backup air supply

B. Carbon Monoxide (CO) levels in excess of 5 PPM

2.2.5 Carbon Monoxide (CO) Monitor: Continuously monitor and record on a strip chart recorder Carbon Monoxide (CO) levels. Place monitors in the airline between compressor and back-up air supply and between backup air supply and workers. Connect monitors so that they also sound an alarm as specified under "Warning Devices".

2.2.6 Compressor Shut Down: Interconnect monitors, alarms and compressor so that compressor is automatically shut down and the alarms sounded if any of the following occur:

A. Carbon Monoxide (CO) concentrations exceed 5 PPM in the air line between the filter bank and backup air supply

B. Compressor temperature exceeds normal operating range

2.2.7 Compressor Motor - Provide a compressor driven by an electric motor. Do not use a gas or diesel engines to drive compressor. Insure that electrical supply available at the work site is adequate to energize motor.

2.2.8 Air Intake: Locate air intake remotely from any source of automobile exhaust or any exhaust from engines, motors, auxiliary generator or buildings.

2.2.9 After-Cooler: Provide an after-cooler at entry to filter system which is capable of reducing temperatures to outside ambient air temperatures.

2.2.10 Self Contained Breathing Apparatus (SCBA): Configure system to permit the recharging of 1/2 hour 2260 PSI SCBA cylinders.

3 PART 3 - EXECUTION

3.1 GENERAL

3.1.1 Respiratory Protection Program: Comply with ANSI Z88.2 - 1980 "Practices for Respiratory Protection" and OSHA 29 CFR 1910 and 1926.

3.1.2 Require that respiratory protection be used at all times that there is any possibility of disturbance of asbestos-containing materials whether intentional or accidental.

3.1.3 Require that a respirator be worn by anyone in a Work Area at all times, regardless of activity, during a period that starts with any operation which could cause airborne fibers until the area has been cleared for re-occupancy in accordance with Section 01714.

3.1.4 Regardless of Airborne Fiber Levels: Require that the minimum level of respiratory protection used be half-face air-purifying respirators with high efficiency filters.

3.1.5 Do not allow the use of single-use, disposable, or quarter-face respirators for any purpose.

3.2 FIT TESTING

3.2.1 Initial Fitting: Provide initial fitting of respiratory protection during a respiratory protection course of training. Fit types of respirator to be actually worn by each individual. Allow an individual to use only those respirators for which training and fit testing have been provided.

3.2.2 On a Weekly Basis, check the fit of each worker's respirator by having irritant smoke blown onto the respirator from a smoke tube.

3.2.3 Upon Each Wearing: Require that each time an air-purifying respirator is put on it be checked for fit with a positive and negative pressure fit test in accordance with the manufacturer's instructions or ANSI Z88.2 (1980).

3.3 TYPE OF RESPIRATORY PROTECTION REQUIRED

3.3.1 Provide Respiratory Protection as indicated in paragraph below. Higher levels of protection may be provided as desired by Contractor, or as directed by Owner's representative. Start of work respiratory protection will be determined by Contractor's "Negative Exposure Assessment" as provided by 29CRR 1910.1101.

3.3.2 Use the following unless air monitoring results indicate greater protection is necessary. Refer to Protection Factors table for choice of respirators.

A. Loose equipment cleaning prior to removal in uncontaminated area: Half-face dual cartridge-type respirator.

B. Plastic installation which does not disturb asbestos-containing material: Half-face dual cartridge-type respirator.

C. Removing or cleaning items or plastic installation when such operation may disturb asbestos-containing material: Powered air purifying respirator (PAPR).

D. Asbestos-containing material removal: Powered air purifying respirator (PAPR).

E. Gross cleanup of removal area(s): Powered air purifying respirator (PAPR).

F. Installation of encapsulant after air sampling results indicate 0.01 or less f/cc and before plastic removal: powered air purifying respirators.

G. Final wet-cleaning of walls until final air tests show exposure in work areas to be below 0.01 f/cc: powered air purifying respirators.

H. Loading and unloading drums on truck (outside work area): Half-face cartridge respirators.

I. Glove bag and modified glove bag removal: Powered air purifying respirator (PAPR).

J. Vinyl-asbestos floor tile, floor tile mastic, ceiling tile, cement-asbestos board removal: Powered air purifying respirator (PAPR).

K. Built-up roofing and roof flashing removal: Half-face dual cartridge respirators.

L. Disposal at landfill: Half-face dual cartridge respirator.

3.3.3 Fibers: For purposes of this section fibers are defined as all fibers regardless of composition as counted in the OSHA Reference Method (ORM), NIOSH Method 7400 procedure, or asbestos fibers of any size as counted using either a scanning or transmission electron microscope.

3.4 AIR PURIFYING RESPIRATORS

3.4.1 Negative pressure - half or full face mask: Supply a sufficient quantity of respirator filters approved for asbestos, so that workers can change filters during the work day. Require that respirators be wet-rinsed, and filters discarded, each time a worker leaves the Work Area. Require that new filters be installed each time a worker re-enters the Work Area. Store respirators and filters at the job site in the changing room and protect totally from exposure to asbestos prior to their use.

3.4.2 Powered air purifying - half or full face mask: Supply a sufficient quantity of high efficiency respirator filters approved for asbestos so that workers can change filters at any time that flow through the face piece decreases to the level at which the manufacturer recommends filter replacement. Require that regardless of flow, filter cartridges be replaced after 40 hours of use. Require that HEPA elements in filter cartridges be protected from wetting during showering. Require entire exterior housing of respirator, including blower unit, filter cartridges, hoses, battery pack, face mask, belt, and cords, be washed each time a worker leaves the Work Area. Caution should be used to avoid shorting battery pack during washing. Provide an

extra battery pack for each respirator so that one can be charging while one is in use.

3.5 TYPE "C" RESPIRATOR

3.5.1 Air Systems Monitor: Continuously monitor the air system operation including compressor operation, filter system operation, backup air capacity and all warning and monitoring devices at all times that system is in operation. Assign an individual, trained by manufacturer of the equipment in use or by a Certified Industrial Hygienist, in the operation and maintenance of the system to provide this monitoring. Assign no other duties to this individual which will take him away from monitoring the air system.

END OF SECTION - 01562

SECTION 01563

DECONTAMINATION UNITS

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

1.2.1 Provide separate Personnel and Equipment Decontamination facilities. Require that the Personnel Decontamination Unit be the only means of ingress and egress for the Work Area. Require that all materials exit the Work Area through the Equipment Decontamination Unit.

1.3 RELATED WORK SPECIFIED ELSEWHERE

1.3.1 Section 01503 Temporary Facilities - Asbestos Abatement for electrical requirements and requirements relative to connection of decontamination facilities to building systems such as water, sewer, and electrical.

1.3.2 Section 01526 Temporary Enclosures - Isolation of the Work Area

1.3.3 Section 01092 Codes and Regulations - Warning Signs

1.3.4 Section 01301 Submittals - Submittals

1.4 SUBMITTALS

1.4.1 Before the Start of Work: Submit the following to the Owner's Representative for review. Do not begin work until these submittals are returned with Owner's Representative's approval indicating that the submittal is returned for unrestricted use or final-but-restricted use.

A. Personnel Decontamination Unit: Provide sketch showing location.

B. Equipment Decontamination Unit: Provide sketch showing location.

C. Filters: Provide product data.

2 PART 2 - PRODUCTS

2.1 POLYETHYLENE SHEET

2.1.1 Provide flame resistant polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mils thick as indicated, frosted or black as indicated.

2.2 REINFORCED POLYETHYLENE SHEET

2.2.1 Where plastic sheet is the only separation between the Work Area and building exterior, provide translucent, nylon reinforced, laminated, flame resistant, polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mil thick as indicated, frosted or black as indicated.

2.3 DUCT TAPE

2.3.1 Provide duct tape in 2" or 3" widths as indicated, with an adhesive which is formulated to stick aggressively to sheet polyethylene.

2.4 SPRAY ADHESIVE

2.4.1 Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene.

2.5 SHOWER PAN

2.5.1 Provide one piece waterproof shower pan of appropriate size. Fabricate from seamless fiberglass minimum 1/16" thick reinforced with wood, 18 ga. stainless or galvanized steel with welded seems, copper or lead with soldered seams, or a seamless liner of minimum 60 mil thick elastomeric membrane.

2.6 SHOWER WALLS

2.6.1 Provide 8' long by approximately 7' high walls fabricated from rigid, impervious, waterproof material, either corrugated fiberglass roofing or equivalent. Structurally support as necessary for stability.

2.7 SHOWER HEAD AND CONTROLS

2.7.1 Provide a factory-made shower head producing a spray of water which can be adjusted for spray size and intensity. Feed shower with water mixed from hot and cold supply lines. Arrange so that control of water temperature, flow rate, and shut off is from inside shower without outside aid.

2.8 FILTERS

2.8.1 Provide cascaded filter units on drain lines from showers or any other water source carrying asbestos-contaminated water from the Work Area. Provide units with disposable filter elements as indicated below. Connect so that discharged water passes primary filter and output of primary filter passes through secondary filter.

A. Primary Filter - Passes particles 20 microns and smaller

B. Secondary Filter - Passes particles 5 microns and smaller

C. Provide spare filters for both personnel and equipment decontamination unit water filters.

2.9 HOSE BIB

2.9.1 Provide heavy bronze angle type with wheel handle, vacuum breaker, and 3/4" National Standard male hose outlet.

2.10 SHOWER STALL

2.10.1 For Wash Down Station provide leak tight shower enclosure with integrated drain pan fabricated from fiberglass or other durable waterproof material, approximately 3' x 3' square with minimum 6' high sides and back. Structurally support as necessary for stability. Equip with hose bib, as specified in this section, mounted at approximately 4'-0" above drain pan. Connect drain to a reservoir, pump water from reservoir through filters to a drain. Mount filters inside shower stall on back wall beneath hose bib.

2.11 ELASTOMERIC MEMBRANE

2.11.1 Provide uniform flat sheets of flexible sheet roofing material fabricated from EPDM (ethylene propylene diene monomers) or Neoprene (polychloroprene), in a nominal 45 mil thickness.

2.12 LUMBER

2.12.1 Provide kiln dried lumber of any grade or species.

2.13 SUMP PUMP

2.13.1 Provide totally submersible waterproof sump pump with integral float switch. Provide unit sized to pump 2 times the flow capacity of all showers or hoses supplying water to the sump, through the filters specified herein when they are loaded to the extent that replacement is required. Provide unit capable of pumping debris, sand, plaster or other materials washed off during decontamination procedures without damage to mechanism of pump. Adjust float switch so that a minimum of 3" remains between top of liquid and top of sump pan.

2.14 HOLDING TANK

2.14.1 Provide holding tank for waste water to prevent water from backing up in shower or wash room.

2.15 GROUND FAULT CIRCUIT INTERRUPTER

2.15.1 To be installed on all electrical equipment, including cords, used in the decontamination units.

3 PART 3 - EXECUTION

3.1 PERSONNEL DECONTAMINATION UNIT

3.1.1 Provide a Personnel Decontamination Unit outside the work area consisting of a serial arrangement of connected rooms or spaces, Clean Room, Shower Room, and Equipment Room. Provide one shower head per ten workers on a shift. Require all persons without exception to pass through this Decontamination Unit for entry into and exiting from the Work Area for any purpose. Do not allow parallel routes for entry or exit. Do not remove equipment or materials through Personnel

Decontamination Unit. Provide adequate temporary lighting and heat within Decontamination Units.

3.1.2 Clean Room (changing room): Provide a room that is physically and visually separated from the rest of the building for the purpose of changing into protective clothing.

A. Construct using polyethylene sheeting, at least 6 mil in thickness, to provide an airtight seal between the Clean Room and the rest of the building.

B. Locate so that access to Work Area from Clean Room is through Shower Room.

C. Separate Clean Room from the building by a sheet plastic flapped doorway.

D. Require workers to remove all street clothes in this room, dress in protective coveralls, and don respiratory protection equipment. Do not allow asbestos-contaminated items to enter this room. Require Workers to enter this room either from outside the structure dressed in street clothes, or naked from the showers.

E. An existing room may be utilized as the Clean Room if it is suitably located and of a configuration whereby workers may enter the Clean Room directly from the Shower Room. Protect all surfaces of room with sheet plastic as set forth in Section 01526 Temporary Enclosures. Authorization for this must be obtained from the Owner's Representative in writing prior to start of construction. Submit written request in accordance with Section 01632 "Product Substitutions" detailing layout and protective measures proposed.

F. Maintain floor of changing room dry and clean at all times. Do not allow overflow water from shower to wet floor in changing room.

G. Damp wipe all surfaces twice after each shift change with a disinfectant solution.

H. Provide posted information for all emergency phone numbers and procedures.

I. Provide a continuously adequate supply of disposable bath towels.

J. Provide 1 storage locker per employee. Equip room with benches and shelves and clean protective clothing, replacement filters for respirators, towels and other required protective equipment.

K. Provide a lockable door which may be secured during non-work hours.

L. Provide all other components indicated on the contract drawings.

3.1.3 Airlock: Provide an airlock between Shower Room and Clean Room. This is a transit area for workers.

A. Separate this room from Shower Room and Clean Room by sheet plastic flapped doorways.

B. Separate this room from the rest of the building with airtight walls fabricated of 6 mil polyethylene.

C. Separate this room from the Shower Room and Clean Rooms with airtight walls fabricated of 6 mil polyethylene.

3.1.4 Shower Room: Provide a completely watertight operational shower to be used for transit by cleanly dressed workers heading for the Work Area from the Clean Room, or for showering by workers headed out of the Work Area after undressing in the Equipment Room.

A. Construct room by providing a shower pan and 2 shower walls in a configuration that will cause water running down walls to drip into pan. Install a freely draining wooden floor in shower pan at elevation of top of pan.

B. Separate this room from the rest of the building with airtight walls fabricated of 6 mil polyethylene.

C. Separate this room from the Clean Room and Equipment Room0 with airtight walls fabricated of 6 mil polyethylene.

D. Provide splash proof entrances.

E. Provide shower head and controls.

F. Provide temporary extensions of existing hot and cold water and drainage, as necessary for a complete and operable shower.

G. Provide a soap dish and a continuously adequate supply of soap and maintain in sanitary condition. Provide liquid shampoo.

H. Arrange so that water from showering does not splash into the Clean or Equipment Rooms.

I. Arrange water shut off and drain pump operation controls so that a single individual can shower without assistance from either inside or outside of the Work Area.

J. Pump waste water to drain. Provide 20 micron and 5 micron waste water filters in line to drain or waste water storage. Change filters daily or more often if necessary. Locate filters inside shower unit so that water lost during filter changes is caught by shower pan.

K. Provide hose bib.

3.1.5 Airlock: Provide an airlock between Shower Room and Equipment Room. This is a transit area for workers. Separate this room from Equipment Room by a sheet plastic flap doorway.

A. Separate this room from the rest of the building with airtight walls fabricated of 6 mil polyethylene.

B. Separate this room from the Equipment Room and Shower Room with airtight walls fabricated of 6 mil polyethylene.

C. Separate from Equipment Room by a sheet plastic flapped doorway.

3.1.6 Equipment Room (contaminated area): Require work equipment, footwear and additional contaminated work clothing to be left here. This is a change and transit area for workers.

A. Separate this room from the Work Area by a 6 mil polyethylene flapped doorway.

B. Separate this room from the rest of the building with airtight walls fabricated of 6 mil polyethylene.

C. Separate this room from the Shower Room and Work Area with airtight walls fabricated of 6 mil polyethylene.

D. Provide a container for collection of used protective clothing.

3.1.7 Work Area: Separate Work Area from the Equipment Room by polyethylene barriers. If the airborne asbestos level in the Work Area is expected to be high, as in dry removal, add an intermediate cleaning space between the Equipment Room and the Work Area. Damp wipe clean all surfaces after each shift change.

3.1.8 Decontamination Sequence: Require that all workers adhere to the following sequence when entering or leaving the Work Area.

3.1.9 Entering Work Area: Worker enters Clean Room and removes street clothing, puts on protective overalls and respirator, and passes through the Shower Room into the Equipment Room.

A. Any additional clothing and equipment left in Equipment Room needed by the worker are put on in the Equipment Room.

B. Worker proceeds to Work Area.

3.1.10 Exiting Work Area

A. Before leaving the Work Area, require the worker to remove all gross contamination and debris from overalls and feet.

B. The worker then proceeds to the Equipment Room and removes all clothing except respiratory protection equipment.

C. Extra work clothing such as boots, hard hats, goggles, and gloves are to be stored in contaminated end of the Equipment Room.

D. Disposable coveralls are placed in a bag for disposal with other material.

E. Require that Decontamination procedures found in Section 01560 be followed by all individuals leaving the Work Area.

F. After showering, the worker moves to the Clean Room and dresses in either new coveralls for another entry or street clothes if leaving.

3.2 EQUIPMENT DECONTAMINATION UNIT

3.2.1 Provide an Equipment Decontamination Unit consisting of a serial arrangement of rooms, Clean Room, Holding Room, Wash Room for removal of equipment and material from Work Area. Do not allow personnel to enter or exit Work Area through Equipment Decontamination Unit. Arrange as follows:

3.2.2 Wash Down Station: Provide an enclosed Shower Unit located in Work Area just outside Wash Room as an equipment, bag and container cleaning station. Metal waste from containment may be washed in wash down station. **If there is a discrepancy on any debris remaining on the metal there will be samples collected at the contractor's expense and submitted to a certified laboratory.**

3.2.3 Wash Room: Provide wash room for cleaning of bagged or containerized asbestos-containing waste materials passed from the Work Area.

A. Construct wash room of wood framing of appropriate sized lumber and polyethylene sheeting, at least 6 mil in thickness and located so that packaged materials, after being wiped clean, can be passed to the Holding Room.

B. Separate this room from the Work Area by a single flapped door of 6 mil polyethylene sheeting.

C. Provide a drop cloth layer of plastic on floor in the Wash Room for every load-out operation. Roll this drop cloth layer of plastic from Wash Room into Work Area after each load-out. Provide a minimum of two (2) layers of plastic at all times. Use only clear plastic to cover floors.

D. Pump waste water to drain. Provide 20 micron and 5 micron waste water filters in line to drain or waste water storage. Change filters daily or more often if necessary. Locate filters inside shower unit so that water lost during filter changes is caught by shower pan.

3.2.4 Airlock: Provide an airlock between Wash Room and Holding Room. This is a transit area.

A. Separate this room from adjacent spaces by a sheet plastic flapped doorway.

B. Separate this room from the rest of the building and adjacent spaces with airtight walls fabricated of 6 mil polyethylene.

3.2.5 Clean Room: Provide Clean Room to isolate the Holding Room from the building exterior. If possible locate to provide direct access to the Holding Room from the building exterior.

A. Erect Critical and Primary Barriers as described in Section 01526 "Temporary Enclosures" in an existing space. If no space exists construct Clean Room of wood framing of appropriate size and polyethylene sheeting, at least 6 mil in thickness.

A.(1) Separate this room from the exterior by a single flap door of 6 mil polyethylene sheeting.

3.2.6 Load-out Area

A. The load-out area is the transfer area from the building to a truck or dumpster. It may be the Clean Room of the Equipment Decontamination unit or a separate room or loading dock area. Erect Critical and Primary barriers as described in Section 01526 "Temporary Enclosures" in load-out area.

B. During transfer of material from load-out area erect primary barriers as described in Section 01526 "Temporary Enclosures" as necessary to seal path from load-out area to truck or dumpster.

C. Provide a lockable door to secure the work area during non-work hours.

3.2.7 Decontamination Sequence: Take all equipment or material from the Work Area through the Equipment Decontamination Unit according to the following procedure:

A. At wash down station, thoroughly wet clean contaminated equipment or sealed polyethylene bags and pass into Wash Room.

B. When passing equipment or containers into the Wash Room, close all doorways of the Equipment Decontamination Unit, other than the doorway between the Wash down Station and the Wash Room. Keep all outside personnel clear of the Equipment Decontamination Unit.

C. Once inside the washroom, wet clean the bags and/or equipment.

D. When cleaning is complete pass items into Holding Room. Close all doorways except the doorway between the Holding room and the Clean Room.

E. Workers from the building exterior enter Holding Area and remove decontaminated equipment and/or containers for disposal.

F. Require these workers to wear full protective clothing and appropriate respiratory protection.

G. At no time is a worker from an uncontaminated area to enter the enclosure when a removal worker is inside.

3.3 CONSTRUCTION OF THE DECONTAMINATION UNITS

3.3.1 Walls and Ceiling: Construct airtight walls and ceiling using polyethylene sheeting, at least 6 mil in thickness. Attach to existing building components or a temporary framework.

3.3.2 Floors: Use 2 layers (minimum) of 6 mil polyethylene sheeting to cover floors in all areas of the Decontamination Units. Use only clear plastic to cover floors.

3.3.3 Flap Doors: Fabricated from three (3) overlapping sheets with openings a minimum of three feet (3') wide. Configure so that sheeting overlaps adjacent surfaces. Weigh sheets at bottoms as required so that they quickly close after being released. Put arrows on sheets to indicate direction of overlap and/or travel. Provide a minimum of six feet (6') between entrance and exit of any room. Provide a minimum of three feet (3') between doors to airlocks, if applicable.

3.3.4 If the Decontamination area is located within an area containing friable asbestos on overhead ceilings, ducts, piping, etc., provide the area with a minimum 1/4 inch hardboard or 1/2 inch plywood "ceiling" with polyethylene sheeting, at least 6 mil in thickness covering the top of the "ceiling".

3.3.5 Visual Barrier: Where the Decontamination area is immediately adjacent to and within view of occupied areas, provide a visual barrier of opaque polyethylene sheeting at least 6 mil in thickness so that worker privacy is maintained and work procedures are not visible to building occupants. Where the area adjacent to the Decontamination area is accessible to the public, construct a solid barrier on the public side of the sheeting to protect the sheeting. Construct barrier with wood or metal studs covered with minimum 1/4 inch thick hardboard or 1/2 inch plywood. Where the solid barrier is provided, sheeting need not be opaque.

3.3.6 Alternate methods of providing Decontamination facilities may be submitted to the Owner's Representative for approval. Do not proceed with any such method(s) without written authorization of the Owner's Representative.

3.3.7 Electrical: Provide sub-panel at Clean Room to accommodate all removal equipment. Connect all electrical branch circuits in Decontamination unit and particularly any pumps in shower room to a ground-fault circuit protection device.

3.4 CLEANING OF DECONTAMINATION UNITS

3.4.1 Clean debris and residue from inside of Decontamination Units on a daily basis or as otherwise indicated on Contract Drawings. Damp wipe or hose down all surfaces after each shift change. Clean debris from shower pans on a daily basis.

3.4.2 If the Clean Room of the Personnel Decontamination Unit becomes contaminated with asbestos-containing debris, abandon the entire Decontamination Unit and erect a new Decontamination Unit. Use the former Clean Room as an inner section of the new Equipment Room.

3.5 MAINTENANCE OF DECONTAMINATION UNITS

3.5.1 Inspect all seals and doorways prior to each work shift and as indicated by conditions throughout removal. Repair immediately if necessary. Clean and dry decontamination units at the end of each work shift.

3.6 SIGNS

3.6.1 Post an approximately 20 inch by 14 inch manufactured caution sign at each entrance to the Work Area displaying the following legend with letter sizes and styles of a visibility required by 29 CFR 1926:

3.7 LEGEND

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED
IN THIS AREA

3.7.1 Provide spacing between respective lines at least equal to the height of the respective upper line.

3.7.2 Post an approximately 10 inch by 14 inch manufactured sign at each entrance to each Work Area displaying the following legend with letter sizes and styles of a visibility at least equal to the following:

LEGEND	NOTATION
NO FOOD, BEVERAGES OR TOBACCO PERMITTED	3/4" Block
ALL PERSONS SHALL DON PROTECTIVE CLOTHING (COVERINGS) BEFORE ENTERING THE WORK AREA	3/4" Block
ALL PERSONS SHALL SHOWER IMMEDIATELY AFTER LEAVING WORK AREA AND BEFORE ENTERING THE CHANGING AREA	3/4" Block

3.7.3 Post Work Area emergency procedures

END OF SECTION - 01563

SECTION 01601

MATERIALS AND EQUIPMENT-ASBESTOS ABATEMENT

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

1.2.1 This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the project.

1.2.2 The Contractor's Construction Schedule and the Schedule of Submittals are included under Section 01301 "Submittals."

1.2.3 Standards: Refer to Section 01091 "Definitions and Standards" for applicability of industry standards to products specified.

1.2.4 Administrative procedures for handling requests for substitutions made after award of the Contract are included under Section 01632 "Product Substitutions."

1.3 DEFINITIONS

1.3.1 Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.

1.3.2 "Products" are items purchased for use in performing the Work or for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material", "equipment", "system", and terms of similar intent.

1.3.3 "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturers published product literature, which is current as of the date of the Contract Documents.

1.3.4 "Materials" are products that are substantially shaped; cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

1.3.5 "Equipment" is products that may be either operational or fixed.

1.3.6 Operational Equipment are products with operating parts, whether motorized or manually operated, that require temporary or permanent service connections, such as wiring or piping.

1.3.7 Fixed Equipment is products necessary for accomplishing the work that are used as a temporary facility during the work and removed afterward.

1.4 SUBMITTALS

1.4.1 Required submittals: A general listing of products requiring submittals is included at the end of Section 01301 "Submittals." This listing may not be complete. Submittal requirements are found in each specification section. Prepare a schedule in tabular form showing each product listed. Include the manufacturer's name and proprietary product names for each item listed.

1.4.2 Product List Schedule: Prepare a schedule showing products specified in a tabular form acceptable to the Owner's Representative. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.

1.4.3 Coordinate the product list schedule with the Contractor's Construction Schedule and the Schedule of Submittals.

1.4.4 Form: Prepare the product listing schedule with information on each item tabulated under the following column headings:

A. Related Specification Section number.

B. Generic name used in Contract Documents.

C. Proprietary name, model number and similar designations.

D. Manufacturer's name and address.

E. Supplier's name and address.

F. Installer's name and address.

G. Projected delivery date, or time span of delivery period.

1.4.5 Owner's Representative's Action

A. The Owner's Representative will respond in writing to the Contractor within 2 weeks of receipt of the completed product list schedule. No response within this time period constitutes no objection to listed manufacturers or products, but does not constitute a waiver of the requirement that products comply with Contract Documents. The Owner's Representative's response will include the following:

B. A list of unacceptable product selections, containing a brief explanation for this action.

1.5 QUALITY ASSURANCE

1.5.1 Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

1.6.1 Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.

A. Schedule delivery to minimize long-term storage at the site and overcrowding of construction spaces.

B. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.

C. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

D. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.

E. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

F. Store heavy materials away from the project structure in a manner that will not endanger the supporting construction.

G. Store products subject to damage by the elements above ground, under cover in a weather tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

2 PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

2.1.1 General Product Requirements: Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect. Products must comply with the Contract Documents, be undamaged and, unless otherwise indicated, be unused at the time of installation.

2.1.2 Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

2.1.3 Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous project experience. Procedures governing product selection include the following:

2.1.4 Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.

2.1.5 Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.

A. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.

2.1.6 Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.

3 PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated.

END OF SECTION - 01601

SECTION 01632

PRODUCT SUBSTITUTIONS-ASBESTOS ABATEMENT

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

1.2.1 This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

1.2.2 Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.

1.2.3 Procedural requirements governing the Contractor's selection of products and product options are included under Section "Materials and Equipment."

1.3 DEFINITIONS

1.3.1 Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

1.3.2 Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions". The following are not considered substitutions:

A. Substitutions requested by Bidders during the bidding period and accepted prior to award of Contract are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.

B. Revisions to Contract Documents requested by the Owner or Owner's Representative.

C. Specified options of products and construction methods included in Contract Documents.

D. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

1.4.1 Substitution Request Submittal: Requests for substitution will be considered if received within five days prior to beginning work affected by the substitution. Requests received less than five days weeks before commencement of affected Work may be considered or rejected at the discretion of the Owner's Representative.

A. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

B. Identify the product, or the fabrication or installation method to be replaced in each request. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

C. Product Data, including Drawings and descriptions of products, fabrication, installation procedures, and manufacturer's instructions for use

D. Samples, where applicable or requested

E. A detailed comparison of significant qualities of the proposed substitution with those of the work specified; significant qualities may include elements such as size, weight, durability, performance and visual effect

F. Coordination information, including a list of changes or modifications needed for other parts of the work and for construction performed by the Owner and separate contractors that will become necessary to accommodate the proposed substitution

G. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution, and an indication of the effect of the proposed substitution on overall Contract Time.

H. Cost information, including a proposal of the net change, if any in the Contract Sum.

I. Certification by the Contractor that the substitution proposed is in every significant respect equal to or better than that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

1.4.2 Owner's Representative's Action: Within one week of receipt of the request for substitution, the Owner's Representative will request additional information or documentation necessary for evaluation of the request. Within 2 weeks of receipt of the request, or one week of receipt of the additional information or documentation, which ever is later, the Owner's Representative will notify the Contractor of acceptance or rejection of the proposed substitution. Acceptance will be in the form of a Change Order.

2 PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

2.1.1 Conditions: The Contractor's substitution request will be received and considered by the Owner's Representative when one or more of the following conditions are satisfied, as determined by the Owner's Representative; otherwise requests will be returned without action except to record noncompliance with these requirements.

A. Extensive revisions to Contract Documents are not required.

B. Proposed changes are in keeping with the general intent of Contract Documents.

C. The request is timely, fully documented, and properly submitted.

D. The specified equipment, product or method of construction cannot be provided within the Contract Time. The request will not be considered if the equipment, product or method cannot be provided as a result of failure to pursue the work promptly or coordinate activities properly.

E. The specified equipment, product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

F. A substantial advantage is offered the Owner, in terms of safety, cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Owner's Representative for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

G. The specified equipment, product or method of construction cannot be provided in a manner that is compatible with other materials, and the Contractor certifies that the substitution will overcome the incompatibility.

H. The specified equipment, product or method of construction cannot be coordinated with other materials, and the Contractor certifies that the proposed substitution can be coordinated.

I. The specified equipment, product or method of construction cannot provide a warranty required by the Contract Documents and the Contractor certifies that the proposed substitution provides the required warranty.

2.1.2 The Contractor's submittal and Owner's Representative's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

3 PART 3 - EXECUTION (Not Applicable.)

END OF SECTION - 01632

SECTION 01701

PROJECT CLOSEOUT-ASBESTOS ABATEMENT

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY

1.2.1 This Section specifies administrative and procedural requirements for project closeout, including but not limited to:

A. Inspection procedures.

B. Project record document submittal.

C. Submittal of warranties.

D. Final cleaning.

1.3 DESCRIPTION OF REQUIREMENTS

1.3.1 Definitions: Project closeout is the term used to describe certain collective project requirements, indicating completion of the Work, that are to be fulfilled near the end of the Contract time in preparation for final acceptance and occupancy of the Work by the Owner, as well as final payment to the Contractor and the normal termination of the Contract.

A. Specific requirements for individual units of work are included in the appropriate sections in Divisions 2 through 16.

B. Time of closeout is directly related to "Substantial Completion"; therefore, the time of closeout may be either a single time period for the entire Work or a series of time periods for individual elements of the Work that have been certified as substantially complete at different dates. This time variation, if any, shall be applicable to the other provisions of this section.

1.4 PREREQUISITES TO SUBSTANTIAL COMPLETION

1.4.1 General: Complete the following before requesting the Owner's Representative to inspect for certification of substantial completion, either for the entire Work or for portions of the Work. Include list of known exceptions.

A. In the progress payment request that coincides with, or is the first request following, the date completion is claimed, show either 100% completion for the portion of the Work claimed as "complete", or list incomplete items, the value of incomplete work, and reasons for the Work being incomplete.

B. Include supporting documentation for completion as indicated in these contract documents.

C. Submit a statement showing an accounting of changes to the Contract Sum.

D. Advise Owner of pending insurance change-over requirements.

E. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.

F. Obtain and submit releases enabling Owner's full, unrestricted use of the Work and access to services and utilities. Where required, include occupancy permits, operating certificates and similar releases.

G. Submit record drawings, maintenance manuals, damage or settlement survey, and similar final record information.

H. Complete final cleaning up requirements, including touch-up painting of marred surfaces.

I. Touch-up and otherwise repair and restore any damages to finishes, floors, walls, or any other item or fixture which is the result of Contractor's actions.

1.4.2 Inspection Procedures: Upon receipt of Contractor's request for inspection, the Owner's Representative will either proceed with inspection or advise Contractor of unfulfilled prerequisites.

A. Following initial inspection, Owner's Representative will either prepare the certificate of substantial completion, or will advise Contractor of work which must be performed before the certificate will be issued. The Owner's Representative will repeat the inspection when requested and when assured that the Work has been substantially completed.

B. Results of the completed inspection will form the initial "punch-list" for final acceptance.

1.5 PREREQUISITES TO FINAL ACCEPTANCE

1.5.1 General: Complete the following before requesting the Owner's Representative's final inspection for certification of final acceptance, and final payment as required by the General Conditions. List known exceptions, if any, in request:

A. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

B. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

C. Submit a certified copy of the Owner's Representatives final punch-list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and has been endorsed and dated by the Owner's Representative and Owner.

D. Submit consent of surety.

1.5.2 Re-inspection Procedure: The Owner's Representative will re-inspect the Work upon receipt of the Contractor's notice that the work, including punch-list items resulting from earlier inspections, has been completed, except for these items whose completion has been delayed because of circumstances that are acceptable to the Owner's Representative.

A. Upon completion of re-inspection, the Owner's Representative will either prepare a certificate of final acceptance, or will advise the Contractor of work that is incomplete or of obligations that have not been fulfilled, but are required for final acceptance.

B. If necessary, the re-inspection procedure will be repeated at the expense of the contractor.

1.6 RECORD DOCUMENT SUBMITTALS

1.6.1 General: Specific requirements for record documents are indicated in the individual sections of these specifications. Other requirements are indicated in the General Conditions. General submittal requirements are indicated in "submittals" sections.

A. Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Owner's Representative's reference during normal working hours.

1.6.2 Record Drawings: Maintain a record set of blue or black line white-prints of contract drawings and shop drawings in a clean, undamaged condition. Mark-up the set of record documents to show the actual installation where the installed work varies substantially from the work as originally shown. Mark whichever drawing is most capable of showing the actual "field" condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at the corresponding location on the working drawings. Give particular attention to concealed work that would be difficult to measure and record at a later date.

A. Mark record sets with red erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of work.

B. Mark-up new information which is known to be important to the Owner, but for some reason was not shown on either contract drawings or shop drawings.

C. Note related change-order number where applicable.

D. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on cover of each set.

1.6.3 Record Product Data: Maintain one copy of each product data submittal. Mark these documents to show significant variations in the actual Work performed in comparison with the submitted information. Include both variations in the products

as delivered to the site, and variations from the manufacturer's instructions and recommendations for installation. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned at a later date by direct observation. Note related change orders and mark-up of record drawings and specifications.

A. Upon Completion of mark-up, submit complete set of record product data to the Owner's Representative for the Owner's records.

1.6.4 Record Sample Submittal: Immediately prior to date or dates of substantial completion, the Contractor will meet at the site with the Owner's Representative and the Owner's personnel, if desired, to determine which, if any, of the submitted samples that have been maintained by the Contractor during progress of the Work, are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's sample storage space.

1.6.5 Miscellaneous Record Submittals: Refer to other sections of these specifications for requirements of miscellaneous record-keeping and submittals in connection with the actual performance of the Work. Immediately prior to the date or dates of substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Owner's Representative for the Owner's records.

2 PART 2 - PRODUCTS (Not Applicable.)

3 PART 3 - EXECUTION

3.1 FINAL CLEANING

3.1.1 General: Special cleaning requirements for specific units of Work are included in the appropriate sections of Division 2 through 16. General Cleaning during the regular progress of the Work is required by the General Conditions and is included under section "Temporary Facilities".

3.1.2 Cleaning: Provide final cleaning of the Work at the time indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of work to the condition expected from a normal, commercial building cleaning and maintenance program.

A. Clean light fixtures and lamps which have been affected by the work so as to function with full efficiency. Replace lamps where inoperable.

3.1.3 Removal of Protection: Except as otherwise indicated or requested by the Owner's Representative's, remove temporary protection devices and facilities which were installed during the course of the work to protect previously completed work during the remainder of the construction period.

3.1.4 Compliances: Comply with safety standards and governing regulations for cleaning operations. Do not burn waste materials at the site. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile or other harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

SECTION 01701

PROJECT CLOSEOUT-ASBESTOS ABATEMENT

END OF SECTION - 01701

SECTION 01711

PROJECT DECONTAMINATION

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF REQUIREMENTS

1.2.1 General: Decontamination of the Work Area following asbestos abatement.

A. If the asbestos abatement work is on damaged or friable materials the work procedure uses two cleanings of the primary barrier plastic prior to its removal and one cleaning of the room surfaces to remove any new or existing contamination. Unless specifically indicated otherwise all materials are considered damaged or friable for purposes of this section. If the asbestos abatement work is on undamaged and non-friable materials, then the work procedures uses one cleaning of the primary barrier plastic and one cleaning of the room surfaces to remove any new or existing contamination. In both cases operation of the negative pressure system is used to remove airborne fibers generated by the abatement work.

1.3 RELATED WORK SPECIFIED ELSEWHERE

1.3.1 Removal of Gross Debris is integral with the performance of abatement work and as such is specified in the appropriate work section(s) of these specifications:

A. Section 02081 Removal of Asbestos-Containing Materials

B. Section 02082 Removal of Asbestos-Contaminated Soil

C. Section 09805 Encapsulation of Asbestos-Containing Materials

1.3.2 Work Area Clearance: Air testing and other requirements which must be met before release of Contractor and re-occupancy of the work area are specified in Section 01714 Work Area Clearance.

2 PART 2 - PRODUCTS (Not Applicable.)

3 PART 3 - EXECUTION

3.1 GENERAL

3.1.1 Work of This Section includes the decontamination of air in the Work Area which has been, or may have been, contaminated by the elevated airborne asbestos fiber levels generated during abatement activities, or which may previously have had elevated fiber levels due to friable asbestos-containing materials in the space.

3.1.2 Work of This Section includes the cleaning, decontamination, and removal of temporary facilities installed prior to abatement work, including:

A. Primary and Critical Barriers erected by work of Section 01526

B. Decontamination Unit erected by work of Section 01563

C. Negative Pressure System installed by work of Section 01513

3.2 START OF WORK

3.2.1 Previous Work: During completion of the asbestos abatement work specified in other sections, the Secondary Barrier of polyethylene sheeting will have been removed and disposed of along with any gross debris generated by the asbestos abatement work.

3.2.2 Start of Work: Work of this section begins with the cleaning of the Primary Barrier. At start of work the following will be in place:

A. Primary Barrier: Two layers of polyethylene sheeting on floor and two layers on walls.

B. Critical Barrier: An airtight barrier between the Work Area and other portions of the building or the outside.

C. Critical Barrier Sheeting: Over lighting fixtures and clocks, ventilation openings, doorways, convectors, speakers and other openings.

D. Decontamination Units: For personnel and equipment in operating condition.

E. Negative Pressure System: In operation.

3.3 WORK SEQUENCE

3.3.1 The work shall be carried out in the sequence as listed below.

3.4 FIRST CLEANING

3.4.1 Carry out a first cleaning of all surfaces of the work area including items of remaining sheeting, tools, scaffolding and/or staging by use of damp-cleaning and mopping, and/or a High Efficiency Particulate Air (HEPA) filtered vacuum. (Note: A HEPA vacuum may fail if used with wet material.) Do not perform dry dusting or dry sweeping. Use each surface of a cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible debris from removed materials or residue on plastic sheeting or other surfaces.

3.5 VISUAL INSPECTION

3.5.1 Conduct visual inspection per ASTM guideline E-1368-90 and reclean as necessary. When visual inspection is passed, Phase I air monitoring may be performed after a 12 hour waiting period.

A. After Final Cleaning Perform a Complete Visual Inspection of the entire Work Area per ASTM guideline E-1368-90, including: all surfaces, ceiling, walls, floor, decontamination unit, all plastic sheeting, seals over ventilation

openings, doorways, windows, and other openings; look for debris from any sources, residue on surfaces, dust or other matter. Visual inspection is not complete until confirmed in writing, on the certification, by Project Administrator.

B. Temporary lighting: Provide adequate lighting for visual inspection of all surfaces in the areas to be subjected to visual inspection.

C. Lifts: Provide ladders, scaffolding, and lifts as required to provide access to all surfaces in the area to be subjected to visual inspection. Access is to allow touching of all surfaces.

D. Wait 12 Hours to allow HEPA filtered fan units to clean air of airborne asbestos fibers. Use oscillating fans as necessary to assure circulation of air in all parts of work areas during this period. Maintain negative pressure system in operation for the entire 12 hour period.

3.6 PHASE I PCM PRE-CLEARANCE AIR SAMPLING

3.6.1 After the work area has been found visually clean, air samples will be taken and analyzed in accordance with the procedure for Phase Contrast Microscopy set forth in Section 01714 Work Area Clearance:

A. If Release Criteria are not met, repeat First Cleaning and continue decontamination procedure from that point.

B. If Release Criteria are met continue cleaning and clearance procedures as given below.

3.7 REMOVAL OF PRIMARY BARRIER(S)

3.7.1 After the work area has passed the Phase I Clearance:

A. Remove the material contamination unit if there is one and all Primary Barrier sheeting, except for any remaining layer over flooring finish material, equipment and/or supplies previously excluded from the work area.

B. Remove the primary barrier(s)

C. Leave the critical barrier(s): Which form the sole barrier between the Work Area and other portions of the building or the outside.

D. Leave the Critical Barrier Sheeting: Over lighting fixtures and clocks, ventilation openings, doorways, convectors, speakers, and other openings.

E. Leave the Decontamination Unit: For personnel, in operating condition.

F. Leave the negative pressure system and maintain in continuous operation.

3.8 FINAL CLEANING

3.8.1 Final cleaning: Clean all surfaces in the work area in the same manner as the first cleaning immediately after removal of Primary plastic. This cleaning is now being applied to existing room surfaces and critical barriers. Take care to avoid water marks or other damage to surfaces.

A. At the completion of the above cleaning visually inspect all surfaces. Reclean if any dust, debris, etc. is found.

3.8.2 Cleaning Carpeting: At the completion of cleaning of all surfaces except carpeting, remove barrier over carpeting and HEPA vacuum carpeting designated to remain in Work Areas using a floor cleaning attachment adjusted so that rubber skirting is in contact with carpet surface. Use a passive (non-power brush type) floor attachment with rubber floor seals and adjustable above-floor height. Completely clean carpeting in one direction with each pass of the floor attachment overlapping the previous pass by one-half the attachment width. At the completion of one such cleaning, vacuum clean in the same manner in a direction at right angles to the initial cleaning.

3.9 ENCAPSULATION

3.9.1 Encapsulation of substrate: Perform encapsulation of substrate or installation of spray-applied finishes or fireproofing, where required, at this time. Maintain negative pressure system in operation during encapsulation work. Perform work only after meeting the following requirements:

A. Surfaces to be covered have met the requirements for a visual inspection in this section.

B. Airborne fiber counts in the Work Area are at or below 0.01 fibers per cubic centimeter as measured by phase contrast microscopy.

3.9.2 Wait until encapsulant is dry: not more than 24 hours. Maintain negative pressure system in operation for the entire waiting period.

3.10 FINAL AIR SAMPLING PCM

3.10.1 Phase Contrast Microscopy (PCM): After the work area is found to be visually clean, air samples will be taken and analyzed in accordance with the procedure for Phase Contrast Microscopy set forth in Section 01714 Work Area Clearance:

A. If Release Criteria are not met, repeat Final Cleaning and continue Decontamination Procedure from that point.

B. If Release Criteria are met, proceed to work of this Section on Removal of Work Area Isolation.

3.11 REMOVAL OF WORK AREA ISOLATION

3.11.1 After all requirements of this section and Section 01714 Work Area Clearance have been met:

A. Remove the Critical Barriers separating the Work Area from the rest of the building.

B. HEPA vacuum carpeting designated to remain in work areas using a floor cleaning attachment adjusted so that rubber skirting is in contact with carpet surface. Use a passive (non power brush type) floor attachment with rubber floor seals and adjustable above-floor height. Completely clean carpeting in one direction with each pass of the floor attachment overlapping the previous pass by one-half the attachment width. At the completion of one such cleaning, vacuum clean in the same manner in a direction at right angles to the initial cleaning.

3.11.2 Shut down and remove the negative pressure system: Seal HEPA filtered fan units, HEPA vacuums and similar equipment with 6 mil polyethylene sheet and duct tape to form a tight seal at intake end before being moved from Work Area.

3.11.3 Remove Personnel Decontamination Unit

A. Remove any small quantities of residual material found with wet wiping, HEPA filtered vacuum cleaners and local area protection. If significant quantities, as determined by the Owner's Representative, are found then the entire area affected shall be decontaminated as specified in Section 01712 Cleaning & Decontamination Procedures.

B. Remove all equipment, materials, debris from the work site.

C. Dispose of all asbestos-containing waste material as specified in Section 02084 Disposal of Asbestos Containing Waste Material.

3.12 CERTIFICATE OF VISUAL INSPECTION

3.12.1 Following this section is a "Certificate of Visual Inspection". This certification is to be completed by the Contractor and certified by the Project Administrator. Submit completed Certificate with Application for Final Payment. Final payment will not be made until this Certificate is executed.

3.13 SUBSTANTIAL COMPLETION OF ABATEMENT WORK

3.13.1 Asbestos Abatement Work is Substantially Complete upon meeting the requirements of this section and Section 01714 Work Area Clearance, including submission of:

A. Certificate of Visual Inspection

B. Receipts documenting proper disposal as required by Section 02084 Disposal of Asbestos-Containing Waste Material

C. Punch list detailing repairs to be made and incomplete items.

END OF SECTION - 01711

CERTIFICATE OF VISUAL INSPECTION

BUILDING NAME/NUMBER:

CONTAINMENT AREA DESCRIPTION:

_____

In accordance with Section 01711 "Project Decontamination" the Contractor hereby certifies that he has visually inspected the Work Area (all surfaces including pipes, beams, ledges, walls, ceiling and floor, Decontamination Unit, sheet plastic, etc.) and has found no dust, debris or residue.

By: _____ Date:
(SIGNATURE)

(PRINT NAME)

(PRINT TITLE)

PROJECT ADMINISTRATOR CERTIFICATION

The Project Administrator hereby certifies that he has accompanied the Contractor on his visual inspection and verifies that this inspection has been thorough and to the best of his knowledge and belief, the Contractor's Certification above is a true and honest one.

By: _____ Date:
(SIGNATURE)

(PRINT NAME)

(PRINT TITLE)

SECTION 01712

CLEANING & DECONTAMINATION PROCEDURES

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF THE WORK

1.2.1 Cleaning and decontamination is to be performed in all work areas.

1.3 RELATED WORK SPECIFIED ELSEWHERE

1.3.1 Work Area Clearance: Specified in Section 01714 Work Area Clearance

2 PART 2 - PRODUCTS (Not Applicable.)

3 PART 3 - EXECUTION

3.1 GENERAL

3.1.1 Complete the following before start of work of this section:

01503 - Temporary Facilities
01513 - Negative Pressure and Air Circulation System
01562 - Respiratory Protection
01526 - Temporary Enclosures
01560 - Worker Protection - Asbestos Abatement
01563 - Decontamination Units

3.2 WET CLEANING

3.2.1 Accomplish wet cleaning during decontamination with paper towels or disposable rags and amended water. Change water frequently.

3.2.2 Material adhered to a surface with removal encapsulant may require the application of additional removal encapsulant to facilitate cleaning.

3.3 REMOVAL OF ASBESTOS-CONTAINING DEBRIS

3.3.1 Remove asbestos-containing debris and decontaminate the area involved using the following sequence:

3.3.2 Pick up large pieces of debris and place in the bottom of a 6 mil polyethylene disposal bag conforming to the requirements of Section 02084 Disposal of Asbestos-Containing Waste Material. Place pieces in the bag without dropping and avoiding unnecessary disturbance and release of material.

3.3.3 Remove all small debris with the HEPA vacuum.

3.3.4 HEPA vacuum ladder and/or any tools used and pass out of the work area.

3.3.5 HEPA vacuum all surfaces in the room starting at the top of wall and working downward to the floor. Then start at corner of floor farthest from Work Area entrance and work towards entrance.

3.3.6 HEPA vacuum the floor using a floor attachment with rubber floor seals and adjustable floor to attachment height. Adjust the height so that the rubber seals just touch the floor if carpeted and are within 1/16" of hard surface floors. Vacuum the floor in parallel passes with each pass overlapping the previous by one-half the width of the floor attachment. At the completion of one cleaning vacuum the floor a second time at right angles to the first.

3.4 CLEANING AND DECONTAMINATING OBJECTS

3.4.1 HEPA vacuum all surfaces of object and immediate area before moving the object.

3.4.2 Pick up object, if possible, and HEPA vacuum all surfaces.

3.4.3 Wet clean object, if possible, and place in storage location.

3.4.4 Decontaminate area where object was located by HEPA vacuuming twice, in two perpendicular directions. Wet clean if necessary to remove any debris.

3.4.5 Return object to its original location.

3.5 DECONTAMINATION OF ROOMS

3.5.1 HEPA vacuum all surfaces in the room starting at the ceiling, then top of wall and working downward to the floor.

3.5.2 HEPA vacuum the floor using a floor attachment with rubber floor seals and adjustable floor to attachment height. Adjust the height so that the rubber seals just touch the floor if carpeted and are within 1/16" of hard surface floors. Vacuum the floor in parallel passes with each pass overlapping the previous by one half the width of the floor attachment. At the completion of one cleaning, vacuum the floor a second time at right angles to the first.

3.5.3 Operate HEPA filtered fan unit in space for 12 hours minimum.

3.5.4 At completion of Decontamination Work workers decontaminate in accordance with Section 01560 Worker Protection - Asbestos Abatement.

3.5.5 Secure area from occupancy until air monitoring results per Section 01714 Work Area Clearance indicates area is safe for re-occupancy.

END OF SECTION - 01712

SECTION 01714

WORK AREA CLEARANCE

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division - 1 Specification Sections, apply to work of this section.

1.1.2 Visual Inspection: Required as a prerequisite of air testing, is set forth in Section 01711 Project Decontamination.

1.1.3 Air Monitoring: Performed by the Owner during abatement work, is described in Section 01410 Test Laboratory Services.

1.2 SUMMARY

1.2.1 Not in Contract Sum: This section describes work being performed by the Owner. This work is not in the Contract Sum.

1.2.2 This Section sets forth required post-abatement airborne asbestos concentrations in the Work Area and describes testing procedures the Owner will use to measure these levels.

1.3 CONTRACTOR RELEASE CRITERIA

1.3.1 The Asbestos Abatement Work Area is Cleared when the Work Area is visually clean and airborne asbestos structure concentrations have been reduced to the level specified below.

1.4 VISUAL INSPECTION

1.4.1 Work of this Section will not begin until the visual inspection described in Section 01711 Project Decontamination is complete and has been certified by the Project Administrator.

1.5 AIR MONITORING

1.5.1 To determine if the elevated airborne asbestos structure concentration encountered during abatement operations has been reduced to the specified level, the Owner will secure samples and analyze them according to the following aggressive sampling procedures.

1.6 AGGRESSIVE SAMPLING

1.6.1 All Air Samples will be taken using aggressive sampling techniques as follows:

1.6.2 Before sampling pumps are started the exhaust from forced-air equipment (leaf blower with an approximately 1 horsepower electric motor) will be swept against all walls, ceilings, floors, ledges and other surfaces in the room. This procedure will be continued for 5 minutes per 10,000 cubic feet of room volume.

1.6.3 One 20 inch diameter fan per 10,000 cubic feet of room volume will be mounted in a central location at approximately 2 meters above floor, directed toward ceiling and operated at low speed for the entire period of sample collection.

1.6.4 Air samples will be collected in areas subject to normal air circulation away from room corners, obstructed locations, and sites near windows, doors of vents.

1.6.5 After air sampling pumps have been shut off, fans will be shut off.

1.7 SCHEDULE OF AIR SAMPLES

1.7.1 General: The number and volume of air samples taken and analytical methods used by the Owner will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical instruments used.

1.8 PHASE CONTRAST MICROSCOPY

1.8.1 In each homogeneous Work Area (over 1,000 square feet Plan Area) after completion of all cleaning work, a minimum of 7 samples will be taken and analyzed as follows:

1.8.2 Samples will be collected on 25 mm. cassettes with the following filter media:

A. PCM: 0.8 mixed cellulose ester in a cassette with a 50 mm. conductive extension cowl.

B. Number of PCM samples will be as follows:

Location Sampled	Number of Samples Minimum	Minimum Volume (Liters)	Rate LPM
Each Work Area	5	1800	1-10*
OR	OR	1800	1-10*
Each Room of Work Area	1 sample for each room of work area (minimum of 5 samples for all rooms is required) and 1 sample for each extra 5000 square feet		
Field Blank	2	N/A	Leave open in a sealed plastic bag or other clean container for duration of sampling

1.8.3 Analysis: Fibers on each filter will be measured using the most recent revision of NIOSH Method 7400.

1.8.4 Fibers: referred to in this section include fibers regardless of composition as counted by the phase contrast microscopy method used.

1.8.5 Release Criteria: Decontamination of the work site is complete when every Work Area sample is at or below the Lower Limit of Quantitation above. If any sample is above this limit then the decontamination is incomplete and re-cleaning per section 01711 Project Decontamination is required.

1.9 LABORATORY TESTING

1.9.1 PHASE CONTRAST MICROSCOPY

1.9.2 The services of a testing laboratory will be employed by the Owner to perform laboratory analysis of the air samples. A microscope and technician will be set up at the job site, so that verbal reports on air samples can be obtained within 2-4 hours. A complete record, certified by the testing laboratory, of all air monitoring tests and results will be furnished to the Owner's Representative, the Owner, and the Contractor.

1.10 TRANSMISSION ELECTRON MICROSCOPY

1.10.1 Samples will be sent by overnight courier for analysis by Transmission Electron Microscopy. Samples may not be carried on weekends, so that samples shipped on Friday would arrive on the following Monday. Verbal results will normally be available within five (5) working days after receipt of samples by the laboratory. All Transmission Electron Microscopy results will be available to the Contractor.

A. With bid, submit unit cost for each day of waiting beyond that set forth in the paragraph above.

1.11 RE-SAMPLING

1.11.1 If, for any reason, the Final Air Clearance Samples do not meet the minimum clearance requirements, re-cleaning and re-sampling must be accomplished. The additional cost of re-sampling and re-analysis will be taken on by the Removal Contractor and the method of sampling and analysis will be the same as that used for the first set of samples.

2

END OF SECTION - 01714

SECTION 02081

REMOVAL OF ASBESTOS CONTAINING MATERIALS

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to work of this section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

1.2.1 Installation of Critical and Primary Barriers, and Work Area Isolation Procedures are set forth in Section 01526 Temporary Enclosures.

1.2.2 Project Decontamination procedures after removal of the Secondary Barrier are specified in Section 01711 Project Decontamination.

1.2.3 Disposal of asbestos-containing waste is specified in Section 02084 Disposal of Asbestos-Containing Waste Material.

1.3 SUBMITTALS

1.3.1 Before Start of Work: Submit the following to the Owner's Representative for review. Do not start work until these submittals are returned with Owner's Representative's approval indicating that the submittal is returned for unrestricted use.

1.3.2 Surfactant: Submit product data, use instructions and recommendations from manufacturer of surfactant intended for use. Include data substantiating that material complies with requirements.

1.3.3 Removal Encapsulant: Submit product data, use instructions and recommendations from manufacturer of removal encapsulant intended for use. Include data substantiating that material complies with requirements.

1.3.4 NESHAP Certification: Submit certification from manufacturer of surfactant or removal encapsulant that, to the extent required by this specification, the material, if used in accordance with manufacturer's instructions, will wet Asbestos-Containing Materials to which it is applied as required by the National Emission Standard for Hazardous Pollutants (NESHAP) Asbestos Regulations (40 CFR 61, Subpart M).

1.3.5 Material Safety Data Sheet: Submit the Material Safety Data Sheet, or equivalent, in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200) for each surfactant, encapsulating material and solvent proposed for use on the work. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.

1.3.6 Glove-bags: Submit product data.

1.3.7 Mini-Enclosures: Submit sketch of mini-enclosure arrangement to be used.

2 PART 2 - PRODUCTS

2.1 WETTING MATERIALS

2.1.1 For wetting prior to disturbance of Asbestos-Containing Materials use either amended water or a removal encapsulant:

2.1.2 Amended Water: Provide water to which a surfactant has been added. Use a mixture of surfactant and water which results in wetting of the Asbestos-Containing Material and retardation of fiber release during disturbance of the material equal to or greater than that provided by the use of one ounce of a surfactant consisting of 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with five gallons of water.

2.1.3 Removal Encapsulant: Provide a penetrating type encapsulant designed specifically for removal of Asbestos-Containing Material. Use a material which results in wetting of the Asbestos-Containing Material and retardation of fiber release during disturbance of the material equal to or greater than that provided by water amended with a surfactant consisting of one ounce of a mixture of 50% polyoxyethylene ester and 50% polyoxyethylene ether in five gallons of water.

2.2 DISPOSAL BAGS

2.2.1 Provide 6 mil thick leak-tight polyethylene bags labeled as required by Section 02084 Disposal of Asbestos Containing Waste Material.

2.3 FIBERBOARD DRUMS

2.3.1 Provide heavy duty leak tight fiberboard drums with tight sealing locking metal tops.

2.4 PAPER BOARD BOXES

2.4.1 Provide heavy duty corrugated paper board boxes coated with plastic or wax to retard deterioration from moisture. Provide in sizes that will easily fit in disposal bags.

2.5 FELT

2.5.1 Standard felt approximately 1/16" thick and 36" to 72" in width.

2.6 GLOVEBAG

2.6.1 Constructed of a minimum of 6 mil thick plastic, seamless at the bottom, with two sealed inward projecting long sleeved gloves and equipped with a pouch for storage of tools and ports for sprayer wand and HEPA vacuum attachment.

3 PART 3 - EXECUTION

3.1 SECONDARY BARRIER

3.1.1 Secondary Barrier: Over the Primary Barrier, install as a drop cloth a clear 6 mil sheet plastic in all areas where asbestos removal work is to be carried out. Completely cover floor with sheet plastic. Where the work is within 10'-0" of a wall extend the Secondary Barrier up wall to ceiling. Support sheet plastic on wall with duct tape, seal top of Secondary plastic to Primary Barrier with duct tape so that debris is unable to get behind it. Provide cross strips of duct tape at wall support as necessary to support sheet plastic and prevent its falling during removal operations.

3.2 WORKER PROTECTION

3.2.1 Before beginning work with any material for which a Material Safety Data Sheet has been submitted provide workers with the required protective equipment. Require that appropriate protective equipment be used at all times.

3.3 WET REMOVAL (FULL-ENCLOSURE WORK AREA)

3.3.1 Thoroughly wet to satisfaction of Owner's Representative Asbestos-Containing Materials to be removed prior to stripping and/or tooling to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal encapsulant. Saturate material sufficiently to wet to the substrate without causing excess dripping. Allow time for amended water or removal encapsulant to penetrate material thoroughly. If amended water is used, spray material repeatedly during the work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's written instructions. Perforate outer covering of any installation which has been painted and/or jacketed in order to allow penetration of amended water or removal encapsulant, or use injection equipment to wet material under the covering. Where necessary, carefully strip away while simultaneously spraying amended water or removal encapsulant on the installation to minimize dispersal of asbestos fibers into the air.

3.3.2 Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.

3.3.3 Remove saturated Asbestos-Containing Material in small sections from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into disposal bags. Evacuate air from disposal bags with a HEPA filtered vacuum cleaner before sealing. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside and move to Wash Down Station adjacent to Material Decontamination Unit.

3.3.4 Pipe Insulation: Spray with a mist of amended water or removal encapsulant. Allow amended water or removal encapsulant to saturate material to substrate. If a removal encapsulant is used, use in strict accordance with manufacturer's instructions. Cut bands holding preformed pipe insulation, slit jackets at seams, remove and hand-place in a disposal bag. Remove job-molded fitting insulation in chunks and hand place in a disposal bag. Do not drop to floor. Remove any residue on pipe or fitting with stiff bristle nylon hand brush. In locations where pipe fitting insulation is removed from pipe with straight runs insulated with fibrous glass or other non-asbestos-containing fibrous material, remove fibrous material 6" from the point where it contacts the asbestos-containing insulation.

3.4 GLOVEBAGS

3.4.1 Comply with all applicable OSHA Class I removal procedures, including supervision by a competent person as defined by the regulation, wet methods and use of HEPA filtered vacuums. At least **two** persons shall perform Class I glove-bag removals.

3.4.2 Complete requirements of the following:

A. Section 01560 Worker Protection - Asbestos Abatement

B. Section 01562 Respiratory Protection

3.4.3 Place polyethylene sheeting below the area where glove-bag work will be performed. Extend polyethylene one foot horizontally in all directions for each vertical foot the piping is above the floor.

3.4.4 Cordon off the work zone with barrier tape and post warning signs at entrances to work zone.

3.4.5 Before beginning operation, loose and friable material adjacent to the glove-bag/box shall be wrapped and sealed in two layers of 6 mil polyethylene sheeting or otherwise rendered intact.

3.4.6 Place necessary tools into pouch located inside glove bag. This will usually include: bone saw, utility knife, rags, scrub brush, wire cutters, tin snips and pre-wetted cloth.

3.4.7 Install each glove-bag so that it completely covers the circumference of pipe or other structure where the work is to be done.

3.4.8 Use smoke tube and aspirator bulb to test seal. If leaks are found, tape closed using duct tape and re-test.

3.4.9 Insert wand from garden sprayer through water sleeve. Duct tape water sleeve tightly around the wand to prevent leakage.

3.4.10 Thoroughly wet material to be worked on with amended water or removal encapsulant and allow to soak in. Wet adequately to penetrate and soak material through to substrate.

3.4.11 One person places his hands into the long-sleeved gloves while the second person directs garden sprayer at the work.

3.4.12 Cut insulation at each end of the section to be removed. Spray amended water or removal encapsulant on the cutting area to keep dust to a minimum.

3.4.13 Remove insulation using putty knives or other tools. Place pieces in bottom of bag without dropping.

3.4.14 Rinse all tools with water inside the bag and place back into pouch.

3.4.15 Using scrub brush, rags and water, scrub and wipe down the exposed pipe. Remove water wand from water sleeve. Collapse the bag by evacuating air utilizing a HEPA vacuum.

3.4.16 Remove the vacuum nozzle, twist water sleeve closed and seal with duct tape.

3.4.17 Tool Pouch Removal: From outside the bag, pull the tool pouch away from the bag. Place duct tape over twisted portion and then cut the tool bag from the glove bag, cutting through the twisted/taped section. Contaminated tools may then be placed directly into next glove bag without cleaning or decontaminated and dried.

3.4.18 With removed insulation in the bottom of the bag, twist the bag several times and tape it to isolate the material in the bottom during removal of the glove bag from the pipe.

3.4.19 Place the used glove-bag in a 6 mil disposal bag.

3.4.20 Clean all surfaces in the Work Area using disposable cloths wetted with water with surfactant or removal encapsulant added.

3.4.21 Seal exposed ends of remaining pipe insulation.

3.4.22 Remove disposable suits and place these into bag with waste.

3.5 MINI-ENCLOSURES

3.5.1 A Mini-Enclosure consists of a small, walk-in Work Room with an attached separate Change Room. Worker decontamination requires a remote personnel decontamination unit.

3.5.2 Complete requirements of the following:

Section 01560 Worker Protection - Asbestos Abatement
Section 01562 Respiratory Protection

3.5.3 Sequence of Work: Before beginning work of this sub-section complete the following:

A. Comply with all applicable OSHA Class I removal procedures, including supervision by a competent person as defined by the regulation, wet removal methods, and use of HEPA filtered vacuums.

B. Construct a personnel decontamination unit in accordance with Section 01563 Decontamination Units.

C. Cordon off the work zone within which the mini-enclosure will be installed with barrier tape and post signs at all entrances.

D. Shut down HVAC system to the general area in which the mini-enclosure will be constructed or otherwise minimize air flow within the area.

3.5.4 Work Room: Utilize a prefabricated or construct Work Room in the same manner as a Primary Barrier fabricated from 6 mil sheet plastic. Line walls and floor of Work Room with a continuous Secondary Barrier.

3.5.5 Change Room: Provide an approximately 3'-0" by 3'-0" Change Room attached to Work Room. Fabricate Change Room from 6 mil sheet plastic in the same manner as a Primary Barrier. Locate so that access to Work Area is though Change Room.

3.5.6 Step Off Area: Cover floor in front of entry to Change Room with one layer of 6 mil sheet plastic. Securely anchor sheet plastic to prevent slipping.

3.5.7 Flapped Door Construction: Provide flapped door as entry to Change Room and entry from Change Room to Work Room. Fabricate each flapped door from overlapping contacting layers of sheet plastic. Fasten each layer on the top and one side. Reinforce free side and bottom of each sheet with duct tape. Alternate sides that are fastened on each layer. Form arrows pointing to entry side from duct tape on inside and outside of door.

3.5.8 Signage: At entry to Change Room post an approximately 20 inch by 14 inch manufactured caution sign displaying the following legend with letter sizes and styles of a visibility required by 29 CFR 1926.1101:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED
IN THIS AREA

A. Provide spacing between respective lines at least equal to the height of the respective upper line.

3.5.9 Entry to Work Room: Require that any time a worker enters the Work Room the following procedure is followed.

A. Outside of Change Room remove all street clothes and don clean coveralls and respirator. A swim suit or second disposable suit may be worn beneath outer coveralls.

B. Enter Change Room be sure that entry is completely closed.

C. Enter Work Room be sure that entry is completely closed.

3.5.10 Worker Decontamination: Require that any time a worker leaves the mini-Enclosure the following procedure be followed.

A. Maintain a bucket of clean potable water in the Change Room. Do not amend with a wetting agent.

B. Do not allow debris in work area to dry or accumulate. HEPA vacuum debris from floor prior to beginning exit procedures.

C. HEPA vacuum gross debris from disposable suit and foot coverings inside the Work Area. Leave respirator in place.

D. Proceed with respirator in place to Change Room.

E. Be sure that entry to Work Area is completely closed.

F. Wash hands, face and surface of respirator with water and wet paper towels. Use caution to avoid breaking seal between respirator face-piece and face.

G. In Change Room don clean disposable suit leaving respirator in place.

H. Exit change room, be sure that entry to Change Room is completely closed. Proceed to next Mini-Enclosure, or a remote shower.

I. At end of work day decontaminate fully in accordance with procedures in section "Worker Protection".

3.5.11 Material Decontamination: Require that the following procedure be used in removing equipment and bagged debris from the Work Room.

A. Worker in Work Room cleans equipment and bagged debris and hands one piece of equipment or one bag of debris at a time to worker in Change Room.

B. Worker in Change Room wet cleans each piece of equipment or bag. Equipment is sealed completely in 6 mil sheet plastic or bags in the Change Room and passed through the flapped door to the Step Off Area. Bagged waste is placed in a second clean disposal bag and passed to the Step Off Area. Ensure that only one of the two flapped doorways is open at any given time.

C. Each bag is immediately placed in a sealable cart for transport to the load out area. No bags are to be stored outside of the Mini-Enclosure.

D. All bags are to be transported through the building in clean sealed containers that have never been in a asbestos Work Area, Mini-Enclosure or decontamination unit.

3.5.12 Mini-Enclosure Decontamination: At completion of all work decontaminate the Work and Changing Rooms as set forth in Section 01711 Project Decontamination.

END OF SECTION - 02081

SECTION 02084

DISPOSAL OF ASBESTOS CONTAINING WASTE MATERIAL

1 PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

1.1.2 Section 01092 Codes and Regulations - Asbestos Abatement describes applicable federal, state and local regulations.

1.2 DESCRIPTION OF THE WORK

1.2.1 This section describes the disposal of Asbestos-Containing Materials. Disposal includes packaging of asbestos-containing waste materials. Disposal may be accomplished either by land filling or converting asbestos containing materials to non asbestos waste.

1.3 SUBMITTALS

1.3.1 Before Start of Work: Submit the following to the Owner's Representative for review. Do not start work until these submittals are returned with Owner's Representative's approval indicating that the submittal is returned for unrestricted use.

1.3.2 Copy of state or local license for waste hauler.

1.3.3 Name and address of landfill where asbestos-containing waste materials are to be buried. Include contact person and telephone number.

1.3.4 Submit copies of all manifests and disposal site receipts to Owner's Representative prior to project closeout.

2 PART 2 - PRODUCTS

2.1 DISPOSAL BAGS

2.1.1 Provide 6 mil thick leak-tight polyethylene bags labeled with three labels with text as follows:

2.2 FIRST LABEL

2.2.1 Provide in accordance with 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard with NESHAP additions:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
BREATHING AIRBORNE ASBESTOS
FIBERS IS HAZARDOUS TO YOUR HEALTH
OWNER NAME, CONTRACTOR NAME
LOCATION AT WHICH WASTE WAS GENERATED

SECOND LABEL

2.2.2 Provide in accordance with U. S. Department of Transportation regulation on hazardous waste marking. 49 CFR parts 171 and 172. Hazardous Substances: Final Rule. Published November 21, 1986 and revised October 21, 1991:

RQ
ASBESTOS
NA 2212, III

3 PART 3 - EXECUTION

3.1 Comply with the following sections during all phases of this work:

3.1.1 Section 01560 Worker Protection - Asbestos Abatement
3.1.2 Section 01562 Respiratory Protection

3.2 GENERAL

3.2.1 All waste is to be hauled by a waste hauler with all required licenses from all state and local authority with jurisdiction.

3.2.2 Seal asbestos waste in leak-proof impermeable containers labeled in accordance with Title 29, Code of Federal Regulations, Section 1910.1200 (f).

3.2.3 Protect interior of truck or dumpster with Critical and Primary Barriers as described in Section 01526 Temporary Enclosures.

3.2.4 Carefully load containerized waste in fully enclosed dumpsters, trucks or other appropriate vehicles for transport. Exercise care before and during transport, to insure that no unauthorized persons have access to the material. Vehicle must be placarded with DOT label.

3.2.5 Do not store containerized materials outside of the Work Area. Take containers from the Work Area directly to a sealed truck or dumpster.

3.2.6 Do not transport disposal bagged materials on open trucks. Double bagged material may be transported on open trucks if they are first loaded in sealed drums. Label drums with same warning labels as bags. Uncontaminated drums may be reused. Treat drums that have been contaminated as asbestos-containing waste and dispose of in accordance with this specification.

3.2.7 Advise the landfill operator or processor, in advance of transport, of the quantity of material to be delivered.

3.2.8 At disposal site unload containerized waste:

A. At a disposal site, sealed plastic bags may be carefully unloaded from the truck. If bags are broken or damaged, return to work site for rebagging. Clean entire truck and contents which have been in contact with containerized waste, using procedures set forth in Section 01711-Project Decontamination.

B. Ensure that no visible emissions are released to the outside air from sealed plastic bags or impermeable containers while transporting or handling at the site where materials and waste are deposited.

3.2.9 Retain receipts from landfill or processor for materials disposed of.

3.2.10 At completion of hauling and disposal of each load, submit copy of waste manifest, chain of custody form, and landfill receipt to Owner's Representative.

END OF SECTION - 02084

SECTION 03810

INORGANIC LEAD SPECIFICATION

PART I GENERAL

1.1 DESCRIPTION OF WORK

A. The Work covered by this section includes the handling of Lead bearing paints which are encountered during the renovation/demolition activities of all Lead painted surfaces including, but not limited to interior brick walls and wall attachments (electrical conduits/panels, gas lines, water lines, exhaust flues, 1'x1' ceiling tiles), window sills/frames, HVAC exhaust ducts, and the incidental procedures and equipment required to protect workers and occupants of the building, or both, from contact with airborne Lead dust, fallen dusts containing Lead, and attached Lead bearing materials. The work also includes the proper disposal of the removed Lead containing materials at an approved disposal site according to current Federal, State, Regional, or Local regulations that apply.

B. The Contractor shall supply all labor, materials, equipment, services, insurance and incidentals which are necessary or required to perform the Work. The Work shall be performed in accordance with applicable governmental regulations and these Specifications.

C. The Contractor will be responsible for all medical monitoring before and after abatement in accordance with applicable laws and regulations including without limitation OSHA 29 CFR 1910.1025, 1926.62 and Title 8, CCR 1532.1.

D. The Contractor will be responsible for all environmental and health and safety monitoring including without limitation conducting personal breathing zone monitoring and the posting of results and all required disposal tests.

19. The Contractor will be responsible for completing all Lead waste characterization testing requirements prior to the removal activities so the proper Lead waste stream can be identified for each material. Based on the sample analysis the Contractor must make every effort to minimize the waste stream utilizing industry accepted standards.

F. The Contractor will be responsible for the removal as specified and the storage, transportation and disposal of all Lead paint and Lead materials removed from surfaces as well as all removed components in the affected area.

G. This Lead specification is general in scope to cover conditions that most often occur. However, the Contractor is bound only by the applicable portions of the specification. Additional or specific instructions to the Contractor may be added as part of the Scope of Work of a contract. In such cases, the Contractor is bound by those special provisions or requirements.

1.2 **RELATED WORK** This specification contains the requirements of the current Federal and State regulations for occupational exposure to Lead and Lead bearing compounds.

1.3 SCOPE

This specification covers the removal of Lead painted components as defined below:

SECTION 03810

INORGANIC LEAD SPECIFICATION

South Orange County Community College District
28000 Marguerite Pkwy, Mission Viejo, CA

Special Annex Building

COMPONENT / SUBSTRATE	LOCATION	LEAD CONTENT (mg/cm²)	APPROXIMATE QUANTITY/WORK DESCRIPTION
Door Frame/Metal/White	Throughout Building	1.3	4 each
Wall AC/Units/Metal/Off White	Throughout Exterior of Building	1.3	2 each

Classroom Complex Building

COMPONENT / SUBSTRATE	LOCATION	LEAD CONTENT (mg/cm²)	APPROXIMATE QUANTITY/WORK DESCRIPTION
No Suspect Lead Containing Materials Noted			

[1] Material may or may not be impacted by the scheduled renovation/demolition activities.

1.4 **APPLICABLE PUBLICATIONS**: The publications listed below are incorporated into this specification and shall be read as if printed herein. In case of conflict between the referenced documents and the requirements in the following test, the stricter requirements shall apply. When differences occur between Federal, State, Regional, City or local regulations or ordinances, the stricter requirements shall apply. However, only the regulations of agencies that have jurisdiction over the operations apply. Others may be used as guidelines. Recommended practices by regulatory agencies or scientific advisory organizations may be used as guidelines in establishing current state-of-the-art practices.

A. **CODE OF FEDERAL REGULATIONS:**

29 CFR 1910.1025	Inorganic Lead, (General Industry)
29 CFR 1910.10	Hazardous & Unsafe Conditions
29 CFR 1910.20	Employee Access to Medical Records
29 CFR 1910.133	Employee Protective Equipment
29 CFR 1910.134	Respiratory Protection
29 CFR 1910.141	Lavatory Facilities
29 CFR 1910.1200	Hazard Communications Standard
29 CFR 1926.20	General Safety and Health - Construction
29 CFR 1926.21	Safety Training and Education
29 CFR 1926.25	Housekeeping
29 CFR 1926.28	Personal Protective Equipment
29 CFR 1926.51(f)	Washing Facilities
29 CFR 1926.55	Gases, Vapors, Fumes, Dusts, Mists
29 CFR 1926.57	Ventilation
29 CFR 1926.59	Hazard Communications Standards (Construction)
29 CFR 1926.62	Lead Exposure in Construction
29 CFR 1926.103	Respiratory Protection
29 CFR 1926.150	Fire Protection
29 CFR 1926.353	Ventilation-Welding, Heating, etc.

40 CFR, Part 261 RCRA (Resource Conservation & Recovery Act) of 1976, as amended in 1980 and 1984 - Hazardous Waste Disposal (Toxic & Hazardous Chemicals).

42 U.S.C. 4822 (d) (2) (A) Public Law, Section 302, Lead Based Paint Poisoning Prevention Act. (Public Housing & Indian Housing Agencies - *only*)

42 U.S.C. 9601, CERCLA, Comprehensive Environmental Response, Compensation & Liability Act and the Superfund Amendments and Authorization Act (SARA), Public Law 99-499, 100 Statute 1613.

Department of Transportation (DOT) Regulations regarding the transportation of hazardous materials, 49 CFR.

B. **STATE OF CALIFORNIA & LOCAL REGULATIONS**

CCR T8 1532.1 Construction Safety Orders, Lead

CCR T17 Division 1, Chapter 8, Accreditation, Certification, and Work Practices for Lead-Based Paint and Lead Hazards

CCR T22 Division 4.5, Environmental Health Standards for the Management of Hazardous Waste

C. **GUIDANCE DOCUMENTS**

1. National Institute for Occupational Safety & Health, (NIOSH), Occupational Exposure to Inorganic Lead, Criteria for a Recommended Standard. Pub 78-158, 1978.

2. U.S. EPA, Air Quality Criteria for Lead, EPA-600/8-83/028a, Final Draft, 1986.

3. National Institute for Occupational Safety & Health (NIOSH), NIOSH Respirator Decision Logic, Pub 87-108, 1987.

4. National Institute for Occupational Safety & Health (NIOSH), NIOSH Guide to Industrial Respiratory Protection, Pub 87-116, 1987.

5. National Institute for Occupational Safety & Health (NIOSH), Recommended Industrial Ventilation Guidelines, Pub 96-162.

6. American Conference of Governmental Industrial Consultants (ACGIH), Industrial Ventilation Manual, 22 Edition, 1980.

7. American National Standards Institute (ANSI) Pub Z9.2-79 Local Exhaust Ventilation Systems. Pub Z88.2-80 Practices for Respiratory Protection.

8. American Conference of Governmental Industrial Hygienists (ACGIH), Documentation of "Threshold Limit Values and Biological Exposure Indices", Fifth Edition, 1989 - 1990.

9. Department of Housing and Urban Development, Office of Public & Indian Housing, *Lead-Based Paint: Interim Guidelines for Hazard Identification and Abatement in Public and Indian Housing, September 1990.*

1.5 DEFINITIONS AND REQUIREMENTS:

A. Lead: all metallic Lead, inorganic Lead compounds, Lead containing paints, bulk Lead sheets, and organic Lead soaps.

B. Action Level: Exposure without the use of respirators to airborne concentrations of Lead in the breathing zone of 30 micrograms/cubic meter (ug/m^3) of air sampled and average over an 8 hour work period.

C. Permissible Exposure Limit: A limit of 50 ug/m^3 Lead exposure averaged over an 8 hour work period. The 8 hour time-weighted average (TWA), allowable exposure is reduced proportionately if more than 8 hours is worked that day. Periods when respirators are worn may be calculated with periods when they are not worn, according to the respirator protection factor, to develop the 8 hour TWA.

D. Exposure Monitoring: The following criteria must be met:

1. Sample of breathing zone exposure as if no respirator were worn.

2. Sample for at least (1) full 8-hour work shift.

3. Sample the most exposed employee for each job classification in each different work area.

4. Full shift samples must be representative of the employees' regular, daily exposure to Lead.

5. The employer must determine by air sampling if employees are exposed to Lead above the Action Level or Permissible Exposure Limit.

6. Previous air monitoring results in similar situations during the past 12 months may be used to satisfy initial monitoring requirements or selection of respiratory equipment.

7. Air monitoring result reports shall include at a minimum:
   - Date
   - Locations and type.
   - Employee/Area name.
   - Sample Time.
   - Sample volume.
   - Airborne concentration (mg/m^3).
   - Note actions taken in response to exceeding the established criteria.

8. All air sampling data must be recorded even that which shows that employees are below the Action Level.

E. Frequency: If initial monitoring results show that occupational exposure of workers is below the Action Level, then only periodic monitoring is required. If it is above the Action Level, but below the PEL, sample every six months.

When the monitoring results are above the PEL, then monitoring must continue at least quarterly until results show that exposures have fallen below the Action Level.

Whenever there are changes in the operations, or type or location of the work, initial monitoring must be repeated to establish the workers' exposure.

F. Notification: Within five (5) days following receipt of monitoring results, the employer must make the information available to the employees in writing. Posting of results, on site, is required.

G. Method of Compliance: The employer shall implement engineering and work practice controls, including administrative controls, to reduce and maintain employee exposure to lead at or below the PEL.

H. Respiratory Protection: Where a negative exposure assessment has not been performed and/or where engineering control and change of work practices may not reduce the employee exposures to below the PEL of 50 ug/m^3, then proper respiratory protection as defined in 29 CFR 1926.62 and Title 8, CCR, Section 1532.1, Table II must be used according to the airborne concentrations of Lead present in the breathing zone.

I. Compliance Program: Each employer shall develop a written compliance program in accordance with 29 CFR 1926.62 and Title 8, CCR, Section 1532.1 for the control of occupational exposures to Lead at or below the PEL. Compliance programs must be explicit in the methodologies to reduce the exposures. This program must be provided to the Consultant five (5) days prior to project commencement.

J. Mechanical Ventilation: The ventilation systems must meet ANSI criteria and be tested for static pressure at least every three months, or directly after maintenance or major repair. Temporary mechanical ventilation, such as negative air machines, must be inspected daily for leaks and proper assembly. HEPA filter systems must be inspected for leaks daily.

K. Recirculation of Air: Air that is returned to the work space must be filtered with a HEPA filter to retain the Lead particulate. Such devices must be inspected daily.

Also, open vents, shafts or ventilation systems inlets and outlets must be sealed shut to prevent capture of the Lead dust in the air which would be transported throughout the influence of the ventilation system.

L. Administrative Controls: If the employer uses administrative controls to reduce employee TWA exposures to Lead, the employer must establish and implement a job rotation schedule in accordance with Title 8, CCR, section 1532.1.

M. Respiratory Program: The employer shall establish a written respiratory program in accordance with 29 CFR 1910.134 and Title 8, CCR, Section 5144. Each employee must be trained and instructed in the handling and use of the appropriate respiratory protection for the concentration to which they are exposed.

N. Protective Clothing: The employer shall provide disposable or other protective clothing to protect the worker's street clothing and exposed skin form exposure to Lead dust. Dirty clothing can be a substantial contribution to the worker's inhalation or ingestion of Lead dust and may be a source of introduction into the home where children may reside.

O. Cleaning and Replacement: The employer shall provide the protective clothing required in a clean and dry condition at least weekly, and daily to employees whose exposure levels without regard to a respirator are over 200 ug/m^3 of Lead as an 8-hour TWA.

P. Laundry: The employer must inform the laundry of the Lead contaminated clothing and label the bags in which it is transported to the laundry.

CAUTION - CLOTHING CONTAMINATED WITH LEAD, DO NOT REMOVE DUST BY SHAKING OR BLOWING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE LOCAL, STATE OR FEDERAL REGULATIONS.

Q. Air Hoses: The use of air hoses to remove dust from clothing, equipment, or other protective clothing is *prohibited.*

R. Housekeeping: The following practices shall be used;

1. Maintain the surfaces as free of Lead as practical.

2. Air cleaning with air hoses or blowers on surfaces is prohibited.

3. Shoveling, or gross removal may only be done in enclosed, ventilated areas and where employees are properly protected.

4. Where vacuuming is used, the vacuum must be fitted with a HEPA filter.
5. Clean-up of the work area must be done daily.

S. Eating and Rest Places: Rest places and places where employees eat must be kept free of Lead contamination. Eating, drinking, chewing, smoking or applying skin creams or lotions in Lead contaminated work areas is *prohibited.* Ingestion is a major source of introduction of Lead into the body.

T. Lavatories: The employer shall provide clean, adequate lavatories to comply with 29 CFR 1926.62. Washing facilities is required. Employees need to wash their hands and face before eating, drinking, chewing, or smoking.

U. Medical Surveillance: The employer shall initiate a program of medical surveillance for each employee which is or may be exposed above the Action Level of 30µg/m^3 8 hour TWA each year. The medical surveillance shall be made by a licensed physician using the protocol defined in 29 CFR 1926.62 and Title8, CCR, section 1532.1.

V. Medical Notification: Each employee whose blood Lead levels are above 40mg/dl of whole blood shall be notified. They shall be monitored according to the schedule in 29 CFR 1926.62 and Title 8, CCR, Section 1532.1, until blood Lead levels fall below 40mg/dl.

W. Medical Removal: Each employee monitored for blood Lead shall be removed from work status when the blood Lead levels exceed 50mg/dl, or according to the schedule in 29 CFR 1926.62 and Title 8, CCR, Section 1532.1.

X. Employee Information and Training program: The employer shall communicate information concerning Lead hazards according to the requirements of the Hazard Communication Standard, Title 8, CCR, section 5194. The employer shall provide initial training in accordance with Title 8, CCR, Section 1532.1, for employees who may be exposed to Lead dust above the Action Level (AL) on any day. The employer shall ensure that all employees and supervisors who are engaged in Lead related construction

work as defined in Title 17, CCR, Section 35022 and have been shown to be exposed to Lead at or above the PEL, meet the training requirements of Title 8, CCR, section 1532.1 and are certified by the California Department of Health Services.

Y. Signs: The employer shall post signs at the work site that are readily visible to those who enter where the PEL may be exceeded. They shall read:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

Z. Record Keeping: The employer shall keep accurate records of medical examinations, blood Lead data, air sampling results, ventilation system inspections, the number and names of employees present, the respiratory protection worn, the protective equipment worn, and workers medically removed from the job and any other job site variables that affect the exposures of the workers. The records must be kept for the duration of thirty (30) years. The records affecting each employee must be made available on request.

AA. Observation of Monitoring: The employer must make methods and observations available to employees of the air monitoring on the job. Individual medical information must not be disclosed without the employee's permission.

BB. Lead Waste Characterization Testing: The Contractor is responsible conducting tests on all wastes including without limitation, Toxicity Characteristic Leaching Procedures (TCLP), Toxicity Threshold Limit Concentration (TTLC) and Soluble Threshold Limit Concentration (STLC) analysis on wastes suspected of containing Lead prior to storage, transport and disposal as required for compliance with all applicable Federal, State and local laws, regulations and standards. The waste characterization testing must be performed in accordance with all current Federal, State and Local regulatory requirements.

CC. Weekly transport and landfill manifests shall be submitted along with pay requests for Completed Work.

1.6 QUALITY ASSURANCE

A. Onsite Observations:

1. Consultant will provide observations regarding integrity of barriers, contamination control, decontamination facilities, enclosures (when they are used), protective clothing worker protection programs, Contractor's air monitoring procedures, proper performance of abatement/removal of the Lead bearing materials including area preparation, isolation, disposal of refuse and compliance with the EPA, OSHA, State, City and Local regulations affecting the job.

2. If at any time, the Consultant determines that the practices are in violation of applicable regulations or defined procedures, to practices that endanger the employees, he/she shall notify the Contractor orally that operation must cease until approved corrective action is taken. The notification shall be followed by a written confirmation to the Contractor.

3. If the work has been stopped for reasons in 1.6.A.3 above, the work may not be restarted until the Contractor receives a written authorization to proceed from the

Consultant. The Contractor shall bear the costs of the delay due to non-compliance with the regulations or the contract.

4. Any costs resulting from such a stop work order issued by the Consultant and any work costs involved in restarting the work, will be borne by the Contractor and will not be considered as the basis for an increase in the contract amount or time due to delays.

5. The safety of the Contractor's employee used under this contract specification and any visitors on the job site are the sole responsibility of the Contractor.

B. Auditing of the Contractor:

1. The Lead work site may be audited by the Consultant as the Consultant deems necessary relative to compliance with all applicable Federal, State and Local laws, standards and regulations.

2. Allow the Consultant or its representative access to the site, log books and monitoring data upon request.

3. Provide the Consultant on a weekly basis the following reports:

   a. Supervisor's Daily logs.
   b. Personnel air monitoring results for each work area.
   c. Waste Manifests

4. Chain-of-custody forms are to be kept for all samples.

1.7 **TITLE TO MATERIALS** All Lead bearing materials and refuse resulting form operations or renovation/demolition work, except as specified herein, shall become the property of the Contractor and shall be disposed of according to Federal and State regulations in an EPA approved disposal site. The Owner will not accept possession of any Lead bearing materials or refuse after their removal by the Contractor.

1.8 **PROTECTION OF EXISTING WORK TO REMAIN** The Contractor shall perform the Lead paint removal and demolition work without *damage or contamination* of the adjacent areas. California DHS considers contamination outside the work area a "Lead hazard". Where adjacent areas are damaged or contaminated with Lead dust of refuse, it shall be restored to its original condition at no expense to the Owner. The restorative procedures shall be performed in accordance with the DHS Regulations (Title 17 CCR, Division 1, Chapter 8) and approved by the Owner or the Consultant prior to the start of restoration of decontamination.

1.9 **MEDICAL REQUIREMENTS** The OSHA Lead standard is strict about the medical monitoring of employees exposed to Lead bearing dusts, fumes or mists. The employer must conduct the initial monitoring of the work place as required and use that information to develop a plan for medical monitoring of the employees. It is to the Contractor's responsibility to conduct biological monitoring and medical surveillance in accordance with 29CFR, 1926.62 and Title 8, CCR, section 1532.1.

1.10 **TRAINING** Prior to the assignment of activities that may disturb Lead materials, each employee must be instructed about the hazards of Lead in accordance with the requirements of the Hazard Communication Standards and the procedures and equipment that must be used to minimize exposures. This includes the use of respirators, protective clothing and methods of removal.

The Contractor's & workers must be licensed by the State for removal of Lead materials and refuse when workers have the potential to be exposed to airborne Lead concentration in excess of the PEL. Unless a negative exposure assessment has been performed the Contractor shall assume that when they are performing anyone or a combination of the "trigger tasks" listed in T8 CCR Section 1532.1 (d) that airborne concentrations of Lead will be in excess of the PEL. Any Federal, State, Regional, City or Local permits or licenses required must be obtained by the Contractor prior to beginning work.

1.11 **PERMITS AND NOTIFICATIONS** Obtain all necessary permits in conjunction with the Lead materials removal, hauling and waste site disposal and provide timely notification of such actions as may be required by Federal, State or Local authorities. Except, as negotiated, the Contractor shall procure and pay for all permits and inspections, except those performed by the Owner, and shall furnish any bonds, security, or deposits required to permit performance of the work defined. The Contractor will be responsible for the determination of required regulatory postings for the Lead project.

1.12 **SAFETY COMPLIANCE** In addition to detailed requirements of this specification, the Contractor shall comply with the safety and health requirements of applicable Federal, State and Local regulations. Where interpretations are necessary, they shall be obtained before commencing work. Where the referenced regulations vary, the most stringent requirements shall apply.

1.13.1 **RESPIRATOR PROGRAMS** All workers inside the Lead work area will wear the appropriate respirator for the existing Lead concentration. The Contractor shall prepare a respirator program required in the Federal regulation at 29 CFR 1910.134, or State requirements whichever is stricter. The respiratory requirements in Table II, 29 CFR 1910.1025 - Lead must be followed. They are:

Airborne Concentration of Lead and Use	Required Respirators
Not in Excess of 500 ug/m^3 (10X PEL)	**Half-mask, air-purifying respirator with HEPA filters. Half-mask supplied air respirator operated in demand mode (negative pressure) mode.**
Not in Excess of 1,250 ug/m^3 (25X PEL)	**Loose fitting hood or helmet PAPR with HEPA filters Hood or helmet supplied air respirator operated in a continuous flow mode**
Not in Excess of 2500 ug/m^3 (50X PEL)	**Full face air purifying respirator with HEPA filters. Tight fitting PAPR with HEPA filters Full face supplied air operated in demand mode Half- mask or full face supplied air operated in a continuous flow mode Full face SCBA operated in demand mode**
Not in Excess of 50,000 ug/m^3 (1,000X PEL)	**Half-mask supplied air operated in pressure demand or other positive pressure mode.**
Not in Excess of 100,000 ug/m^3 (2,000X PEL)	**Full-face supplied air operated in pressure demand or other positive pressure mode.**
Greater than 100,000 ug/m^3 or unknown	**Full facepiece self-contained breathing (SCBA) operated in pressure demand or other positive**

Airborne Concentration of Lead and Use	Required Respirators
	pressure mode.

Notes:

1. HEPA means High Efficiency Particulate Aerosol filter at 99.97% efficiency collection of .3 micron diameter particles or larger.
2. The values in the table are based upon reasonable measurements in the breathing Zone of workers for an 8 hour time-weighted average work day.

The Workers must be properly trained in the care, use and maintenance of respirators. The Contractor will require that a fit test be performed on and passed by his/her workers not less than six (6) months before they enter the work area. The Contractor must implement a formal respiratory protection program in accordance with 29 CFR 1926.62.

The Workers may not remove their Respirators until they enter the washing area (or equivalent) of the decontamination chamber.

1.14 SUBMITTALS

A. Certification of Compliance: Submit the manufacturer's certification that vacuums, ventilation equipment or other equipment required to contain Lead conforms to ANSI Z9.2 (See references)

B. Lead Work Plan: Submit a detailed plan of the work procedures to be used in the Lead activities and related work. Such a plan shall include the location of Lead control areas, change rooms, rest areas, eating areas, mini-enclosures (if used) methods of storage and methods of disposal.

The Contractor must not deviate from procedures set forth in this specification, unless express permission is granted by the Consultant. All deviations from established Lead work activities are subject to review and approval by the Owner or the Consultant. Applicable regulations must be obeyed.

C. Testing Laboratory: Submit the name, address and telephone number of the testing laboratory selected for the monitoring of the airborne concentrations of Lead. The analytical laboratory shall be accredited by ELAP or NLLAP or be a current participant in the NIOSH Environmental Lead Proficiency Analytical Testing Program (ELPAT) and maintains certification results.

D. Industrial Consultant/Safety Personnel: Submit the name of any industrial Consultant or safety personnel who will be involved in the Contractor's Lead monitoring and training program. If third party monitoring of the air is conducted the name of the organization conducting the work must be offered by the Contractor.

E. Monitoring Results: The results of air monitoring or blood Lead analyses shall be submitted to the Consultant for review within 24 hours after the Contractor receives them. Any unwarranted overexposure must be reported to the Consultant who will review the methods of prevention developed by the Contractor.

F. Notification: Notify the Owner and the Consultant three (3) working days prior to the start of Lead work activities. Where fire protection systems must be deactivated, the Consultant and the Fire Department shall be notified at least three (3) days prior to that action.

G. Landfill: Submit written evidence that the landfills or EPA disposal sites are approved by the Federal, State, or Local authorities for dumping of the Lead bearing refuse. A landfill (dump site) log or manifest must be maintained and submitted to the Consultant. All dump receipts must be reconciled with the manifest and provided to the Consultant for review.

H. Local Exhaust Systems: Pressure differentials of at least - .02 inches of water shall be maintained for any negative air enclosures used in the Lead work operations.

I. Permits: Submit copies of the permits for Lead work as applies, and proof that all arrangements have been made for the transportation and disposal of the Lead bearing materials and refuse to a dumpsite approved by the EPA or local authorities.

J. Schedule and Work Plan: The Contractor shall submit a written work plan and work force schedule to the Consultant for review. It must establish the locations, expected rates of removal, start and completion dates and number of workers assigned on the job. The plan should include any time-phased work or phasing out of the job at the end.

K. Respirator Program: As noted above, the Contractor must develop a viable respirator program based upon monitoring results on the job.

L. Air Monitoring: The Contractor must provide the methods, techniques and the names of persons or organizations that will perform the regular personal and environmental air monitoring for *Lead in Air or Wipe Samples*. The information is subject to review by the Consultant for calibrations, proper entries, recordkeeping, testing laboratory and proper analytical techniques.

M. Disposal Site Records: Upon completion of the Lead work the Contractor must submit the transportation manifests and dump receipts that are reconciled, to the Consultant for review. This phase is part of the contract and the Contractor will not be released until this action is completed.

N. Occupancy Release: The Contractor shall notify the Consultant that the Lead work areas are free of airborne Lead and that there is no Lead bearing dust contamination and are available for use or release to the Owner for renovation/demolition activities.

O. Final Documentation: The Contractor must provide all of the documentation generated during the Lead work including the disposal receipts, manifest, monitoring data, etc. for inclusion in a final closure report. The Consultant advises the Owner not to allow release of the Contractor until all the final documentation is provided.

1.15 **SANITARY FACILITIES** Adequate toilet facilities are required in the work area. Since this is a Lead project, the Contractor is required to provide a lunch/rest area away from contaminated areas and soap and water to wash hands and faces prior to eating. Where such facilities do not exist in the building, the Contractor shall provide temporary facilities. This includes an area to change clothes and clean or repair respirators.

SECTION 03810

INORGANIC LEAD SPECIFICATION

1.16 DELIVERY, STORAGE AND PROTECTION

A. Delivery: Deliver all materials in the original packages, containers or bundles bearing the manufacturer and brand name.

B. Storage: Store all materials subject to damage off the ground, away from wet or damp surfaces and under of cover sufficient to prevent damage of contamination.

Lead bearing materials or refuse must be stored in locked rooms or locked dumpsters before it is delivered to the dumpsite.

C. Protection: Damaged or deteriorating materials shall not be used and shall not be discarded in the promises. This includes any refuse that is not Lead bearing that is generated by the Contractor. It must be removed from the premises.

Any materials that become contaminated with Lead bearing materials that cannot be decontaminated shall be disposed of in accordance with the applicable Federal, State and Local regulations.

END OF PART 1 - GENERAL

PART 2 PRODUCTS

2.1 RESPIRATORS

A. Selection: Select respirators from those currently approved by the National Institute for Occupational Safety & Health (NIOSH) as defined in the NIOSH Certified Equipment List (most current).

B. Lead Respirators: Provide respirators of the type listed in Table II of 29 CFR 1926.62 and Title 8, CCR, Section 1532.1 for the airborne concentrations of Lead encountered for handling, removal, decontamination, packaging or disposal.

C. Types of Respirators: The types of respirators required are defined in Table II described above. However, the Contractor must measure the airborne concentrations and select the appropriate respirator. Historical date may be relied upon if it validly can be applied to the work site for respirator selection. In all other cases, the Contractor must obtain approval form the Consultant for special conditions.

2.2 ENCAPSULANTS

A. Penetrating: Where the Contractor wishes to use encapsulants, or is directed by the Owner or in the scope of work, there are a large number of encapsulants for fine particles available. They should meet the EPA's recommendations for application and composition. Any other products must be approved by the Consultant before use.

B. Bridging: There are a number of bridging encapsulants available on the market that meet the EPA recommendations for application and composition to surface coat contaminated surfaces. Any deviations must receive the Owner's and Consultant's approval.

2.3 **PLASTIC SHEET** Plastic sheet used for Lead work shall be used in sufficient size and length to reduce the number of joints. The minimum thickness shall be:

APPLICATION	THICKNESS
Wall Barriers	4 mil
Floor Barriers	2 layers of 6 mil
Other Applications	4 mil

2.4 **PLASTIC BAGS** Any plastic bags used for containment of Lead bearing material refuse, contaminated clothing or tools, or other materials used in the work area shall be a minimum of 6 mil in thickness of polyethylene. The bags must be labeled with a proper warning label, sealed and placed into DOT approved metal drums where State or Local authorities require it.

2.5 **TAPE** Duct tape shall be capable of sealing joints of adjacent plastic sheet and attachment of plastic to surfaces under wet or dry conditions and be able to stick when wetted with amended water.

2.6 **DISPOSAL CONTAINERS** Disposal containers shall be suitable to receive and retain Lead bearing refuse until transported to the landfill for disposal. It is the Contractor's responsibility to determine the proper waste containerization based on the type of waste generated as in accordance with Title 22, CCR, Division 4.5 and any other applicable federal, state, local requirements. The containers shall be labeled in accordance to requirements of Federal, State and Local authorities that apply.

2.7 **EYE PROTECTION** During the Lead project, employees will need protection from flying particles during scraping, removal, handling of waste and packaging. The Contractor is responsible to provide eye and any other protective measures, according to 29 CFR 1910.133.

2.8 **SPECIAL CLOTHING**

A. Protective Clothing: Where required by the regulations, the Contractor must provide workers who have the potential to be exposed to Lead containing materials or airborne concentrations above the PEL of 50 ug/m^3 protective and work clothing, such as:

- Coveralls, or similar full body clothing.
- Head covers, gloves, hats, shoe covers, etc.
- Face shield or goggles, where required.

B. Work Clothing: Provide work clothing or safety devices along with the protective clothing as required. Such safety devices such as rubber boots may be decontaminated and reused.

2.9 **WARNING SIGNS** The employer shall post the following warning signs in each work area where the PEL could reasonably be exceeded. The signs shall be at least 20" x 14" with bold lettering two (2) inches tall.

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

As directed by the consultant, the Contractor shall place two (2) inch wide barrier tape with the wording "CAUTION: LEAD-PAINT ABATEMENT" at the entrance to discourage unauthorized entry.

2.10 **SURFACTANTS** (WETTING AGENT) Surfactants shall be mixed as recommended by the manufacturer to produce amended water. Generally, the ratio is about (30:1) or one cup of surfactant to 30 gallons of water, depending upon the concentrations of the original material.

2.11 **OTHER MATERIALS** The Contractor shall provide standard commercial grade quality of all other materials such as lumber, nails and hardware which may be required to construct or dismantle the decontamination areas and barriers that isolate the Lead work areas.

2.12 **TOOLS AND EQUIPMENT**

A. Water Sprayer: Water sprayers for amended water or encapsulants shall be an airless or other low pressure type, such as hand sprayers.

B. Airless Sprayer: An airless sprayer may be used for the application of penetrating wash solution such as trisodium phosphate or sodium hexametaphosphates to remove Lead residues from walls or other surfaces.

C. Negative Air Machines: All negative air machines shall be of the type that filters the exhaust through a HEPA filter and properly permitted through SCAQMD. They must be vented outside the enclosures or building. A failure of the exhaust system may contaminate the entire work area with fine airborne Lead dust which cannot be seen with the naked eye, thus creating unknown and unwarranted exposures to occupants.

D. Exhaust System Requirements: A local exhaust system must be provided to the work area where airborne concentrations can reasonably be expected to exceed the PEL of 50 $\mu g/m^3$ for an 8 hour time- weighted average work day. Where exhaust systems are used to ventilate enclosures, a minimum pressure differential of -.02 inches of water must be maintained to ensure that Lead containing dusts cannot escape. All filters and exhaust equipment must conform to the ANSI Z9.2 HEPA requirements.

E. Vacuum Equipment: All vacuum equipment utilized in the work area shall use the HEPA filters on the discharge and be suitable for wet use where water in involved. Vacuum equipment which is exhausted outside the work area shall be properly permitted through SCAQMD.

F. Scaffolding: Scaffolding as required shall meet the current safety and health regulations administered by the Federal or applicable State standards.

G. Transportation Equipment: Transportation equipment shall be suitable for loading, temporary storage, transit and unloading of contaminated waste without exposure to persons or property. All transportation of Lead refuse to the dump sites must be in covered vehicles.

H. Electrical: Electrical tools and equipment shall meet all applicable codes and regulations. Ground fault interrupters and assured grounding programs are required because of the wet nature of some of the Lead Paint removal projects.

I. Fall Protection: The Contractor shall adhere to the Fall Protection requirements set forth in 1926.502.

END OF PART 2 - PRODUCTS

SECTION 03810

INORGANIC LEAD SPECIFICATION

PART 3 - EXECUTION

3.1 **WORK PROCEDURE** All Lead paint removal work must be performed in accordance with Federal, State and local regulations. The following procedures that are known to control the release and spreading of Lead dust must be utilized at all times:

A. Wet removal procedures.

B. Protective clothing must be worn where workers are in contact with Lead dust to prevent spread of contamination.

C. Eating, drinking and smoking is prohibited in Lead paint removal or control areas.

D. Local exhaust ventilation and enclosures to enclose the Lead paint removal operations, when feasible.

E. Housekeeping: All surfaces shall be maintained as free as practicable of accumulations of lead, clean change areas and showers where feasible, shall be provided for workers whose lead exposure exceeds the PEL, adequate hand-washing facilities shall be available and utilized for all activities involving Lead.

3.2 **LEAD PAINT REMOVAL & CONTROL AREA (ENCLOSED)** For the interior or exterior removal or demolition of components that contain Lead where the paint will become detached from the substrate or broken up due to the removal or demolition activities this method of Lead control shall be used and the following procedures are required:

A. Seal the openings where the release of Lead could occur outside the work area with two (2) layers of 6-mil flame retardant poly secured with duct tape (i.e., windows, doorways, HVAC systems, and any other openings).

B. Cover floors with a minimum of one (1) layer of 6-mil flame retardant poly secured with duct tape.

C. As directed by the consultant, utilization of negative air machines for total enclosures or for partial enclosures.

D. Mini-enclosures may be used where only small amounts of Lead paint must be removed from the substrate. There is no need to provide a full enclosure except for complete removal of paint from large substrates. Mini-enclosures require ventilation using a HEPA vacuum cleaner or small negative air machine that will provide negative pressure ventilation.

3.3 **LEAD PAINT OPEN CONTROL AREA** For the interior or exterior removal or demolition of components that contain Lead where the paint will most likely not become detached from the substrate or the paint will not be broken up during removal or demolition activities, with the approval of the Consultant, an open area may be used.

A. Establish designated limits to the Lead work area by using Lead caution tape and signs or other continuous barriers or barricades to separate the Lead operations from non-lead work areas.

B. Cover floors with a minimum of one (1) layer of 6-mil flame retardant poly secured with duct tape.

C. Control measures are dictated by the amounts of Lead in the air. When the PEL is exceeded additional engineering controls, as stated in the OSHA Lead in Construction standards, apply.

D. Where exterior Lead paint activities is required, the Contractor shall cover the ground and/or shrubbery, outside the windows, door frames, walls, etc. requiring Lead removal with a minimum of one layer of 6-mil flame retardant polyethylene sheeting to avoid contaminating the soil with Lead dust and chips. The area shall be pre-cleaned so as to remove any existing Lead paint chips. Additionally, two (2) layers of 6-mil polyethylene sheeting must be installed at all openings to the inside of the building including but not limited to, windows, doorways, or other openings from the immediate work area.

3.4 DECONTAMINATION AREA/ WASTE LOAD-OUT

A. Construct the following Worker decontamination enclosure system contiguous to or adjacent to the work area:

1. An equipment or dirty room with two doorways, one to the work area and one to the shower room.

2. If feasible, a shower room with two doorways, one to the equipment room and one to the clean room. The shower room shall contain at least one shower with hot and cold water. The Contractor shall ensure that the shower enclosure system does not leak. Additionally, the shower shall always contain an ample supply of soap, shampoo and clean dry towels. The Contractor shall utilize a three-stage water filtration system prior to release of shower water into a leak-tight labeled drum. The water shall be profiled for Lead content and subsequently disposed of properly.

3. A clean room with one doorway into the shower and one entrance/exit to non-contaminated areas. The clean room shall possess sufficient space for storing the Workers' street clothes, towels and other non-contaminated items.

B Workers shall change clothes exclusively (i.e. dress and undress) within the clean room. If additional space is required for changing clothes, the Contractor shall construct modesty rooms (if inside the building, use black polyethylene sheeting, if outside the building, use 1/2" plywood).

C. The Worker decontamination enclosure system should exist independently of the facility but contiguous to the work area (i.e. building facilities such as toilets, sinks and showers shall not be used in constructing the decontamination enclosure system).

D. The Worker decontamination area shall be under negative air pressure at all times. Additionally, the Contractor shall provide sufficient quantities of make-up air to the work area.

E. The Contractor shall construct a waste load-out wash down station contiguous to the equipment room or work area. The waste load-out area shall be constructed with a minimum of two layers of 6-mil polyethylene sheeting and secured with duct tape.

F. The Contractor shall move all materials or equipment from the work area through the waste load-out or equipment decontamination room according to the following sequence:

1. The Contractor shall establish air locks at the entrance to the waste load-out area.

2. All ingress and egress from the waste load-out area shall take place between the work area's separate airlock and the wash down station.

3. The Workers shall thoroughly wet contaminated equipment and waste bags in the work area and pass the equipment, bags into the wash room. After the Workers pass the equipment, bags into the wash room, they shall repeat the wet cleaning and place the equipment into the second chamber of the waste load-out facility. All Workers in the waste load-out facility shall wear full protective clothing and appropriate respiratory protection. If rented equipment is used, it must be completely decontaminated. Surface dust wipe tests may be necessary.

G. Lunch Room & Facilities: The Contractor shall provide a separate place for the employees to eat and rest that is not contaminated with Lead dust. Contaminated clothing and devices shall be prohibited from any eating lunch room area.

3.5 **CONTROLLING OFFSITE DISPERSAL** The Contractor must implement control measures to contain Lead dust and debris within the Work Area including without limitation:

A. Control and limit access to the Lead work areas.

B. Limit tracking of dust and debris.

C. Implement a program of ongoing cleanup.

3.6 **CLEANUP AND AIR MONITORING** The Contractor shall be responsible for not exceeding the OSHA established PEL during the preparation, removal and cleanup operations relating to Lead. If levels at any time exceed the PEL, it shall be the Contractor's responsibility to initiate proper engineering controls and work practices until airborne Lead is reduced to below the OSHA PEL.

3.7 **DISPOSAL OF LEAD WASTE** The Contractor shall be responsible for the performance of all collection and analysis of generated lead waste for disposal. The Consultant will observe all sample collection and shall be provided copies of the sample analysis prior to disposal of the material. This includes, but is not limited to TTLC and STLC/TCLP testing.

A. As work progresses and to prevent exceeding available storage capacity on site, the Contractor shall remove sealed and labeled containers of waste from the site and dispose of such containers at an authorized disposal site in accordance with applicable regulations.

3.7.1 The Contractor shall contact the regional EPA, State, and local authorities to determine Lead paint debris disposal requirements. The requirements of Resource Conservation and Recovery Act (RCRA) shall be complied with as well as applicable state solid waste plan requirements. The Contractor shall ensure that applicable local, state and federal permits are obtained for transportation of hazardous materials and that all waste materials are properly classified for proper transport and disposal. During the renovation / demolition activities, the Contractor shall not leave debris in the yard or nearby property, incinerate debris, dump waste by the road or in an unauthorized dumpster, or introduce Lead-contaminated water into storm (will not be flushed down yard inlet or street drain) or sanitary sewers (will not be flushed down toilet or other household drain).

A. If the intact LBP exhibits all of the following characteristics, you may handle it as an architectural waste/trash:

1. If the component is greater in size than 60mm, which is the California definition of debris;

2. If the paint adhered to the component does not exhibit any cracking, peeling or flaking powder or any other delamination;

3. If the Lead waste does not exceed 50 mg/kg using the TTLC procedure or;

4. If the Lead waste does not exceed 5.0 mg/L using the STLC procedure ;

NOTE: A letter from the landfill will be required to acknowledge the receipt of Lead-containing materials.

B. Lead painted metal adhered to components that does not exhibit any cracking, peeling, or flaking or any other delamination may be recycled. It is the Contractor's responsibility to locate a metal recycling company who will accept the Lead painted metal components. A signed letter indicating the knowledge of the Lead painted metal components and acceptance by the recycling company must be submitted to the Consultant prior to the transfer of the components off-site.

3.7.2 Testing on Lead paint waste materials generated by the Contractor by use of the TTLC, STLC or TCLP Procedure will be completed by the Contractor.

3.7.3 The following materials shall be tested to determine whether or not they are hazardous.

A. shower waste water

B. dust from HEPA filters and from damp sweeping

C. All Lead adhered components removed from buildings. Like components should be tested together to reduce the potential for disposal as RCRA waste

D. plastic sheets, duct tape, or tape used to cover floors and other services during the Lead paint/Lead painted component removal

E. solvents and caustics used during stripping processes

F. liquid waste, such as wash water used to decontaminate components and liquid waste from exterior water blasting

G. rags, sponges, mops, HEPA filters, respirator cartridges, scrapers, and other materials used for testing, removal and cleanup

H. disposable work clothes and respirator filters

I. any other items contaminated with Lead paint.

3.7.4 Non-Hazardous Solid Waste (as determined by testing). The Contractor shall place Lead-based paint chips, debris, and Lead dust in double (4-mil) or single (6-mil) polyethylene bags that are air-tight and puncture-resistant. Pieces of wood or other types of substrates that do not fit into plastic bags will be wrapped with 6-mil polyethylene sheeting and labeled independently with appropriate warning verbiage, tracking classification labels in accordance with local, state and federal regulations and/or may use metal DOT drums as primary labeled containers.

3.7.5 The Contractor will place all disposable cleaning materials, such as sponges, mop heads, filters, disposable clothing, and brooms in double (4-mil) or single (6-mil) plastic bags and sealed.

3.7.6 The Contractor shall clean surfaces and equipment and bag large debris. The Contractor shall then remove plastic sheeting and tape from covered surfaces. Prior to removing the plastic sheeting, the Contractor shall lightly mist the sheeting in order to keep dust down and fold inward to form tight small bundles to bag for disposal. The Contractor shall place all plastic sheeting in double (4-mil) or single (6-mil) thick plastic bags and seal.

3.7.7 The Contractor shall bag and seal vacuum bags and filters in double (4-mil) or single (6-mil) thick plastic bags.

3.7.8 The Contractor shall place all contaminated clothing or clothing covers used during removal and cleanup in plastic bags for disposal prior to leaving equipment room.

3.7.9 The Contractor shall place solvent residues and residues from strippers in drums made out of materials that cannot be dissolved or corroded by chemicals. Solvents will be tested by the Contractor to determine if they are hazardous. Solvents, caustic and acid waste must be segregated and not stored in the same containers.

3.7.10 The Contractor shall contain and properly dispose of all liquid waste, including Lead-dust contaminated wash water.

3.7.11 The Contractor shall HEPA vacuum the exterior of all liquid waste containers prior to removing the waste containers from the work area and shall wet wipe the containers to ensure that there is no residual contamination. Containers should then be moved out of the work area into the designated storage area.

3.7.12 The Contractor shall carefully place the containers into the truck or dumpster used for disposal.

3.7.13 The Contractor shall ensure that all waste is transported in covered vehicles to a landfill, or lined landfill, if available.

3.7.14 If the Contractor subcontracts the removing of the Lead-based paint waste, he shall insure that the company removing the waste material adequately covers all loads so as to assure that no dust or debris is released.

3.7.15 Disposal of Hazardous Waste (as determined by testing). The Contractor will be required to comply with the Resource Conservation and Recovery Act (RCRA) and any other applicable federal, state, local requirements.

3.7.16 Waste Containers. The Contractor will comply with EPA, and DOT regulations for containers. The Contractor shall contact the state and local authorities to determine their criteria for proper containerization of RCRA Lead waste, California hazardous Lead waste and non-hazardous Lead waste. The more stringent regulations shall apply to the proper containerization of the identified Lead waste.

3.7.17 Waste Transportation. If the Contractor is not a certified hazardous waste transporter, a contract shall be entered into with a certified transporter to transport the waste. The Contractor shall require the certified hazardous waste transporter to follow all applicable hazardous waste transportation regulations.

Please note that the regulatory guidance issued by Waste Evaluation Department of Toxic Substance Control on Lead painted building debris dated 6/13/94 is not a variance but a regulatory guidance and will not be interpreted as a variance from RCRA, Federal guidelines or HUD guidelines.

3.8 **FINAL INSPECTION AND TESTING:**

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A. After thorough cleaning of the work space, and satisfactory degree of cleanliness has been achieved, the Contractor shall notify the Consultant that the work area is ready for a final visual inspection. The Consultant and the Contractor shall then visually inspect the work area for the detection of any visible Lead dust or contamination. If the visual inspection does not reveal any dust or other signs of contamination the area is considered complete.

B. The Consultant may perform Lead dust wipe surface and / or soil sampling on the horizontal, vertical surfaces and bare soil areas in accordance with the clearance requirements specified in the HUD Regulations.

END OF PART 3 - EXECUTION

SOUTH ORANGE COUNTY
COMMUNITY COLLEGE DISTRICT

BID NO. 1094

JAMES B. UTT LEARNING RESOURCE CENTER RENOVATION

AT

SADDLEBACK COLLEGE

28000 Marguerite Parkway
Mission Viejo, California 92692

PROJECT MANUAL

VOLUME #2

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FEBRUARY, 2010

SCANNED

SOUTH ORANGE COUNTY COMMUNITY COLLEGE DISTRICT

SADDLEBACK COLLEGE

28000 Marguerite Parkway
Mission Viejo, California 92692

LEARNING RESOURCE CENTER RENOVATION

PROJECT MANUAL

LICENSED ARCHITECT
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C-27137
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RENEWAL DATE
STATE OF CALIFORNIA

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DATE MAY 07 20 TB

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GENERAL CONDITIONS

ARTICLE 1. DEFINITIONS

(a) Action of the Governing Board is a vote of a majority of the members in a lawful meeting.

(b) Addenda are the changes in plans, specifications, drawings, and/or Project Documents which have been authorized in writing by the DISTRICT or ARCHITECT, and which alter, explain, or clarify the Project Documents prior to the bid deadline.

(c) Approval means written authorization by ARCHITECT or DISTRICT.

(d) Agreement includes collectively all Project Documents.

(e) Project Documents includes collectively, to wit: Notice Calling for Bids, Information for Bidders, Bid Form, Bid Security, Designation of Subcontractor form, Information Required of Bidder, all prequalification forms submitted pursuant to Public Contract Code Section 20111.5, if any, Noncollusion Affidavit, Workers' Compensation Certificate, Faithful Performance Bond, Payment Bond, Agreement, Escrow Agreement, Drug-Free Workplace Certification, Change Order forms, Shop Drawing Transmittals form, Insurance Certificates and Endorsements, Guarantee form, Contractor's Certificate Regarding Non-Asbestos Containing Materials, General Conditions, Supplemental Conditions, if any, Special Conditions, if any, Drawings, Specifications, and all modifications, addenda and amendments thereto. The Project Documents are complementary, and what is called for by any one shall be as binding as if called for by all.

(f) CONTRACTOR or DISTRICT are those mentioned as such in the Agreement. They are treated throughout the Project Documents as if they are of singular number and neuter gender.

(g) DISTRICT is the Governing Board or its duly authorized representative.

(h) Locality in which the work is performed means the county and city in which the work is done.

(i) Project is the planned undertaking as provided for in the Project Documents by DISTRICT and CONTRACTOR.

(j) Provide shall include "provide complete in place," that is, "furnish and install."

(k) Safety Orders are those issued by the Division of Industrial Safety and OSHA safety and health standards for construction.

(l) Standards, Rules, and Regulations referred to are recognized printed standards and shall be considered as one and a part of these specifications within limits specified.

(m) Subcontractor, as used herein, includes those having a direct contractual relationship with CONTRACTOR and one who furnishes material worked to a special design according to plans, drawings, and specifications, but does not include one who merely furnishes material not so worked.

(n) Surety is the person, firm, or corporation that executes as a California admitted surety insurer, the CONTRACTOR's Bid Security, faithful performance bond and payment bond.

(o) Work of the CONTRACTOR or subcontractor includes labor or materials (including, without limitation, equipment and appliances) or both, incorporated in, or to be incorporated in the Project.

(p) Workers includes laborer, worker, or mechanic.

ARTICLE 2. STATUS OF CONTRACTOR

(a) CONTRACTOR is and shall at all times be deemed to be an independent contractor and shall be wholly responsible for the manner in which it performs the services required of it by the terms of the Project Documents. Nothing herein contained shall be construed as creating the relationship of employer and employee, or principal and agent, between the DISTRICT and CONTRACTOR or any of CONTRACTOR's agents or employees. CONTRACTOR assumes exclusively the responsibility for the acts of its employees as they relate to the services to be provided during the course and scope of their employment. CONTRACTOR, its agents and employees shall not be entitled to any rights or privileges of DISTRICT employees and shall not be considered in any manner to be DISTRICT employees. DISTRICT shall be permitted to monitor the activities of the CONTRACTOR to determine compliance with the terms of the Project Documents.

(b) Contractors are required by law to be licensed and regulated by the Contractors' State License Board. Any CONTRACTOR not so licensed is subject to penalties under the law, and the contract will be considered void pursuant to Section 7028.7 of the Business and Professions Code. Any questions concerning a contractor may be referred to the Registrar, Contractors' State License Board, 9821 Business Park Drive, P. O. Box 26000, Sacramento, CA 95826.

ARTICLE 3. CHANGE IN NAME AND NATURE OF CONTRACTOR'S LEGAL ENTITY

Before CONTRACTOR makes any change in the name or legal nature of the CONTRACTOR's entity, CONTRACTOR shall first notify the DISTRICT in writing and cooperate with DISTRICT in making such changes as the DISTRICT may request in the Project Documents.

ARTICLE 4. CONTRACTOR'S SUPERVISION, PROSECUTION AND PROGRESS

(a) During progress of the work, CONTRACTOR shall keep on the work site a competent superintendent satisfactory to DISTRICT. Before commencing the work herein, CONTRACTOR shall give written notice to DISTRICT and ARCHITECT of the name, qualifications and experience of such superintendent. If Superintendent is found unsatisfactory by DISTRICT, CONTRACTOR shall replace the Superintendent with one acceptable to the DISTRICT. Superintendent shall not be changed except with written consent of DISTRICT, unless a superintendent proves to be unsatisfactory to CONTRACTOR and ceases to be in its employ, in which case, CONTRACTOR shall notify DISTRICT and ARCHITECT in writing and replace said Superintendent with one acceptable to the DISTRICT. Superintendent shall represent CONTRACTOR and all directions given to Superintendent shall be as binding as if given to CONTRACTOR.

(b) CONTRACTOR shall supervise and direct the work competently and efficiently, devoting such attention thereto and applying such skills as may be necessary to perform the work in accordance with the Project Documents. CONTRACTOR shall carefully study and compare all plans, drawings, specifications, and other instructions and shall at once report to ARCHITECT any error, inconsistency or omission which CONTRACTOR or its employees may discover. The CONTRACTOR represents itself to DISTRICT as a skilled, knowledgeable, and experienced CONTRACTOR. The CONTRACTOR shall carefully study and compare the Project Documents with each other, and shall at once report to the ARCHITECT any errors, inconsistencies, or omissions discovered. The CONTRACTOR shall be liable to the DISTRICT for damage resulting from errors, inconsistencies, or omissions in the Project Documents that the CONTRACTOR recognized and which CONTRACTOR knowingly failed to report and which a similarly skilled, knowledgeable, and experienced contractor would have discovered.

(c) The CONTRACTOR shall verify all indicated dimensions before ordering materials or equipment, or before performing work. The CONTRACTOR shall take field measurements, verify field conditions, and shall carefully compare such field measurements and conditions and other information known to the CONTRACTOR with the Project Documents before commencing work. Errors, inconsistencies or omissions discovered shall be reported to the DISTRICT at once. Upon commencement of any item of work, the CONTRACTOR shall be responsible for dimensions related to such item of work and shall make any corrections necessary to make work properly fit at no additional cost to DISTRICT. This responsibility for verification of dimensions is a non-delegable duty and may not be delegated to subcontractors or agents.

(d) Omissions from the plans, drawings or specifications, or the misdescription of details of work which are manifestly necessary to carry out the intent of the plans, drawings and specifications, or which are customarily performed, shall not relieve the CONTRACTOR from performing such omitted or misdescribed work, but they shall be performed as if fully and correctly set forth and described in the plans, drawings and specifications.

(e) The CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. The CONTRACTOR shall be responsible to see that the finished work complies accurately with the Project Documents.

ARTICLE 5. SUBCONTRACTORS

(a) CONTRACTOR agrees to bind every subcontractor by terms of the Project Documents as far as such terms are applicable to subcontractor's work. If CONTRACTOR shall subcontract any part of the work, CONTRACTOR shall be as fully responsible to DISTRICT for acts and omissions of any subcontractor and of persons either directly or indirectly employed by any subcontractor, as it is for acts and omissions of persons directly employed by CONTRACTOR. Nothing contained in Project Documents shall create any contractual relation between any subcontractor and DISTRICT, nor shall the contract documents be construed to be for the benefit of any subcontractor.

(b) DISTRICT's consent to any subcontractor shall not in any way relieve CONTRACTOR of any obligations under the Project Documents and no such consent shall be deemed to waive any provision of any Project Document.

(c) CONTRACTOR must submit with its bid, a Designation of Subcontractors pursuant to the Subletting and Subcontracting Fair Practices Act. If CONTRACTOR specifies more than one subcontractor for the same portion of work or fails to specify a subcontractor, and such portion of the work exceeds one-half of one percent of the total bid, CONTRACTOR agrees that it is fully qualified to perform and shall perform such work itself, unless CONTRACTOR provides for substitution or addition of subcontractors. Substitution or addition of subcontractors shall be permitted only as authorized under the Subletting and Subcontracting Fair Practices Act, Public Contract Code Section 4100, et. seq.

(d) In accordance with Business and Professions Code Section 7059, if CONTRACTOR is designated as a "specialty contractor" (as defined in Section 7058 of the Public Contract Code), all of the work to be performed outside of the CONTRACTOR's license specialty shall be performed by a licensed subcontractor in compliance with the Subletting and Subcontracting Fair Practices Act, Public Contract Code Section 4100, et seq.

(e) A copy of each subcontract, if in writing, or, if not in writing, then a written statement signed by the CONTRACTOR giving the name of the subcontractor and the terms and conditions of such subcontract, shall be filed with the DISTRICT before the subcontractor begins work. Each subcontract shall contain a reference to the Agreement between the DISTRICT and the CONTRACTOR and the terms of that Agreement and all parts of the Project Documents shall be made a part of such subcontract insofar as applicable to the work covered thereby. Each subcontract will provide for termination in accordance with Article 13 of these General Conditions. Each subcontract shall provide for its annulment by the CONTRACTOR at the order of the ARCHITECT if in the ARCHITECT'S opinion the subcontractor fails to comply with the requirements of the Project Documents insofar as the same may be applicable to this work. Nothing herein contained shall relieve the CONTRACTOR of any liability or obligation hereunder.

ARTICLE 6. PROHIBITED INTERESTS

No official of DISTRICT who is authorized in such capacity and on behalf of DISTRICT to negotiate, make, accept, or approve, or to take part in negotiating, making, accepting or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with construction of the Project, shall become directly or indirectly interested financially in this Project or in any part thereof. No officer, employee, architect, attorney, engineer or inspector of or for DISTRICT who is authorized in such capacity and on behalf of DISTRICT to exercise any executive, supervisory or other similar functions in connection with construction of Project shall become directly or indirectly interested financially in this Project or in any part thereof. CONTRACTOR shall receive no compensation and shall repay DISTRICT for any compensation received by CONTRACTOR hereunder, should CONTRACTOR aid, abet or knowingly participate in violation of this Article 6.

ARTICLE 7. DISTRICT'S INSPECTOR

(a) One or more Inspector(s), including special inspectors, as required, will be employed by DISTRICT and will be assigned to the Project.

(b) No work shall be performed by the CONTRACTOR solely upon the instructions or comments by the Inspector. The Inspector has no authority to interpret the Project Documents or order extra work and any extra work performed without the written instruction of the DISTRICT shall be at CONTRACTOR's sole cost and expense and there will be no delay damages incurred by DISTRICT for such work. Any change to the approved Drawings and Specifications shall be made by an Addendum or a Change Order, issuedby the Architect, and approved by the Division of the State Architect as required by section 4-338, part 1, Title 24, CCR.

(c) No work shall be carried on except with the knowledge and under the inspection of said Inspector(s). He/she shall have free access to any or all parts of work at any time. CONTRACTOR shall furnish Inspector reasonable opportunities for obtaining such information as may be necessary to keep Inspector fully informed respecting progress and manner of work and character of materials. Inspection of work shall not relieve CONTRACTOR from any obligation to fulfill the Project Documents. Inspector or ARCHITECT shall have authority to stop work whenever provisions of Project Documents are not being complied with and such noncompliance is discovered. CONTRACTOR shall instruct its employees accordingly.

(d) CONTRACTOR understands and agrees that the Inspector for the Project may also serve concurrently as inspector for other DISTRICT projects and may not therefore be available on site during the entire work day. It shall be the responsibility of CONTRACTOR to notify the Inspector not less than twenty-four (24) hours in advance of materials and equipment deliveries and required inspections.

ARTICLE 8. ARCHITECT'S STATUS

(a) The ARCHITECT shall be the DISTRICT's representative during construction and shall observe the progress and quality of the work on behalf of the DISTRICT. ARCHITECT shall have the authority to act on behalf of DISTRICT only to the extent expressly provided in the Project Documents. ARCHITECT shall have authority to stop work whenever such stoppage may be necessary in ARCHITECT'S reasonable opinion to ensure the proper execution of the Project Documents.

(b) The ARCHITECT shall be, in the first instance, the judge of the performance of the work. ARCHITECT shall exercise authority under the Project Documents to enforce CONTRACTOR's faithful performance.

(c) The ARCHITECT shall have all authority and responsibility established by law. The ARCHITECT has the authority to enforce compliance with the Project Documents and the CONTRACTOR shall promptly comply with instructions from the ARCHITECT or an authorized representative of the ARCHITECT.

(d) On all questions related to the quantities, the acceptability of material, equipment or workmanship, the execution, progress or sequence of work, the interpretation of plans, specifications or drawings, and the acceptable performance of the CONTRACTOR pursuant to the decision of the ARCHITECT shall govern and shall be precedent to any payment unless otherwise ordered by the Governing Board. The progress and completion of the work shall not be impaired or delayed by virtue of any question or dispute arising out of or related to the foregoing matters and the instructions of the ARCHITECT relating thereto.

(e) General supervision and direction of the work by the ARCHITECT shall in no way imply that the ARCHITECT or his or her representatives are in any way responsible for the safety of the CONTRACTOR or its employees or that the ARCHITECT or his or her representatives will maintain supervision over the CONTRACTOR's construction methods or personnel other than to ensure that the quality of the finished work is in accordance with the Project Documents.

ARTICLE 9. NOTICE OF TAXABLE POSSESSORY INTEREST

The terms of the Agreement may result in the creation of a possessory interest. If such a possessory interest is vested in a private party to the Agreement, the private party may be subjected to the payment of property taxes levied on such interest.

ARTICLE 10. ASSIGNMENT OF ANTITRUST ACTIONS

Public Contract Code Section 7103.5 provides:

> In entering into a public works contract or a subcontract to supply goods, services, or materials pursuant to a public works contract, the contractor or subcontractor offers and agrees to assign to the

awarding body (DISTRICT) all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Section 15) or under the Cartwright Act (Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, services, or materials pursuant to the public works contract or the subcontract. This assignment shall be made and become effective at the time the awarding body tenders final payment to the contractor, without further acknowledgment by the parties.

CONTRACTOR, for itself and all subcontractors, agrees to assign to DISTRICT all rights, title, and interest in and to all such causes of action CONTRACTOR and all subcontractors may have under the Agreement. This assignment shall become effective at the time DISTRICT tenders final payment to the CONTRACTOR and CONTRACTOR shall require assignments from all subcontractors to comply herewith.

ARTICLE 11. OTHER CONTRACTS

(a) DISTRICT reserves the right to let other contracts in connection with this work. CONTRACTOR shall afford other contractors reasonable opportunity for introduction and storage of their materials and execution of their work and shall properly connect and coordinate its work with such other contractors.

(b) If any part of CONTRACTOR's work depends for proper execution or results upon work of any other contractor, the CONTRACTOR shall inspect and promptly report to ARCHITECT in writing any defects in such work that render it unsuitable for such proper execution and results. CONTRACTOR will be held accountable for damages to DISTRICT for that work which it failed to inspect or should have inspected. CONTRACTOR's failure to inspect and report shall constitute its acceptance of other contractor's work as fit and proper for reception of its work, except as to defects which may develop in other contractors' work after execution of CONTRACTOR's work.

(c) To ensure proper execution of its subsequent work, CONTRACTOR shall measure and inspect work already in place and shall at once report to the ARCHITECT in writing any discrepancy between executed work and Project Documents.

(d) CONTRACTOR shall ascertain to its own satisfaction the scope of the Project and nature of any other contracts that have been or may be awarded by DISTRICT in prosecution of the Project to the end that CONTRACTOR may perform this Agreement in the light of such other contracts, if any.

(e) Nothing herein contained shall be interpreted as granting to CONTRACTOR exclusive occupancy at site of Project. CONTRACTOR shall not cause any unnecessary hindrance or delay to any other contractor working on Project. If simultaneous execution of any contract for Project is likely to cause interference with performance of some other contract or contracts, DISTRICT shall decide which contractor shall cease work temporarily

and which contractor shall continue or whether work can be coordinated so that contractors may proceed simultaneously.

(f) DISTRICT shall not be responsible for any damages suffered or extra costs incurred by CONTRACTOR resulting directly or indirectly from award or performance or attempted performance of any other contract or contracts on Project, or caused by any decision or omission of DISTRICT respecting the order of precedence in performance of contracts.

ARTICLE 12. OCCUPANCY

DISTRICT reserves the right to occupy buildings and/or portions of the site at any time before completion, and such occupancy shall not constitute final acceptance of any part of work covered by this Agreement, nor shall such occupancy extend the date specified for completion of the work. Beneficial occupancy of building(s) does not commence any warranty period nor shall it entitle CONTRACTOR to any additional compensation due to such occupancy.

ARTICLE 13. DISTRICT'S RIGHT TO TERMINATE AGREEMENT

(a) Termination for Cause. If the CONTRACTOR refuses or fails to complete the work or any separable part thereof with such diligence as will insure its completion within the time specified or any extension thereof, or fails to complete said work within such time, or if the CONTRACTOR should file a petition for relief as a debtor, or should relief be ordered against CONTRACTOR as a debtor under Title 11 of the United States Code, or if CONTRACTOR should make a general assignment for the benefit of its creditors, or if a receiver should be appointed on account of its insolvency, or if it should refuse or should fail to supply enough properly skilled workers or proper equipment, tools, and materials in the necessary quantity and quality to complete the work in the time specified, or if CONTRACTOR should fail to make prompt payment to subcontractors for materials or labor, or disregard laws or ordinances or instructions of DISTRICT, or if CONTRACTOR or its subcontractors should otherwise be guilty of a violation of any provision of this Agreement, then CONTRACTOR shall be deemed to be in default of the Agreement and DISTRICT may, without prejudice to any other right or remedy, serve written notice upon CONTRACTOR and its surety of DISTRICT's intention to terminate this Agreement, such notice to contain the reasons for such intention to terminate, and unless within ten (10) calendar days after the service of such notice such condition shall cease or such violation shall cease, or arrangements satisfactory to DISTRICT for the correction thereof be made and corrective action commenced in a diligent and workmanlike manner and pursued to satisfactory completion, this Agreement shall upon the expiration of said ten (10) calendar days, cease and terminate. In such case, CONTRACTOR shall be excluded from the worksite and not be entitled to receive any further payment until work is finished to DISTRICT's satisfaction.

(b) In the event of any such termination, surety shall have the right to take over and perform this Agreement, provided, however, that if surety within five (5) calendar days after service upon it of said notice of termination does not give DISTRICT written notice of its

intention to take over and perform this Agreement or does not commence performance thereof within ten (10) calendar days after date of serving such notice of termination by DISTRICT on surety, DISTRICT may take over the work and prosecute same to completion by any means determined by DISTRICT including hiring another contractor for the account and at the expense of CONTRACTOR, and CONTRACTOR and its surety shall be liable to DISTRICT for any excess cost or other damages occasioned by the DISTRICT thereby. Time is of the essence in this Agreement. If the DISTRICT takes over the work as hereinabove provided, the DISTRICT may, without liability for so doing, take possession of and utilize in completing the work such materials, supplies, equipment and other property belonging to the CONTRACTOR as may be on the site of the work and necessary therefore.

(c) The expense of finishing the work, including compensation for additional architectural, managerial, and administrative services, shall be a charge against CONTRACTOR and CONTRACTOR agrees that the charge may be deducted from any money due or becoming due to CONTRACTOR from DISTRICT or CONTRACTOR shall pay the charge to the DISTRICT. Expense incurred by DISTRICT as herein provided, and damage incurred through CONTRACTOR's default, shall be certified to DISTRICT by ARCHITECT. The surety shall become liable for payment should CONTRACTOR fail to pay in full any cost incurred by the DISTRICT.

(d) Nonappropriation of Funds/Insufficient Funds. In the event that sufficient funds are not appropriated to complete the Project or the DISTRICT determines that sufficient funds are not available to complete the Project, DISTRICT may terminate or suspend the completion of the Project at any time by giving written notice to the CONTRACTOR. In the event that the DISTRICT exercises this option, the DISTRICT shall pay for any and all work and materials completed or delivered onto the site, and the value of any and all work then in progress and orders actually placed which cannot be canceled up to the date of notice of termination. The value of work and materials paid for shall include a factor of fifteen percent (15%) for the CONTRACTOR's overhead and profit and there shall be no other costs or expenses paid to CONTRACTOR. All work, materials and orders paid for pursuant to this provision shall become the property of the DISTRICT. DISTRICT may, without cause, order CONTRACTOR in writing to suspend, delay or interrupt the Project in whole or in part for such period of time as DISTRICT may determine. Adjustment shall be made for increases in the cost of performance of the Agreement caused by suspense, delay or interruption.

(e) DISTRICT may, without cause, order CONTRACTOR in writing to suspend, delay or interrupt the Project in whole or in part for such period of time as DISTRICT may determine. Adjustment shall be made for increases in the cost of performance of the Agreement caused by suspense, delay or interruption.

(f) The foregoing provisions are in addition to and not a limitation of any other rights or remedies available to the DISTRICT.

ARTICLE 14. BONDS

Unless otherwise specified in Special Conditions, CONTRACTOR shall furnish a surety bond in an amount equal to one hundred percent (100%) of contract price as security for faithful performance of this Agreement and shall furnish a separate bond in an amount of one hundred percent (100%) of the contract price as security for payment to persons performing labor and furnishing materials in connection with this Project. Bonds shall be in the form set forth in these Project Documents.

ARTICLE 15. SUBSTITUTION OF SECURITIES

(a) Pursuant to the requirements of Public Contract Code Section 22300, upon CONTRACTOR's request, DISTRICT will make payment to CONTRACTOR of any earned retention funds withheld from payments under this Agreement if CONTRACTOR deposits with the DISTRICT or in escrow with a California or federally chartered bank acceptable to DISTRICT, securities eligible for the investment pursuant to Government Code Section 16430 or bank or savings and loan certificates of deposit, upon the following conditions:

(1) CONTRACTOR shall be the beneficial owner of any securities substituted for retention funds withheld and shall receive any interest thereon.

(2) All expenses relating to the substitution of securities under said Section 22300 and under this Article 15, including, but not limited to DISTRICT's overhead and administrative expenses, and expenses of escrow agent shall be the responsibility of the CONTRACTOR.

(3) If CONTRACTOR shall choose to enter into an escrow agreement, such agreement shall be in the form as set forth in Public Contract Code section 22300(f) attached hereto as part of the Project Documents and which shall allow for the conversion to cash to provide funds to meet defaults by the CONTRACTOR including, but not limited to, termination of the CONTRACTOR's control over the work, stop notices filed pursuant to law, assessment of liquidated damages or amount to be kept or retained under the provisions of the Project Documents.

(4) Securities, if any, shall be returned to CONTRACTOR only upon satisfactory completion of the Agreement.

(b) To minimize the expense caused by such substitution of securities, CONTRACTOR shall, prior to or at the time CONTRACTOR requests to substitute security, deposit sufficient security to cover the entire amount to be then withheld and to be withheld under the General Conditions of this Agreement. Should the value of such substituted security at any time fall below the amount for which it was substituted, or any other amount which the DISTRICT determines to withhold, CONTRACTOR shall immediately, and at CONTRACTOR's expense, deposit additional security qualifying under said Section 22300 until the total security deposited is no less than equivalent to the amount subject to withholding under the Agreement.

(c) In the alternative, under Section 22300, CONTRACTOR, at its own expense, may request DISTRICT to make payment of earned retention funds directly to the escrow agent. Also at the expense of CONTRACTOR, CONTRACTOR may direct investment of the payments into securities, and CONTRACTOR shall receive the interest earned on the investment upon the same conditions as shown in paragraph (a) for securities deposited by CONTRACTOR. Upon satisfactory completion of the Agreement, CONTRACTOR shall receive from the escrow agent all securities, interest and payments received by the escrow agent from DISTRICT, pursuant to the terms of Section 22300.

(d) If any provision of this Article 15 shall be found to be illegal or unenforceable, then, notwithstanding, this Article 15 shall remain in full force and effect, and such provision shall be deemed stricken.

ARTICLE 16. FIRE INSURANCE

CONTRACTOR will procure at CONTRACTOR's own expense, and before commencement of any work under this Agreement, fire insurance on the Project. Amount of fire insurance shall be sufficient to protect against loss or damage in full until work is accepted by DISTRICT. CONTRACTOR shall submit proof of insurance and shall provide endorsements on forms provided by the DISTRICT or on forms approved by the DISTRICT.

ARTICLE 17. PUBLIC LIABILITY AND PROPERTY DAMAGE INSURANCE

(a) CONTRACTOR shall take out and maintain during the life of this Agreement such public liability and property damage insurance as shall protect CONTRACTOR and DISTRICT from all claims for personal injury, including accidental death, to any person (including, as to DISTRICT, injury or death to CONTRACTOR's or subcontractor's employees), as well as from all claims for property damage arising from operations under this Agreement, in amounts as set forth in the Agreement.

(b) CONTRACTOR shall require its subcontractors, if any, to take out and maintain similar public liability and property damage insurance in like amounts or insure the activities of its subcontractors in CONTRACTOR's own policy.

(c) CONTRACTOR, during the progress of the work and until final acceptance of the work by DISTRICT upon completion of the entire Agreement, shall maintain Builder's Risk/ "All Risk," course-of-construction insurance in an amount not less than as set forth in the Agreement. Coverage is to provide extended coverage and insurance against vandalism, malicious mischief, perils of fire, sprinkler leakage, civil authority, sonic boom, earthquake, collapse, flood, wind, lightning, smoke, riot, debris removal (including demolition), and reasonable compensation for ARCHITECT's services and expenses required as a result of such insured loss upon the entire work which is the subject of the Project Documents, including completed work and work in progress to the full insurable amount thereof. The risk of damage to the work due to the perils covered by the Builder's Risk/"All Risk" Insurance, as well as any other hazards which might result in damage to the work, is that of

CONTRACTOR and the surety, and no claims for such loss or damage shall be recognized by DISTRICT nor will such loss or damage excuse the complete and satisfactory performance of the Agreement by CONTRACTOR.

(d) CONTRACTOR shall submit proof of insurance and shall provide endorsements on the forms provided by the DISTRICT or on forms approved by the DISTRICT. Such insurance shall be issued by admitted surety insurers under the same conditions as required for bonds on the Project.

ARTICLE 18. WORKERS' COMPENSATION INSURANCE

(a) In accordance with the provisions of Section 3700 of the Labor Code, the CONTRACTOR and every subcontractor shall be required to secure the payment of compensation to its employees.

(b) The CONTRACTOR shall provide, during the life of the Agreement, workers' compensation insurance for all of its employees engaged in work under this Agreement, on or at the site of the Project, and, in case any of its work is sublet, the CONTRACTOR shall require the subcontractor similarly to provide workers' compensation insurance for all the latter's employees. Any class of employee or employees not covered by a subcontractor's insurance shall be covered by the CONTRACTOR's insurance. In case any class of employees engaged in work under this Agreement, on or at the site of the Project, is not protected under the workers' compensation statute, the CONTRACTOR shall provide or shall cause a subcontractor to provide, adequate insurance coverage for the protection of such employees not otherwise protected before subcontractor commences work. The CONTRACTOR shall file with the DISTRICT certificates of its insurance protecting workers and a thirty (30) day notice shall be provided to DISTRICT before the cancellation or reduction of any policy of CONTRACTOR or subcontractor. CONTRACTOR shall submit proof of insurance and shall provide endorsements on the forms provided by the DISTRICT or on forms approved by the DISTRICT. Such endorsements shall be submitted concurrently with the Project Documents.

ARTICLE 19. PROOF OF CARRIAGE OF INSURANCE

(a) CONTRACTOR shall not commence work nor shall it allow any subcontractor to commence work under this Agreement until all required insurance certificates and endorsements from admitted surety insurers have been obtained and delivered in duplicate to and approved by DISTRICT. Such insurance shall be issued by admitted surety insurers under the same conditions as required for bonds on the Project. CONTRACTOR shall provide proof of insurance on DISTRICT approved forms without revisions.

(b) Certificates and insurance policies shall include the following:

(1) A clause stating:

"This policy shall not be canceled or reduced in required limits of liability or amount of insurance until notice has been mailed to DISTRICT stating date of cancellation or reduction. Date of cancellation or reduction may not be less than thirty (30) days after date of mailing notice."

(2) Language stating in particular those insured, extent of insurance, location and operation to which insurance applies, expiration date, to whom cancellation and reduction notice will be sent, and length of notice period.

(3) Statement that the DISTRICT is an additional insured under the policy described and that such insurance policy shall be primary to any insurance or self-insurance maintained by the DISTRICT.

(c) In case of CONTRACTOR's failure to provide insurance as required by the Agreement, the DISTRICT may, at DISTRICT's option, take out and maintain at the expense of the CONTRACTOR, such insurance in the name of CONTRACTOR, or subcontractor, as the DISTRICT may deem proper and may deduct the cost of taking out and maintaining such insurance from any sums which are due or to become due to the CONTRACTOR under this Agreement.

ARTICLE 20. DRAWINGS AND SPECIFICATIONS

(a) Drawings and Specifications are intended to delineate and describe the Project and its component parts to such a degree as will enable skilled and competent contractors to intelligently bid upon the work, and to carry said work to a successful conclusion.

(b) Drawings and Specifications are intended to comply with all laws, ordinances, rules and regulations of constituted authorities having jurisdiction, and where referred to in the Project Documents, said laws, ordinances, rules and regulations shall be considered as a part of the Agreement within the limits specified. The CONTRACTOR shall bear all expenses of correcting work done contrary to said laws, ordinances, rules and regulations and if the CONTRACTOR performed same (1) without first consulting the ARCHITECT for further instructions regarding said work, or (2) disregarded the ARCHITECT'S instructions regarding said work.

(c) Questions regarding interpretation of drawings and specifications shall be clarified by the ARCHITECT. Before commencing any portion of the work, CONTRACTOR shall carefully examine all drawings and specifications and other information given to CONTRACTOR. CONTRACTOR shall immediately notify ARCHITECT and DISTRICT in writing of any perceived or alleged error, inconsistency, ambiguity, or lack of detail or explanation in the drawings and specifications. If CONTRACTOR or its subcontractors, material or equipment suppliers, or any of their officers, agents, and employees performs, permits, or causes the performance of any work under the Project Documents, which it knows or should have known to be in error, inconsistent, or ambiguous, or not sufficiently detailed or explained, CONTRACTOR shall bear any and all costs arising therefrom including, without limitation, the cost of correction thereof. In the event ARCHITECT

determines that CONTRACTOR's requests for clarification or interpretation are not justified or do not reflect adequate competent supervision or knowledge by the CONTRACTOR or his/her subcontractors, CONTRACTOR shall be required to pay ARCHITECT's reasonable and customary fees in processing and responding to such requests. Should the CONTRACTOR commence work or any part thereof without seeking clarification, CONTRACTOR waives any claim for extra work or damages as a result of any ambiguity, conflict or lack of information.

(d) Figured dimensions on drawings shall govern, but work not dimensioned shall be as directed. Work not particularly shown or specified shall be the same as similar parts that are shown or specified. Large-scale drawings shall take precedence over smaller scale drawings as to shape and details of construction. Specifications shall govern as to materials, workmanship, and installation procedures. Drawings and specifications are intended to be fully cooperative and to agree. If CONTRACTOR observes that drawings and specifications are in conflict, CONTRACTOR shall promptly notify the ARCHITECT in writing, and any necessary changes shall be adjusted as provided in the Article entitled "Changes and Extra Work;" provided, however, that the specification calling for the higher quality material or workmanship shall prevail without additional cost to DISTRICT.

(e) Materials or work described in words which so applied has a well-known technical or trade meaning shall be deemed to refer to such recognized standards.

(f) It is not the intention of the Agreement to go into detailed descriptions of any materials and/or methods commonly known to the trade under "trade name" or "trade term." The mere mention or notation of such "trade name" or "trade term" shall be considered a sufficient notice to CONTRACTOR that it will be required to complete the work so named with all its incidental and accessory items according to the best practices of the trade.

(g) The naming of any material and/or equipment shall mean furnishing and installing of same, including all incidental and accessory items thereto and/or labor necessary to achieve full and complete functioning of the material and/or equipment as per best practices of the trade(s) involved, unless specifically noted otherwise.

(h) ARCHITECT will furnish to CONTRACTOR one (1) complete set of blue-line prints for posting of changes. Additional blue-line prints shall be provided by ARCHITECT upon payment by CONTRACTOR. During the construction period, CONTRACTOR shall maintain the set of blue-line prints in a satisfactory record condition, and shall thoroughly and neatly post, as they occur, all additions, deletions, corrections and/or revisions in the actual construction of the Project. The record drawings must be posted monthly and be current prior to each submission of each certificate of payment.

ARTICLE 21. OWNERSHIP OF DRAWINGS

All plans, drawings, designs, specifications, and other incidental architectural and engineering work or materials and other Project Documents and copies thereof furnished by DISTRICT are DISTRICT's property. They are not to be used in other work and are to be returned to DISTRICT on request at completion of work, and may be used by DISTRICT as it may require, without any additional costs to DISTRICT.

ARTICLE 22. DETAIL DRAWINGS AND INSTRUCTIONS

(a) In case of ambiguity, conflict, or lack of information, ARCHITECT shall furnish additional instructions by means of drawings or otherwise, necessary for proper execution of work. All such drawings and instructions shall be consistent with Project Documents, true developments thereof, and reasonably inferable therefrom. Such additional instructions shall be furnished with reasonable promptness, provided that CONTRACTOR informs the ARCHITECT of the relationship of the request to the critical path of construction.

(b) Work shall be executed in conformity therewith and CONTRACTOR shall do no work without proper drawings and instructions.

(c) The ARCHITECT will furnish necessary additional details to more fully explain the work, which details shall be considered as part of the Project Documents.

(d) Should any details be more elaborate, in the opinion of the CONTRACTOR, than scale drawings and specifications warrant, CONTRACTOR shall give written notice thereof to the ARCHITECT within five (5) days of the receipt of same. In case no notice is given to the ARCHITECT within five (5) days, it will be assumed the details are reasonable development of the scale drawings. In case notice is given, then it will be considered, and if found justified, the ARCHITECT will either modify the drawings or shall recommend to DISTRICT a change order for the extra work involved.

(e) All parts of the described and shown construction shall be of the best quality of their respective kinds and the CONTRACTOR is hereby advised to use all diligence to become fully involved as to the required construction and finish, and in no case to proceed with the different parts of the work without obtaining first from the ARCHITECT such directions and/or drawings as may be necessary for the proper performance of the work.

(f) If it is found at any time, before or after completion of the work, that the CONTRACTOR has varied from the drawings and/or specifications, in materials, quality, form or finish, or in the amount or value of the materials and labor used, the ARCHITECT shall make a recommendation: (1) that all such improper work should be removed, remade and replaced, and all work disturbed by these changes be made good at the CONTRACTOR's expense; or (2) that the DISTRICT deduct from any amount due CONTRACTOR, the sum of money equivalent to the difference in value between the work performed and that called for by the drawings and specifications. ARCHITECT shall determine such difference in value. The DISTRICT, at its option, may pursue either recommendation made by the ARCHITECT.

ARTICLE 23. SHOP DRAWINGS

(a) CONTRACTOR shall check and verify all field measurements and shall submit to ARCHITECT, with sufficient advance time, six (6) copies, checked and approved by CONTRACTOR, of all shop or setting list drawings, schedules, and materials list required for the work of various trades. ARCHITECT shall review such drawings, schedules and materials list only for conformance with design concept of Project and compliance with information given in Project Documents, and return as approved or disapproved with guidance as to required corrections within twenty-five (25) calendar days. CONTRACTOR shall make any corrections required by ARCHITECT, file three (3) corrected copies with ARCHITECT, and furnish such other copies as may be needed for construction within fourteen (14) calendar days. ARCHITECT'S approval of such drawings, schedules, or materials list shall not relieve CONTRACTOR from responsibility for deviations unless CONTRACTOR has in writing called ARCHITECT'S attention to such deviations at time of submission and secured ARCHITECT'S written approval, nor shall it relieve CONTRACTOR from responsibility for errors in shop drawings or schedules.

(b) All submittals of shop drawings, catalog cuts, data sheets, schedules and material lists shall be complete and shall conform to contract drawings and specifications.

(c) The term "shop drawing" as used herein shall be understood to include, but not be limited to, detail design calculations, fabrication and installation drawings, lists, graphs and operating instructions.

(d) Shop drawings shall be submitted at a time sufficiently early to allow review of same by the Division of State Architect (DSA) if required, and the ARCHITECT, and to accommodate the rate of construction progress required under the Project Documents. CONTRACTOR will be required to pay ARCHITECT's reasonable and customary fees in order to expedite review of shop drawings which are not submitted in a timely fashion.

(e) All shop drawing submittals shall be accompanied by an accurately completed transmittal form using the format bound herein. Any shop drawing submittal not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for resubmittal. The CONTRACTOR may authorize a material or equipment supplier to deal directly with the ARCHITECT with regard to shop drawings, however, ultimate responsibility for the accuracy and completeness of the information contained in the submittal shall remain with the CONTRACTOR.

(f) Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of shop drawings on various items using a single transmittal form will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. At its option, the CONTRACTOR or Supplier may obtain from the ARCHITECT quantities of the shop drawing transmittal form at reproduction cost.

(g) CONTRACTOR's review and approval of shop drawings shall include the following stamp:

> "The CONTRACTOR has reviewed and approved not only the field dimensions but the construction criteria and has also made written notation regarding any information in the shop drawings that does not conform to the Project Documents. This shop drawing has been coordinated with all other shop drawings received to date by CONTRACTOR and this duty of coordination has not been delegated to subcontractors, material suppliers, the ARCHITECT, or the engineers on this project.
>
> _____
> Signature of CONTRACTOR"

(h) Within twenty-five (25) calendar days after receipt of shop drawings, the ARCHITECT will return one or more prints of each drawing to CONTRACTOR with his or her comments noted thereon. The CONTRACTOR shall make a complete and acceptable submittal to the ARCHITECT by the second submission of drawings. The DISTRICT shall withhold funds due the CONTRACTOR to cover additional costs of the ARCHITECT'S review beyond the second submission and any other costs incurred by DISTRICT.

(i) If prints of the shop drawing are returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision of said drawing will not be required. If prints of the drawing are returned to the CONTRACTOR marked "MAKE CORRECTIONS NOTED," formal resubmittal of said drawings will not be required. If prints of the drawing are returned to the CONTRACTOR marked "REVISE AND RESUBMIT," the CONTRACTOR shall revise said drawing and shall resubmit six (6) copies of the revised drawing to the ARCHITECT. If prints of the drawing are returned to the CONTRACTOR marked "REJECTED RESUBMIT," the CONTRACTOR shall resubmit six (6) new copies of the drawing to the ARCHITECT.

(j) Fabrication of an item shall not be commenced before the ARCHITECT has reviewed the pertinent shop drawings and returned copies to the CONTRACTOR marked with "NO EXCEPTIONS TAKEN," or "MAKE CORRECTIONS NOTED." Revisions indicated on shop drawings shall be considered as changes necessary to meet the requirements of the Project Documents and shall not be taken as the basis of claims for extra work. The review of such drawings by the ARCHITECT will be limited to checking for general agreement with the Project Documents, and shall in no way relieve the CONTRACTOR of responsibility for errors or omissions contained therein, nor shall such review operate to waive or modify any provision contained in the Project Documents. Fabricating dimensions, quantities of material, applicable code requirements, and other contract requirements shall be the CONTRACTOR's responsibility.

(k) No work represented by required shop drawings shall be purchased or commenced until the applicable submittal has been approved. The work shall conform to the approved shop drawings and all other requirements of the Project Documents. The CONTRACTOR shall not proceed with any related work which may be affected by the work covered under shop drawings until the applicable shop drawings have been approved, particularly where piping, machinery, and equipment and the required arrangements and clearances are involved.

(l) Except where the preparation of a shop drawing is dependent upon the approval of a prior shop drawing, all shop drawings pertaining to the same class or portion of the work shall be submitted simultaneously.

(m) Calculations of a structural nature must be approved by the Division of State Architect.

(n) THE CONTRACTOR SHALL HAVE NO CLAIM FOR DAMAGES OR EXTENSION OF TIME DUE TO ANY DELAY RESULTING FROM THE CONTRACTOR HAVING TO MAKE THE REQUIRED REVISIONS TO SHOP DRAWINGS UNLESS REVIEW BY THE ARCHITECT OF SAID DRAWINGS IS DELAYED BEYOND THE TIME PROVIDED HEREINBEFORE AND THE CONTRACTOR CAN ESTABLISH THAT THE ARCHITECT□S DELAY IN REVIEW ACTUALLY RESULTED IN A DELAY IN THE CONTRACTOR CONSTRUCTION SCHEDULE. CONTRACTOR SHALL NOT BE ENTITLED TO ANY CLAIM FOR DAMAGES RESULTING FROM DSA REVIEW EXTENDING BEYOND FIFTEEN (15) CALENDAR DAYS AFTER SUBMITTAL. HOWEVER, DISTRICT MAY CONSIDER AN EXTENSION OF TIME DUE TO ANY DELAY CAUSED BY DSA REVIEW.

ARTICLE 24. LAYOUT AND FIELD ENGINEERING

All field engineering required for laying out of this work and establishing grades for earthwork operations shall be furnished by CONTRACTOR at its expense. Such work shall be done by a qualified civil engineer approved by the ARCHITECT. Any required "Record" drawings of site development shall be prepared by the approved civil engineer.

ARTICLE 25. SOILS INVESTIGATION REPORT (Not Applicable)

ARTICLE 26. TESTS AND INSPECTIONS

(a) Tests and inspections will comply with California Code of Regulations and with all other laws, ordinances, rules, regulations, or orders of public authorities having jurisdiction over the Project.

(b) If the Agreement, DISTRICT's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, CONTRACTOR shall give notice in accordance with such authority of its readiness for observation or inspection at least two (2) working days prior to being tested or covered up. If inspection is by authority other than

DISTRICT, CONTRACTOR shall inform the DISTRICT's Inspector of the date fixed for such inspection. Required certificates of inspection shall be secured by CONTRACTOR. Observations by DISTRICT's Inspector shall be promptly made, and where practicable, at source of supply. If any work should be covered up without approval or consent of DISTRICT's Inspector, it must be uncovered for examination and satisfactorily reconstructured at CONTRACTOR's expense in compliance with the Agreement. Costs of tests, inspections and any materials found to be not in compliance with the Agreement shall be paid for by CONTRACTOR. Other costs for test and inspection shall be paid by the DISTRICT.

ARTICLE 27. TRENCHES

(a) CONTRACTOR shall provide adequate sheeting, shoring, and bracing, or equivalent method, for the protection of life and limb in trenches and open excavation, which conform to applicable safety standards.

(b) If this Agreement involves the excavation of any trench or trenches five (5) feet or more in depth, and the Project cost is in excess of $25,000, the CONTRACTOR shall, in advance of excavation, submit to the DISTRICT for acceptance or to whomever DISTRICT designates which may include a registered civil or structural engineer employed by the DISTRICT to whom authority to accept has been delegated, a detailed plan showing the design of shoring, bracing, sloping or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trench or trenches. If such plan varies from the Shoring System Standards established by the Construction Safety Orders of the Division of Industrial Safety, the plan shall be prepared by a registered civil or structural engineer employed by the CONTRACTOR, and all costs therefore shall be included in the price named in the Agreement for completion of the work as set forth in the Project Documents. In no case shall such plan be less effective than that required by the Construction Safety Orders. No excavation of such trench or trenches shall be commenced until said plan has been accepted by CAL-OSHA and a CAL-OSHA permit for such plan delivered to the DISTRICT. Labor Code Section 6500 and 6705; Health and Safety Code Section 17922.5)

(c) If this Agreement involves the digging of trenches or excavations that extend deeper than four feet below the surface, the following shall apply pursuant to Public Contract Code section 7104:

(1) The CONTRACTOR shall promptly, and before the following conditions are disturbed, notify the DISTRICT, in writing, of any:

(i) Material that the CONTRACTOR believes may be material that is hazardous waste, as defined in Section 25117 of the Health and Safety Code that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.

(ii) Subsurface or latent physical conditions at the site different from those indicated.

(iii) Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the contract.

(2) The DISTRICT shall promptly investigate the conditions, and if it finds that the conditions do materially so differ, or do involve hazardous waste, and cause a decrease or increase in the CONTRACTOR's cost of, or the time required for, performance of any part of the work shall issue a change order under the procedures described in the Project Documents.

(3) In the event a dispute arises between the DISTRICT and the CONTRACTOR, whether the conditions materially differ or involve hazardous waste, or cause a decrease or increase in the CONTRACTOR's cost of, or time required for, performance of any part of the work, the CONTRACTOR shall not be excused from any scheduled completion date provided for by the Project Documents, but shall proceed with all the work to be performed under the Project Documents. The CONTRACTOR shall retain any and all rights provided either by contract or by law which pertain to the resolution of disputes and protests between the contracting parties.

ARTICLE 28. DOCUMENTS ON WORK

CONTRACTOR shall keep on the job site at all times one legible copy of all Project Documents, including addenda and change orders, and all approved drawings, plans, schedules and specifications. Said Documents shall be kept in good order and available to ARCHITECT, ARCHITECT's representatives, and all authorities having jurisdiction. CONTRACTOR shall be acquainted with and comply with all California Code of Regulations provisions relating to conditions on this Project.

ARTICLE 29. STATE AUDIT

Pursuant to and in accordance with the provisions of Government Code Section 8546.7, or any amendments thereto, all books, records and files of the DISTRICT, the CONTRACTOR, or any subcontractor connected with the performance of this Agreement involving the expenditure of public funds in excess of Ten Thousand Dollars ($10,000.00), including, but not limited to, the costs of administration of the Agreement, shall be subject to the examination and audit of the State Auditor at the request of the DISTRICT or as part of any audit of the DISTRICT for a period of three (3) years after final payment is made under this Agreement .

ARTICLE 30. SUBSTITUTIONS

(a) Prior to Bid Opening. Should the bidder wish to request prior to bid opening, any substitution for the materials, process, service or equipment specified, the bidder shall submit a written request at least ten (10) working days before the bid opening date and hour. If the substituted item is acceptable, the DISTRICT will approve it in an Addendum issued to all bidders of record. Requests received less than ten (10) working days prior to bid opening will not be considered. DISTRICT shall only consider substitution requests from the bidder submitting the bid for the project.

(b) After Bid Opening and Prior to Award of Contract. If the bidder clearly indicates in its bid that it is proposing to use an "equal" product, the brand name or trade name, if any, of a proposed substitute item shall be inserted in the space provided in the bid or shall be otherwise clearly identified in the bid. If the bidder fails to indicate an "equal" product, its bid shall be considered as offering the material, process, service or equipment referred to by the brand name or trade name specified. It is expressly understood and agreed to by the bidder that the DISTRICT reserves the right to reject any such proposed substituted item. It is further expressly understood and agreed by bidder that in the event the DISTRICT rejects a proposed "equal" item, the bidder will then supply the material; process, service or equipment designated by brand name or trade name or a substitute therefore which meets with the approval of the DISTRICT.

With respect to all proposed substitutions of "equal" items, the bidder shall submit all pertinent and appropriate data substantiating its request for substitutions within fifteen (15) days prior to the award of the contract. DISTRICT shall only consider substitution requests from the bidder submitting the bid for the Project. The DISTRICT is not responsible for locating or securing any information which is not included in such substantiating data. The burden of proof as to the quality or suitability of proposed substituted items shall be borne by the bidder. The DISTRICT shall be the sole judge as to the quality and suitability of proposed substituted items, and decisions of the DISTRICT shall be final and conclusive. Unless extended by the mutual agreement of the parties, the DISTRICT shall notify the successful bidder of the decision concerning the proposed substitution of "equal" items prior to the award of the contract. Also such decisions by the DISTRICT shall be in writing, and no proposed substituted item shall be deemed approved unless the DISTRICT has so indicated in writing. These time limitations shall be complied with strictly, and in no case will an extension of time for completion be granted because of the bidder's failure to request the substitution of an item at the times and in the manner set forth herein.

(c) Whenever in specifications any materials, process, service or equipment is indicated or specified by brand name, trade name, proprietary name or by name of manufacturer, such specification shall be deemed to be used for the purpose of facilitating description of material, process, service or equipment desired and shall be deemed to be followed by the words "or equal," and CONTRACTOR may, unless otherwise stated, offer any material, process, service, or equipment which shall be substantially equal or better in every respect to that so indicated or specified subject to DISTRICT or ARCHITECT approval.

(d) If material, process, service, or equipment offered by CONTRACTOR is not, in opinion of ARCHITECT, or DISTRICT, substantially equal or better in every respect to that specified, then CONTRACTOR shall furnish the material, process, service, or equipment specified. Burden of proof as to equality of any material, process, service, or equipment shall rest with CONTRACTOR. Provision authorizing submission of "or equal" substantiating data shall not in any way authorize an extension of time for performance of this Agreement.

(e) In the event CONTRACTOR furnishes material, process, service or equipment other than what was specified by the DISTRICT and which has been accepted by the DISTRICT and which later is defective, then CONTRACTOR at its sole cost and expense shall furnish the DISTRICT specified material, process, service or equipment or fully replace with new the defective material process, service or equipment at DISTRICT's discretion.

(f) In the event CONTRACTOR furnishes material, process service, or equipment more expensive than that specified, difference in cost of such material, process, service, or equipment so furnished shall be borne by CONTRACTOR. Any engineering, design fees, or approval agencies' fees required to make adjustments in material or work of all trades directly or indirectly affected by the approved substituted items shall be borne entirely by CONTRACTOR. Any difference in cost between an approved substitution which is lower in cost than the originally specified item shall be refunded or credited by CONTRACTOR to DISTRICT.

(g) Price, fitness and quality being equal with regard to supplies, the District may prefer supplies grown, manufactured, or produced in California and next prefer supplies partially manufactured grown, or produced in California provided the bids of said suppliers or the prices quoted by them do not exceed by more than 5% of the lowest bids/prices quoted by out of state suppliers, the major portion of the manufacture of the supplies is not done outside of California and the public good will be served thereby. (Government Code section 4330-4334)

ARTICLE 31. SAMPLES

(a) CONTRACTOR shall furnish for approval, within thirty-five (35) calendar days following award of contract, all samples as required in specifications together with catalogs and supporting data required by ARCHITECT. This provision shall not authorize any extension of time for performance of the work. ARCHITECT shall review such samples, as to conformance with design concept of work and for compliance with information given in Project Documents and approve or disapprove same within ten (10) working days from receipt of same.

(b) Unless specified otherwise, sampling, preparation of samples and tests shall be in accordance with the latest standards of the American Society for Testing and Materials.

(c) Samples shall, upon demand of ARCHITECT or DISTRICT, be submitted for tests or examinations and considered before incorporation of same into the work. CONTRACTOR shall be solely responsible for delays due to samples not being submitted in time to allow for

tests. Acceptance or rejection will be expressed in writing. Work shall be equal to approved samples in every respect. Samples which are of value after testing will remain the property of the CONTRACTOR.

ARTICLE 32. PROGRESS SCHEDULE

(a) Within five (5) calendar days after being awarded the contract, CONTRACTOR shall submit a progress schedule for DISTRICT's approval. The schedule shall indicate the beginning and completion dates of all phases of construction and shall use the "critical path method" (commonly called CPM) or equivalent scheduling methodology for the value reporting, planning and scheduling, of all work required under the Project Documents. The schedule will separately identify those milestones or events that must be completed before other portions of the work can be accomplished.

(b) The scheduling is necessary for the DISTRICT's adequate monitoring of the progress of the work and shall be prepared in accordance with the time frame described in Article 4 of the Agreement. The DISTRICT may disapprove such a schedule and require modification to it if, in the opinion of the ARCHITECT or DISTRICT, adherence to the progress schedule will cause the work not to be completed in accordance with the Agreement. CONTRACTOR shall adhere to any such modifications required by the DISTRICT.

(c) CONTRACTOR will exchange scheduling information with subcontractors and suppliers. CONTRACTOR will order work, equipment and materials with sufficient lead time to avoid interruption of the work.

(d) The CONTRACTOR shall submit to DISTRICT a monthly schedule to reflect the actual sequence of the work which shall be totally separate and apart from the original progress schedule.

(e) The CONTRACTOR shall also, if requested by the ARCHITECT or DISTRICT, provide revised schedules within ten (10) calendar days if, at any time, the ARCHITECT or DISTRICT, consider the completion date to be in jeopardy. The revised schedule shall be designed to show how the CONTRACTOR intends to accomplish the work to meet the original completion date. The form and method employed by the CONTRACTOR shall be the same as for the original progress schedule. The CONTRACTOR shall modify any portions of the schedule that become infeasible because of "activities behind schedule" or for any other valid reason. CONTRACTOR will provide documents and justification for any schedule changes. An activity that cannot be completed by its original completion date shall be deemed to be behind schedule.

(f) CONTRACTOR shall submit a revised schedule within ten (10) consecutive calendar days of CONTRACTOR's request for any extension of time. Failure to submit such schedule will result in CONTRACTOR waiving his/her right to obtain any extension of time.

(g) IT IS AGREED THAT THE DISTRICT OWNS THE "FLOAT" ON THIS PROJECT. IF CONTRACTOR SUBMITS A REVISED SCHEDULE SHOWING AN

EARLIER COMPLETION DATE FOR THE PROJECT, DISTRICT□s ACCEPTANCE OF THIS REVISED SCHEDULE SHALL NOT ENTITLE CONTRACTOR TO ANY DELAY CLAIM OR DISRUPTION DAMAGES OR ANY OTHER DAMAGES DUE TO ANY SUCH REVISED SCHEDULE. NOTHING PROVIDED HEREIN SHALL BE CONSTRUED AS A DIRECT, INDIRECT OR IMPLICIT ACCELERATION ORDER TO THE CONTRACTOR.

(h) CONTRACTOR agrees that failure to timely submit the progress schedule, the monthly schedule or any revised progress schedule requested by the ARCHITECT or the DISTRICT may result in delay in payment to CONTRACTOR.

ARTICLE 33. MATERIALS AND WORK

(a) Except as otherwise specifically stated in this Agreement, CONTRACTOR shall provide and pay for all materials, supplies, tools, equipment, labor transportation, superintendence, temporary constructions of every nature, and all other services and facilities of every nature whatsoever necessary to execute and complete the Project within specified time.

(b) Unless otherwise specified, all materials shall be new and the best of their respective kinds and grades as noted or specified, and workmanship shall be of good quality.

(c) Materials shall be furnished in ample quantities and at such times as to insure uninterrupted progress of work and shall be stored properly and protected as required. DISTRICT has no obligation to pay for any prefabricated material stored offsite until delivered and installed to the jobsite and inspected and approved by the inspector of record.

(d) CONTRACTOR shall, after issuance of the Notice to Proceed by DISTRICT, place orders for materials and/or equipment as specified so that delivery of same may be made without delays to the work. CONTRACTOR shall, upon demand from the ARCHITECT, furnish to the ARCHITECT documentary evidence showing that orders have been placed.

(e) DISTRICT reserves the right, for any neglect in not complying with the above instructions, to place orders for such materials and/or equipment as it may deem advisable in order that the work may be completed at the date specified in the Agreement, and all expenses incidental to the procuring of said materials and/or equipment shall be paid for by the CONTRACTOR.

(f) No materials, supplies, or equipment for work under this Agreement shall be purchased subject to any chattel mortgage or under a conditional sale or other agreement by which an interest therein or in any part thereof is retained by seller or supplier. CONTRACTOR warrants good title to all material, supplies, and equipment installed or incorporated in work and agrees upon completion of all work to deliver premises, together with all improvements and appurtenances constructed or placed thereon by it, to DISTRICT free from any claims, liens, or charges. CONTRACTOR further agrees that neither it nor any person, firm, or corporation furnishing any materials or labor for any work covered by this

Agreement shall have any right to lien upon premises or any improvement or appurtenance thereon, except that CONTRACTOR may install metering devices or other equipment of utility companies or of political subdivisions, title to which is commonly retained by utility company or political subdivision. In the event of installation of any such metering device or equipment, CONTRACTOR shall advise DISTRICT as to owner thereof.

(g) Nothing contained in this Article 33, however, shall defeat or impair the rights of persons furnishing material or labor under any bond given by CONTRACTOR for their protection or any rights under any law permitting such persons to look to funds due CONTRACTOR in hand of DISTRICT, and this provision shall be inserted in all subcontracts and material contracts and notice of its provisions shall be given to all persons furnishing materials or labor when no formal contract is entered into for such materials or labor.

(h) The title to new materials and/or equipment and attendant liability for its protection and safety, shall remain in the CONTRACTOR until incorporated in the work and accepted by the DISTRICT; no part of said materials and/or equipment shall be removed from its place of onsite/offsite storage except for immediate installation in the work; and CONTRACTOR shall keep an accurate inventory of all said materials and/or equipment in a manner satisfactory to the DISTRICT or its authorized representative.

ARTICLE 34. INTEGRATION OF WORK

(a) CONTRACTOR shall do all cutting, fitting, patching, and preparation of work as required to make its several parts come together properly, and fit it to receive or be received by work of other contractors or existing conditions showing upon, or reasonably implied by, the drawings and specifications, and shall follow all directions given by the Architect.

(b) All costs caused by defective or ill-timed work shall be borne by CONTRACTOR.

(c) CONTRACTOR shall not endanger any work by cutting, excavating, or otherwise altering work and shall not cut or alter work of any other contractor without the written consent of the ARCHITECT. CONTRACTOR shall be solely responsible for protecting existing work on adjacent properties and shall obtain all required permits for shoring and excavations near property lines.

(d) When modifying existing work or installing new work adjacent to existing work, CONTRACTOR shall match, as closely as conditions of site and materials will allow, the finishes, textures, and colors of the original work, refinishing existing work as required, at no additional cost to DISTRICT.

(e) CONTRACTOR is aware that this Project may be split into several phases. If the Project is split into phases then CONTRACTOR has made allowances for any delays or damages which may arise from coordination with contractors for other phases. If any delays should arise from a contractor working on a different phase, CONTRACTOR's sole remedy for damages, including delay damages, shall be against the contractor who caused such

damage and not the DISTRICT. CONTRACTOR shall provide access to contractors for other phases as necessary to prevent delays and damages to contractors working on other phases of construction.

ARTICLE 35. OBTAINING OF PERMITS, LICENSES AND EASEMENTS

(a) Permits, licenses, and certificates necessary for prosecution of work, shall be secured and paid for by CONTRACTOR, unless otherwise specified. All such permits, licenses, and certificates shall be delivered to the ARCHITECT before demand is made for the certificate of final payment. CONTRACTOR shall, and shall require subcontractors to, maintain contractors' licenses in effect as required by law.

(b) Easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by DISTRICT, unless otherwise specified.

(c) Permits and charges for installation, and inspection thereof, of utility services by serving utilities shall be secured and paid for by DISTRICT.

ARTICLE 36. SURVEYS

Surveys to determine location of property lines and corners will be supplied by DISTRICT. Surveys to determine locations of construction, grading, and site work, shall be provided by CONTRACTOR.

ARTICLE 37. EXISTING UTILITY LINES; REMOVAL, RESTORATION

(a) Pursuant to Government Code Section 4215, the DISTRICT assumes the responsibility for removal, relocation, and protection of utilities located on the construction site at the time of commencement of construction under this Agreement with respect to any such utility facilities which are not identified in the plans and specifications. The CONTRACTOR shall not be assessed for liquidated damages for delay in completion of the Project caused by failure of the DISTRICT to provide for removal or relocation of such utility facilities. If the CONTRACTOR, while performing work under this Agreement, discovers utility facilities not identified by the DISTRICT in the plans or specifications, CONTRACTOR shall immediately notify the DISTRICT and the utility in writing. CONTRACTOR shall be compensated according to the provisions governing changes in the work.

(b) This Article 37 shall not be construed to preclude assessment against the CONTRACTOR for any other delays in completion of the work. Nothing in this Article shall be deemed to require the DISTRICT to indicate the presence of existing service laterals or appurtenances whenever the presence of such utilities on the construction site can be inferred from the presence of other visible facilities, such as buildings, meter junction boxes, on or adjacent to the site of the construction.

(c) As part of the work to be performed, CONTRACTOR shall provide the notices and proceed in accordance with Government Code Sections 4216.2, 4216.3 and 4216.4, and pay all fees charged pursuant to Government Code Section 4216, et seq.

ARTICLE 38. WORK TO COMPLY WITH APPLICABLE LAWS AND REGULATIONS

(a) CONTRACTOR shall give all notices and comply with all laws, ordinances, rules, and regulations applicable to the work as indicated and specified.

(b) If CONTRACTOR observes that drawings or specifications are at variance therewith, CONTRACTOR shall promptly notify ARCHITECT in writing and any changes deemed necessary by the ARCHITECT shall be adjusted as provided for changes in work. If CONTRACTOR performs any work which it knew, or through exercise of reasonable care should have known, to be contrary to such laws, ordinances, rules or regulations, and without such notice to ARCHITECT, CONTRACTOR shall bear all costs arising therefrom. Where plans, drawings or specifications state that materials, processes, or procedures must be approved by the Division of State Architect, State Fire Marshall, or other body or agency, CONTRACTOR shall be responsible for satisfying requirements of such bodies or agencies.

ARTICLE 39. ACCESS TO WORK

DISTRICT and its representatives shall at all times have access to work wherever it is in preparation or progress. CONTRACTOR shall provide safe and proper facilities for such access so that DISTRICT's representatives may perform their functions.

ARTICLE 40. PAYMENTS BY CONTRACTOR

CONTRACTOR shall pay:

(1) For all transportation and utility services not later than the 20th day of the calendar month following that in which such services are rendered;

(2) For all materials, tools, and other expendable equipment to the extent of ninety percent (90%) of cost thereof, not later than the 20th day of the calendar month following that in which such materials, tools, and equipment are delivered at site of Project and balance of cost thereof not later than the 30th day following completion of that part of work in or on which such materials, tools, and equipment are incorporated or used; and

(3) To each of its subcontractors, not later than the 5th day following each payment to CONTRACTOR the respective amounts allowed CONTRACTOR on account of work performed by respective subcontractor to the extent of such subcontractor's interest therein.

(4) Within seven (7) days from the time that all or any portion of the retentions are received by CONTRACTOR from DISTRICT, to each of its subcontractors from

whom retention has been withheld, each subcontractor's share of the retention received. However, if a retention payment received by CONTRACTOR is specifically designated for a particular subcontractor, payment of the retention shall be made to the designated subcontractor, if the payment is consistent with the terms of the subcontract. CONTRACTOR may withhold from a subcontractor its portion of the retentions if a bona fide dispute exists between the subcontractor and the CONTRACTOR. The amount withheld from the retention shall not exceed one hundred fifty percent (150%) of the estimated value of the disputed amount.

ARTICLE 41. INSPECTOR'S FIELD OFFICE

CONTRACTOR shall provide for the exclusive use of Inspector a temporary field office to be located as directed by Inspector and to be maintained until removal is authorized by DISTRICT. Office shall be of substantial waterproof construction with adequate natural light and ventilation by means of stock design windows. Door shall have a key-type lock or padlock hasp. A table satisfactory for study of plans and two chairs shall be provided by CONTRACTOR. CONTRACTOR shall provide and pay for adequate electric lights, telephone service (not a pay phone), and adequate heat for the field office until authorized removal.

ARTICLE 42. UTILITIES

(a) All utilities, including but not limited to electricity, water, gas, and telephone used on work shall be furnished and paid for by CONTRACTOR. CONTRACTOR shall furnish and install necessary temporary distribution systems, including meters, if necessary, from distribution points to points on site where utility is necessary to carry on the work. When it is necessary to interrupt any existing utility service to make connections, a minimum of forty-eight (48) hours advance notice shall be given to the DISTRICT and ARCHITECT. Interruptions in utility services shall be of the shortest possible duration for the work at hand and shall be approved by the DISTRICT and the ARCHITECT. In the event any utility service is interrupted without the required forty-eight (48) hours notice, then CONTRACTOR shall be liable for all damage suffered by DISTRICT due to the interruption. Upon completion of work, CONTRACTOR shall remove all temporary distribution systems.

(b) CONTRACTOR may, with written permission of DISTRICT, use DISTRICT's existing utilities by making prearranged payments to DISTRICT for utilities used by CONTRACTOR for the Project.

ARTICLE 43. SANITARY FACILITIES

The CONTRACTOR shall provide sanitary temporary toilet facilities in no fewer numbers than required by law and such additional facilities as may be directed by the Inspector for the use of all workers. The toilet facilities shall be maintained in a sanitary condition at all times and shall be left at the site until removal is directed by the Inspector. Use of toilet facilities in the work under construction shall not be permitted.

ARTICLE 44. CLEANING UP

CONTRACTOR at all times shall keep work site free from debris such as waste, rubbish, and excess materials and equipment caused by this work. CONTRACTOR shall not leave debris under, in, or about the work site , but shall promptly remove same. Upon completion of work, CONTRACTOR shall clean interior and exterior of building, including fixtures, equipment, walls, floors, ceilings, roofs, window sills and ledges, horizontal projections, and any areas where debris has collected. CONTRACTOR shall clean and polish all glass, plumbing fixtures, and finish hardware and similar finish surfaces and equipment and remove temporary fencing, barricades, planking, sanitary facilities and similar temporary facilities from site. If CONTRACTOR fails to clean up, the DISTRICT shall do so and the cost thereof shall be charged to the CONTRACTOR and deducted from any progress payment due.

ARTICLE 45. PATENTS, ROYALTIES, AND INDEMNITIES

The CONTRACTOR shall hold and save the DISTRICT and its governing board, officers, agents, and employees harmless from liability of any nature or kind, including cost and expense, for or on account of any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of this Agreement, including its use by the DISTRICT, unless otherwise specifically provided in the Project Documents, and unless such liability arises from the sole negligence, or active negligence, or willful misconduct of the DISTRICT.

ARTICLE 46. GUARANTEE

(a) CONTRACTOR warrants that the work (which includes any equipment furnished by CONTRACTOR as part of the materials) shall: (a) be free from defects in workmanship and material; (b) be free from defects in any design performed by CONTRACTOR; (c) be new, and conform and perform to the requirements stated in the specifications and where detail requirements are not so stated, shall conform to applicable industry standards; and (d) be suitable for the use stated in the specifications.

(b) The warranty period for discovery of defective work shall commence on the date stamped on the Notice of Completion verifying County recordation and continue for the period set forth in the specifications or for one year if not so specified. If, during the warranty period, the work is not available for use due to defective work, such time of unavailability shall not be counted as part of the warranty period. The warranty period for corrected defective work shall continue for a duration equivalent to the original warranty period.

(c) District shall give CONTRACTOR prompt written notice after discovery of any defective work. CONTRACTOR shall correct any such defective work, as well as any damage to any other part of the work resulting from such defective work, and provide repair, replacement, or reimbursement, at its sole expense, in a manner approved by the DISTRICT and with due diligence and dispatch as required to make the work ready for use by

DISTRICT, ordinary wear and tear, unusual abuse or neglect excepted. Such corrections shall include, but not be limited to, any necessary adjustments, modifications, changes of design (unless of DISTRICT's design), removal, repair, replacement or reinstallation, and shall include all necessary parts, materials, tools, equipment, transportation charges and labor as may be necessary, and cost of removal and replacement of work shall be performed at a time and in such a manner so as to minimize the disruption to DISTRICT's use of the work.

(d) In the event of failure of CONTRACTOR or Surety to commence and pursue with diligence said repairs or replacements within ten (10) calendar days after being notified in writing, DISTRICT is hereby authorized to proceed to have defects repaired or replaced and made good at expense of CONTRACTOR and Surety who hereby agree to pay costs and charges therefore immediately on demand.

(e) If, in the opinion of the DISTRICT, defective work creates a dangerous condition or requires immediate correction or attention to prevent further loss to the DISTRICT or to prevent interruption of operations of the DISTRICT, the DISTRICT will attempt to give the written notice required by this Article. If the CONTRACTOR or Surety cannot be contacted or neither complies with the DISTRICT's requirements for correction within a reasonable time as determined by the DISTRICT, the DISTRICT may, notwithstanding the provisions of this Article, proceed to make such correction or provide such attention and the costs of such correction or attention shall be charged against the CONTRACTOR and Surety. Such action by the DISTRICT will not relieve the CONTRACTOR and Surety of the guarantees provided in this Article or elsewhere in the Project Documents.

(f) This Article does not in any way limit the guarantees on any items for which a longer guarantee is specified or on any items for which a manufacturer gives a guarantee for a longer period. CONTRACTOR shall furnish to DISTRICT all appropriate guarantee or warranty certificates upon completion of the Project or upon request by DISTRICT.

(g) All guarantees required under this Article shall be in writing on the Guarantee form included in the Project Documents.

(h) CONTRACTOR shall provide to DISTRICT instruction manuals for all items which require same.

(i) Nothing herein shall limit any other rights or remedies available to DISTRICT.

(j) The DISTRICT may collect its reasonable costs and attorneys' fees in any action to enforce this Article.

ARTICLE 47. DUTY TO PROVIDE FIT WORKERS

(a) CONTRACTOR and subcontractors shall at all times enforce strict discipline and good order among their employees and shall not employ on work any unfit person or anyone not skilled in work assigned to such person. It shall be the responsibility of CONTRACTOR to ensure compliance with this Article.

(b) Any person in the employ of the CONTRACTOR or subcontractors whom DISTRICT or ARCHITECT may deem incompetent, unfit, troublesome or otherwise undesirable shall be excluded from the work site and shall not again be employed on it except with written consent of DISTRICT.

ARTICLE 48. WAGE RATES, TRAVEL AND SUBSISTENCE

(a) Pursuant to the provisions of Article 2 (commencing at Section 1770), Chapter 1, Part 7, Division 2 of the Labor Code, the governing board of DISTRICT has obtained the general prevailing rate of per diem wages and the general prevailing rate for holiday and overtime work in the locality in which this public work is to be performed for each craft, classification or type of worker needed for this Project from the Director of the Department of Industrial Relations ("Director.") These rates are on file with the Clerk of the DISTRICT's governing board and copies will be made available to any interested party on request. CONTRACTOR shall post a copy of such wage rates at the work site. Labor Code Section 1773.2. The rates are available on the Internet at www.dir.ca.gov "Statistics & Research."

(b) Holiday and overtime work, when permitted by law, shall be paid for at a rate of at least one and one-half times the above specified rate of per diem wages, unless otherwise specified. Holidays shall be defined in the Collective Bargaining Agreement applicable to each particular craft, classification or type of worker employed.

(c) CONTRACTOR shall pay and shall cause to be paid each worker engaged in work on the Project not less than the general prevailing rate of per diem wages determined by the Director, regardless of any contractual relationship which may be alleged to exist between the CONTRACTOR or any subcontractor and such workers.

(d) CONTRACTOR shall pay and shall cause to be paid to each worker needed to execute the work on the Project travel and subsistence payments, as such travel and subsistence payments are defined in the applicable collective bargaining agreements filed with the Department of Industrial Relations in accordance with Labor Code Section 1773.8.

(e) If during the period this bid is required to remain open, the Director of Industrial Relations determines that there has been a change in any prevailing rate of per diem wages in the locality in which this public work is to be performed, such change shall not alter the wage rates in the Notice Calling for Bids or the contract subsequently awarded.

(f) Pursuant to Labor Code Section 1775, CONTRACTOR shall as a penalty to the DISTRICT, forfeit fifty dollars ($50) for each calendar day, or portion thereof, for each worker paid less than the prevailing rate of per diem wages, determined by the Director, for such craft or classification in which such worker is employed for any public work done under the Agreement by CONTRACTOR or by any subcontractor under it. The amount of the penalty shall be determined by the Labor Commission and shall be based on consideration of the CONTRACTOR's mistake, inadvertence or neglect in failing to pay the correct prevailing rate of per diem wage, or the previous record of the CONTRACTOR in meeting his or her

prevailing rate of per diem wage obligations, or the CONTRACTOR's willful failure to pay the correct prevailing rate of per diem wages. A mistake, inadvertence or neglect in failing to pay the correct prevailing rate of per diem wage is not excusable if the CONTRACTOR had knowledge of his or her obligations under this part. The difference between such prevailing rate of per diem wage and the amount paid to each worker for each calendar day or portion thereof for which each worker was paid less than the prevailing rate of per diem wage shall be paid to each worker by the CONTRACTOR.

(g) Any worker employed to perform work on the Project, which work is not covered by any craft or classification listed in the general prevailing rate of per diem wages determined by the Director shall be paid not less than the minimum rate of wages specified therein for the craft or classification which most nearly corresponds to work to be performed by them, and such minimum wage rate shall be retroactive to time of initial employment of such person in such craft or classification.

(h) Pursuant to Labor Code Section 1773.1, per diem wages are deemed to include employer payments for health and welfare, pension, vacation, travel time, and subsistence pay as provided for in Labor Code Section 1773.8.

(i) CONTRACTOR shall post at appropriate conspicuous points on the site of the Project, a schedule showing all determined minimum wage rates and all authorized deductions, if any, from unpaid wages actually earned.

ARTICLE 49. HOURS OF WORK

(a) As provided in Article 3, (commencing at Section 1810), Chapter 1, Part 7, Division 2 of the Labor Code, eight (8) hours of labor shall constitute a legal day's work. The time of service of any worker employed at any time by the CONTRACTOR or by any subcontractor on any subcontract under this Agreement upon the work or upon any part of the work contemplated by this Agreement shall be limited and restricted by the Agreement to eight (8) hours per day, and forty (40) hours during any one week, except as hereinafter provided. Notwithstanding the provisions hereinabove set forth, work performed by employees of CONTRACTOR in excess of eight (8) hours per day and forty (40) hours during any one week, shall be permitted upon this public work upon compensation for all hours worked in excess of eight (8) hours per day at not less than one and one-half times the basic rate of pay.

(b) The CONTRACTOR shall keep and shall cause each subcontractor to keep an accurate record showing the name of and actual hours worked each calendar day and each calendar week by each worker employed by CONTRACTOR in connection with the work or any part of the work contemplated by this Agreement. The record shall be kept open at all reasonable hours to the inspection of the DISTRICT and to the Division of Labor Standards Enforcement, Department of Industrial Relations.

(c) Pursuant to Labor Code Section 1813, the CONTRACTOR shall pay to the DISTRICT a penalty of Twenty-Five Dollars ($25) for each worker employed in the execution of this Contract by the CONTRACTOR or by any subcontractor for each calendar day during which such worker is required or permitted to work more than eight (8) hours in

any one calendar day and 40 hours in any one calendar week in violation of the provisions of Article 3 (commencing at Section 1810), Chapter 1, Part 7, Division 2 of the Labor Code.

(d) Any work necessary to be performed after regular working hours, or on Sundays or other holidays shall be performed without additional expense to DISTRICT.

ARTICLE 50. PAYROLL RECORDS

(a) Pursuant to the provisions of Labor Code Section 1776, the CONTRACTOR shall keep and shall cause each subcontractor performing any portion of the work under this Agreement to keep an accurate payroll record, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by CONTRACTOR in connection with the work.

(b) The payroll records enumerated under subdivision (a) shall be certified and shall be available for inspection at all reasonable hours at the principal office of the CONTRACTOR on the following basis:

(1) A certified copy of an employee's payroll record shall be made available for inspection or furnished to the employee or his or her authorized representative on request.

(2) A certified copy of all payroll records enumerated in subdivision (a) shall be made available for inspection or furnished upon request to a representative of the DISTRICT, the Division of Labor Standards Enforcement, and the Division of Apprenticeship Standards of the Department of Industrial Relations.

(3) A certified copy of all payroll records enumerated in subdivision (a) shall be made available for inspection upon request by the public or copies thereof made; provided, however, that a request by the public shall be made through the District, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement. If the requested payroll records have not been provided pursuant to paragraph (2), the requesting party shall, prior to being provided the records, reimburse the costs of preparation by the CONTRACTOR, subcontractors, and the entity through which the request was made. The public shall not be given access to the records at the principal office of the CONTRACTOR.

(4) The form of certification shall be as follows:

I, _____ (Name-print), the undersigned, am (position in business) with the authority to act for and on behalf of _____ (Name of business and/or CONTRACTOR), certify under penalty of perjury that the records or copies thereof submitted and consisting of _____

(description, number of pages) are the originals or true, full and correct copies of the originals which depict the payroll record(s) of the actual disbursements by way of cash, check, or whatever form to the individual or individuals named.

Dated: _____ Signature: _____

(c) Contractor shall file a certified copy of the payroll records enumerated in subdivision (a) with the entity that requested the records within ten (10) days after receipt of a written request. In the event that the CONTRACTOR fails to comply within the 10-day period, the CONTRACTOR shall, as a penalty to the DISTRICT, forfeit Twenty-Five Dollars ($25) for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement, these penalties shall be withheld from progress payments then due.

(d) Any copy of payroll records made available for inspection as copies and furnished upon request to the public by the DISTRICT, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement shall be marked or obliterated in such a manner as to prevent disclosure of an individual's name, address, and social security number. The name and address of the CONTRACTOR shall not be marked or obliterated.

(e) The CONTRACTOR shall inform the DISTRICT of the location of the payroll records enumerated under subdivision (a), including the street address, city and county, and shall, within five (5) working days, provide a written notice of a change of location and address.

(f) It shall be the responsibility of the CONTRACTOR to ensure compliance with the provisions of this Article 50 and the provisions of Labor Code Section 1776.

ARTICLE 51. APPRENTICES

(a) The CONTRACTOR acknowledges and agrees that, if this Agreement involves a dollar amount greater than or a number of working days greater than that specified in Labor Code Section 1777.5, this Agreement is governed by the provisions of Labor Code Section 1777.5. It shall be the responsibility of the CONTRACTOR to ensure compliance with this Article 51 and with Labor Code Section 1777.5 for all apprenticing occupations.

(b) Apprentices of any crafts or trades may be employed and, when required by Labor Code Section 1777.5, shall be employed provided they are properly registered in full compliance with the provisions of the Labor Code.

(c) Every such apprentice shall be paid the standard wage paid to apprentices under the regulations of the craft or trade at which he or she is employed, and shall be employed only at the work of the craft or trade to which he or she is registered.

(d) Only apprentices, as defined in Section 3077, who are in training under apprenticeship standards and written apprentice agreements under Chapter 4 (commencing at

Section 3070), Division 3 of the Labor Code, are eligible to be employed on public works. The employment and training of each apprenticeship shall be in accordance with the provisions of the apprenticeship standards and apprentice agreements under which he or she is training.

(e) Pursuant to Labor Code Section 1777.5, the CONTRACTOR and any subcontractors employing workers in any apprenticeship craft or trade in performing any work under this Agreement shall employ apprentices in at least the ratio set forth in Section 1777.5 and apply to the applicable joint apprenticeship committee for a certificate approving the CONTRACTOR or subcontractor under the applicable apprenticeship standards for the employment and training of apprentices.

(f) Every contractor and subcontractor shall submit contract award information to the applicable joint apprenticeship committee which shall include an estimate of journeyman hours to be performed under the Agreement, the number of apprentices to be employed and the approximate dates the apprentices will be employed.

(g) If the CONTRACTOR or subcontractor willfully fails to comply with Labor Code Section 1777.5, then, upon a determination of noncompliance by the Chief of the Division of Apprenticeship Standards, the CONTRACTOR or subcontractor shall be subject to the penalties imposed under Labor Code Section 1777.7. Interpretation and enforcement of these provisions shall be in accordance with the rules and procedures of the California Apprenticeship Council.

(h) The CONTRACTOR and all subcontractors shall comply with Labor Code Section 1777.6, which section forbids certain discriminatory practices in the employment of apprentices.

(i) CONTRACTOR shall become fully acquainted with the law regarding apprentices prior to commencement of the work. Special attention is directed to Sections 1777.5, 1777.6, and 1777.7 of the Labor Code, and Title 8, California Code of Regulations, Section 200, et seq. Questions may be directed to the State Division of Apprenticeship Standards, 455 Golden Gate Avenue, 8th Floor, San Francisco, California 94102, (415) 703-4920.

ARTICLE 52. LABOR - FIRST AID

The CONTRACTOR shall maintain emergency first aid treatment for CONTRACTOR's workers on the Project which complies with the Federal Occupational Safety and Health Act of 1970 (29 U.S.C.A., Sec. 651, et seq.).

ARTICLE 53. PROTECTION OF PERSONS AND PROPERTY

(a) The CONTRACTOR shall be responsible for all damages to persons or property that occur as a result of its fault or negligence in connection with the prosecution of this Agreement and shall take all necessary measures and be responsible for the proper care and protection of all materials delivered and work performed until completion and final

acceptance by the DISTRICT. CONTRACTOR shall provide such heat, covering, and enclosures as are necessary to protect all work, materials, equipment, appliances, and tools against damage by weather conditions. All work shall be solely at the CONTRACTOR's risk with the exception of damage to the work caused by "acts of God" as defined in Public Contract Code Section 7105.

(b) CONTRACTOR shall take, and require subcontractors to take, all necessary precautions for safety of workers and shall comply with all applicable federal, state, local and other safety laws, standards, orders, rules, regulations, and building codes to prevent accidents or injury to persons on, about, or adjacent to the work site and to provide a safe and healthful place of employment. CONTRACTOR shall furnish, erect and properly maintain at all times, as directed by DISTRICT or ARCHITECT or required by conditions and progress of work, all necessary safety devices, safeguards, construction canopies, signs audible devices for protection of the blind, safety rails, belts and nets, barriers, lights, and watchmen for protection of workers and the public and shall post danger signs warning against hazards created by such features in the course of construction. CONTRACTOR shall designate a responsible employee, whose duty shall be to post information regarding protection and obligations of workers and other notices required under occupational safety and health laws, to comply with reporting and other occupational safety requirements, and to protect the life, safety and health of workers. Name and position of person so designated shall be reported in writing to DISTRICT by CONTRACTOR. CONTRACTOR shall correct any violations of safety laws, standards, orders, rules, or regulations. Upon the issuance of a citation or notice of violation by the Division of Occupational Safety and Health, such violation shall be corrected immediately by the CONTRACTOR at CONTRACTOR's expense.

(c) In an emergency affecting safety of person or of work or of adjoining property, CONTRACTOR, without special instruction or authorization from ARCHITECT or DISTRICT, is hereby permitted to act, at its discretion, to prevent such threatened loss or injury; and CONTRACTOR shall so act if so authorized or instructed by Architect or DISTRICT. Any compensation claimed by CONTRACTOR on account of emergency work shall be determined by written agreement with the DISTRICT.

(d) CONTRACTOR shall take adequate precautions to protect existing roads, sidewalks, curbs, pavements, utilities, adjoining property and structures (including, without limitation, protection from settlement or loss of lateral support), and to avoid damage thereto, and repair any damage thereto caused by construction operations.

(e) CONTRACTOR shall (unless waived by the DISTRICT in writing):

(1) When performing new construction on existing sites, become informed and take into specific account the maturity of the students on the site; perform work which may interfere with school routine before or after school hours; enclose working area with a substantial barricade; not allow any unauthorized individuals on the site; require all workers on the Project to be conspicuously identified either by a firm logo on their clothing or prominent identification badge and arrange work to

cause a minimum amount of inconvenience and danger to students and faculty in their regular school activities.

(2) Provide substantial barricades around any shrubs or trees indicated to be preserved.

(3) Deliver materials to building area over route designated by ARCHITECT.

(4) When directed by DISTRICT, take preventive measures to eliminate objectionable dust.

(5) Enforce all instructions of DISTRICT and ARCHITECT regarding signs, advertising, fires, and smoking and require that all workers comply with all regulations while on construction site.

(6) Take care to prevent disturbing or covering any survey markers, monuments, or other devices marking property boundaries or corners. If such markers are disturbed by accident, they shall be replaced by an approved civil engineer at no cost to the DISTRICT.

ARTICLE 54. NON-DISCRIMINATION

In the performance of the terms of this Agreement, CONTRACTOR agrees that it will not engage in nor permit such subcontractor as it may employ to engage in unlawful discrimination in employment of persons because of the race, religious creed, color, national origin, ancestry, physical handicap, medical condition, marital status, age or sex of such persons.

ARTICLE 55. SCHEDULE OF VALUES AND PERIODICAL ESTIMATES

(a) CONTRACTOR shall furnish on form(s) approved by DISTRICT:

(1) Within ten (10) calendar days of award of contract a detailed schedule of values giving complete breakdown of contract price for each component of the Project or site which shall include all subcontractor/supplier agreements showing dollar amounts of these agreements to justify the schedule of values; and

(2) A periodical itemized estimate of work done for purpose of making partial payments thereon. Change order work shall be clearly identified on a separate schedule of values.

(3) Within ten (10) calendar days of request of DISTRICT, a schedule of estimated monthly payments which shall be due CONTRACTOR under the Agreement.

(b) Values employed in making up any of these schedules are subject to the ARCHITECT's written approval and will be used only for determining basis of partial payments and will not be considered as fixing a basis for additions to or deductions from contract price.

ARTICLE 56. CONTRACTOR CLAIMS

If the CONTRACTOR shall claim compensation for any damage sustained by reason of the acts of the DISTRICT or its agents, CONTRACTOR shall, within five (5) calendar days after sustaining of such damage, make to the ARCHITECT a written statement of the damage sustained. On or before the 15th day of the month succeeding that in which such damage shall have been sustained the CONTRACTOR shall file with the DISTRICT an itemized statement of the details and amount of such damage, and unless such statement shall be made as thus required, CONTRACTOR's claims for compensation shall be forfeited and invalidated and it shall not be entitled to consideration for payment on account of any such damage.

ARTICLE 57. DISPUTES - ARCHITECT'S DECISIONS

(a) The ARCHITECT shall, within a reasonable time, make decisions on all matters relating to the CONTRACTOR's execution and progress of the work. The decisions of the ARCHITECT shall not be binding, but shall be advisory only on the CONTRACTOR for the purpose of CONTRACTOR's obligation to proceed with the work.

(b) Except for tort claims, all claims by the CONTRACTOR for a time extension, payment of money or damages arising from work done by, or on behalf of, the CONTRACTOR pursuant to the Agreement and payment of which is not otherwise expressly provided for or the claimant is not otherwise entitled to, or as to the amount of payment which is disputed by the DISTRICT of Three Hundred Seventy Five Thousand Dollars ($375,000) or less shall be subject to the settlement procedures set forth in Public Contract Code Section 20104, et seq. which provisions are incorporated herein by reference.

(c) In the event of a dispute between the parties as to performance of the work, the interpretation of this Agreement or payment or nonpayment for work performed or not performed, the parties shall attempt to resolve the dispute. Pending resolution of the dispute, CONTRACTOR agrees to continue the work diligently to completion. If the dispute is not resolved, CONTRACTOR agrees it will neither rescind the Agreement nor stop the progress of the work, but CONTRACTOR's sole remedy shall be to submit such controversy to determination by a court of the State of California, in Orange County, having competent jurisdiction of the dispute, after the Project has been completed, and not before.

ARTICLE 58. PAYMENTS

(a) Unless otherwise specified in writing, each month within thirty (30) days after receipt by the DISTRICT of the monthly progress schedule and an undisputed, properly submitted payment request from CONTRACTOR which has been certified for payment by the

Architect, there shall be paid to CONTRACTOR a sum equal to ninety percent (90%) of value of work performed and of materials delivered to the jobsite and inspected and approved by the inspector of record and subject to or under the control of the DISTRICT and unused up to the last day of the previous month, less aggregate previous payments. Public Contract Code Section 20104.50 Monthly payments shall be made only on the basis of monthly estimates which shall be prepared by CONTRACTOR on a form approved by DISTRICT and filed before the fifth day of the month during which payment is to be made. Work completed as estimated shall be an estimate only and no inaccuracy or error in said estimate shall operate to release CONTRACTOR or Surety from any damages arising from such work or from enforcing each and every provision of this Agreement, and DISTRICT shall have the right subsequently to correct any error made in any estimate for payment. CONTRACTOR SHALL NOT BE ENTITLED TO HAVE ANY PAYMENT ESTIMATES PROCESSED OR BE ENTITLED TO HAVE ANY PAYMENT FOR WORK PERFORMED SO LONG AS ANY LAWFUL OR PROPER DIRECTION CONCERNING WORK, OR ANY PORTION THEREOF, GIVEN BY THE DISTRICT OR ARCHITECT SHALL REMAIN UNCOMPLIED WITH BY THE CONTRACTOR. CONTRACTOR AGREES TO THE TEN PERCENT (10%) RETENTION ON ALL PROGRESS PAYMENTS. Public Contract Code Section 9203.

(b) DISTRICT has discretion to require from the CONTRACTOR any of the following information with the application for payment: (i) certified payroll covering the period of the prior application for payment; (ii) unconditional waivers and releases from all subcontractors/suppliers for which payment was requested under the prior application for payment; and/or (iii) receipts or bills of sale for any items. CONTRACTOR agrees that payment may be contingent upon District receiving any one or more of these documents.

(c) Before payment is made hereunder, a certificate in writing shall be obtained from the ARCHITECT stating that the work for which the payment is demanded has been performed in accordance with the terms of the Project Documents and that the amount stated in the certificate is due under the terms of the Project Documents, which certificate shall be attached to and made a part of the claim made and filed with the DISTRICT, provided that if the ARCHITECT shall, within three (3) days after written demand therefore, fail to deliver such certificate to the DISTRICT, the CONTRACTOR may file its claim with the DISTRICT without said certificate, but together with such claim shall be filed a statement that demand was made for such certificate and that the same was refused. Thereupon, the DISTRICT will either allow said claim as presented or shall, by an order entered on the minutes of said DISTRICT state the reasons for refusing to allow said claim. It is understood, moreover, that the certificate of the ARCHITECT shall not be conclusive upon the DISTRICT, but advisory only.

(d) Upon receipt of CONTRACTOR's payment request, DISTRICT shall review the payment request as soon as practicable after receipt for the purpose of determining that the payment request is proper. Any payment request determined not to be proper shall be returned to the CONTRACTOR as soon as practicable but not later than seven (7) days after receipt and shall be accompanied by a document setting forth in writing the reasons(s) why the payment request was not proper. Public Contract Code Section 20104.50

(e) NO PAYMENT BY DISTRICT HEREUNDER SHALL BE INTERPRETED SO AS TO IMPLY THAT DISTRICT HAS INSPECTED, APPROVED, OR ACCEPTED ANY PART OF THE WORK.

(f) Unless otherwise provided, on or before making request for final payment of the undisputed amount due under the Agreement, CONTRACTOR shall submit to DISTRICT, in writing a summary of all claims for compensation under or arising out of this Agreement which were timely filed. The acceptance by CONTRACTOR of the payment of the final amount shall constitute a waiver of all claims against DISTRICT under or arising out of this Agreement, except those previously made, in a timely manner and in writing, and identified by CONTRACTOR as unsettled at the time of CONTRACTOR's final request for payment.

(g) CONTRACTOR shall pay each of its subcontractors from whom retention has been withheld each subcontractor's share of the retention received within seven (7) days from the time that all or any portion of the retention are received by the CONTRACTOR subject to any limitations set forth in Public Contract Code Section 7107(e).

(h) The final payment of the ten percent (10%) retention of the value of the work done under this Agreement, if unencumbered, shall be made thirty-five (35) days after recording by the DISTRICT of the Notice of Completion at the County Recorder's Office. APPROVAL OF COMPLETION OF THE PROJECT WILL BE MADE ONLY BY ACTION OF THE GOVERNING BOARD OF DISTRICT. Public Contract Code Section 7107.

ARTICLE 59. CHANGES AND EXTRA WORK

(a) DISTRICT may, as provided by law and without affecting the validity of this Agreement, order changes, modifications, deletions and extra work by issuance of written change orders from time to time during the progress of the Project, contract sum being adjusted accordingly. All such work shall be executed under conditions of the original Agreement except that any extension of time caused thereby shall be adjusted at time of ordering such change. DISTRICT has discretion to order changes on a "time and material" basis with adjustments to time made after CONTRACTOR has justified through documentation the impact on the critical path of the Project.

(b) Notwithstanding any other provision in the Project Documents, the adjustment in the contract sum, if any, and the adjustment in the contract time, if any, set out in a change order shall constitute the entire compensation and/or adjustment in the contract time due CONTRACTOR arising out of the change in the work covered by the change order unless otherwise provided in the change order. The amount of the compensation due CONTRACTOR shall be calculated pursuant to subparagraph (e) of this Article 59. The entire compensation shall not include any additional charges not set forth in subparagraph (e) and shall not include delay damages (due to processing of a change order, refusal to sign a change order) indirect, consequential, and incidental costs including any project management

costs, extended home office and field office overhead, administrative costs and profit other than those amounts authorized under subparagraph (e) of this Article 59.

(c) In giving instructions, ARCHITECT shall have authority to make minor changes in work, not involving change in cost, and not inconsistent with purposes of the Project. Otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless in pursuance of a written order from DISTRICT, authorized by action of the governing board, and no claim for addition to contract sum shall be valid unless so ordered.

(d) If the ARCHITECT determines that work required to be done constitutes extra work outside the scope of the Agreement, the ARCHITECT shall send a request for a detailed proposal to the CONTRACTOR. CONTRACTOR will respond with a detailed proposal within five (5) calendar days of receipt of the Request for Proposal which shall include a complete itemized cost breakdown of all labor and materials showing actual quantities, hours, unit prices, and the wage rates required for the change. If the change order involves a change in construction time, a request for the time change shall accompany the change order cost breakdown. All such requests for time shall be specified by CONTRACTOR as either "work days" or "calendar days." Any request for time received with only the designation of "days" shall be considered calendar days. The term "work days" as used in this paragraph shall mean Monday through Friday, excluding Saturdays, Sundays and federal/State of California observed holidays. If the work is to be performed by a subcontractor, CONTRACTOR must include a bid from the subcontractor containing the same detailed information as required for CONTRACTOR. No extensions of time will be granted for change orders that, in the opinion of the ARCHITECT, do not affect the critical path of the Project.

(e) Value of any such extra work, change, or deduction shall be determined at the discretion of DISTRICT in one or more of the following ways:

(1) By mutual written acceptance of a lump sum proposal from CONTRACTOR properly itemized and supported by sufficient substantiating data to permit evaluation by DISTRICT and ARCHITECT.

(2) By unit prices contained in CONTRACTOR's original bid and incorporated in the Project Documents or fixed by subsequent agreement between DISTRICT and CONTRACTOR.

(3) By cost of material and labor and percentage for overhead and profit ("time and material"). If the value is determined by this method the following requirements shall apply:

(A) Daily Reports by Contractor.

(i) General. At the close of each working day, the CONTRACTOR shall submit a daily report to the ARCHITECT and the Inspector, on forms

approved by the DISTRICT, together with applicable delivery tickets, listing all labor, materials, and equipment involved for that day, and for other services and expenditures when authorized concerning extra work items. An attempt shall be made to reconcile the report daily, and it shall be signed by the ARCHITECT and the CONTRACTOR. In the event of disagreement, pertinent notes shall be entered by each party to explain points which cannot be resolved immediately. Each party shall retain a signed copy of the report. Reports by Subcontractors or others shall be submitted through the CONTRACTOR.

(ii) Labor. The report shall show names of workers, classifications, and hours worked and hourly rate. Project Superintendent expenses are not allowed.

(iii) Materials. The report shall describe and list quantities of materials used and unit cost.

(iv) Equipment. The report shall show type of equipment, size, identification number, and hours of operation, including loading and transportation, if applicable, and hourly/daily cost.

(v) Other Services and Expenditures. Other services and expenditures shall be described in such detail as the DISTRICT may require.

(B) Basis for Establishing Costs

(i) Labor. The costs of labor will be the actual cost for wages prevailing locally for each craft classification or type of workers at the time the extra work is done, plus employer payments of payroll taxes and insurance, health and welfare, pension, vacation, apprenticeship funds, and other direct costs resulting from federal, state or local laws, as well as assessments or benefits required by lawful collective bargaining agreements. The use of labor classification which would increase the extra work cost will not be permitted unless the CONTRACTOR establishes the necessity for such additional costs. Labor costs for equipment operators and helpers shall be reported only when such costs are not included in the invoice for equipment rental.

(ii) Materials. The cost of materials reported shall be at invoice or lowest current price at which such materials are locally available and delivered to the work site in the quantifies involved, plus sales tax, freight and delivery. The DISTRICT reserves the right to approve materials and sources of supply, or to supply materials to the CONTRACTOR if necessary for the progress of the work. No markup shall be applied to any material provided by the DISTRICT.

(iii) Tool and Equipment Rental. No payment will be made for the use of tools which have a replacement value of $100 or less or where an invoice is not provided.

Regardless of ownership, the rates to be used in determining equipment rental costs shall not exceed listed rates prevailing locally at equipment rental source, or distributors, at the time the work is performed. The rental rates paid shall include the cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, and all incidentals. Necessary loading and transportation costs for equipment used on the extra work shall be included.
If equipment is used intermittently and, when not in use, could be returned to its rental source at less expense to the DISTRICT than holding it at the work site, it shall be returned, unless the CONTRACTOR elects to keep it at the work site at no expense to the DISTRICT.

All equipment shall be acceptable to the ARCHITECT, in good working condition, and suitable for the purpose for which it is to be used. Manufacturer's ratings and manufacturer's approved modifications shall be used to classify equipment and it shall be powered by a unit of at least the minimum rating recommended by the manufacturer.

(iv) Other Items. The DISTRICT may authorize other items which may be required on the extra work. Such items include labor, services, material and equipment which are different in their nature from those required by the work and which are of a type not ordinarily available from the CONTRACTOR or any of the subcontractors. Invoices covering all such items in detail shall be submitted with the request for payment.

(v) Invoices. Vendors' invoices for material, equipment rental, and other expenditures, shall be submitted with the request for payment. If the request for payment is not substantiated by invoices or other documentation, the DISTRICT may establish the cost of the item involved at the lowest price which was current at the time of the report.

(C) The following form shall be used as applicable by the DISTRICT and CONTRACTOR to communicate proposed additions and deductions to the Agreement.

		EXTRA	CREDIT
i.	Material/Equipment (attach itemized quantity and unit cost plus sales tax)	_____	_____
ii.	Labor (attach itemized hours and rates)	_____	_____

iii.	Subtotal	_____	_____
iv.	If subcontractor performed work, add Subcontractor's overhead and profit to portions performed by it, not to exceed 15% of Item iii. above	_____	_____
v.	Subtotal	_____	_____
vi.	General Contractor's Overhead and Profit, not to exceed 15% of Item v if Contractor performed the work. If subcontractor performed the work, not to exceed 5% of Item v. Of portions performed by Contractor and subcontractors, portions performed by Contractor shall not exceed 15% of Item V, and portions performed by Subcontractor shall not exceed 5% of Item v.	_____	_____
vii.	Subtotal	_____	_____
viii.	Bond and Liability Insurance Premium, if in fact additional bonds or insurance were actually purchased, not to exceed 1% of Item vii.	_____	_____
ix.	Total	_____	_____

(4) IT IS EXPRESSLY UNDERSTOOD THAT THE VALUE OF SUCH EXTRA WORK OR CHANGES, AS DETERMINED BY ANY OF THE AFOREMENTIONED METHODS, EXPRESSLY INCLUDES ANY AND ALL OF CONTRACTOR's COSTS AND EXPENSES, BOTH DIRECT AND INDIRECT, RESULTING FROM ADDITIONAL TIME REQUIRED ON THE PROJECT, OR RESULTING FROM DELAYS TO THE PROJECT. ANY COSTS OR EXPENSES NOT INCLUDED ARE DEEMED WAIVED. FOR PURPOSES OF DETERMINING THE COST, IF ANY, OF ANY EXTRA WORK, CHANGE, ADDITION OR OMISSION HEREUNDER, ALL TRADE DISCOUNTS, REBATES, REFUNDS, AND ALL RETURNS FROM THE SALE OF SURPLUS MATERIALS AND EQUIPMENT SHALL ACCRUE AND BE CREDITED TO CONTRACTOR, AND CONTRACTOR SHALL ENSURE THAT SUCH DISCOUNTS, REBATES, REFUNDS, AND RETURNS MAY BE SECURED, AND THE AMOUNT THEREOF SHALL BE ALLOWED AS A REDUCTION OF

CONTRACTOR'S COST IN DETERMINING THE ACTUAL COST OF CONSTRUCTION FOR PURPOSES OF ANY EXTRA WORK, CHANGE, ADDITION OR OMISSIONS IN THE WORK AS PROVIDED HEREIN.

(f) If the CONTRACTOR should claim that any instruction, request, drawing, specification, action, condition, omission, default, or other situation obligates the DISTRICT to pay additional compensation to CONTRACTOR or to grant an extension of time, or constitutes a waiver of any provision in the Agreement, CONTRACTOR shall notify the DISTRICT, in writing, of such claim within five (5) calendar days from the date CONTRACTOR has actual or constructive notice of the factual basis supporting the claim. The notice shall state the factual bases for the claim and cite in detail the Project Documents (including plans and specifications) upon which the claim is based. The CONTRACTOR's failure to notify the DISTRICT within such five (5) day period shall be deemed a waiver and relinquishment of such a claim. If such notice be given within the specified time, the procedure for its consideration shall be as stated above in these General Conditions.

(g) "PROHIBITED USAGE OF CONTRACTOR QUALIFYING LANGUAGE STAMPS ON DISTRICT DRAWINGS OR CONTRACT FORMS." Contractor shall not countersign or endorse any form, drawing, change order, contract or other documents with any conditions not mutually agreed to in advance by the DISTRICT and the CONTRACTOR. Endorsement of a contract, change order, specification, drawing or form with the following: "This change order is being executed without waiver of the right to seek additional compensation for such services," shall be of no legal force or effect.

ARTICLE 60. COMPLETION

(a) The DISTRICT shall accept completion of the Project and have the Notice of Completion recorded within ten (10) days of acceptance of completion of the Project when the entire work including punch list items shall have been completed to the satisfaction of the DISTRICT. Civil Code Section 3093. The work may only be accepted as complete by action of the DISTRICT's Governing Board.

(b) However, the DISTRICT, at its sole option, may accept completion of the Project and have the Notice of Completion recorded when the entire work including individual portions of the work shall have been completed to the satisfaction of the DISTRICT, except for minor corrective items, as distinguished from incomplete items.

(c) A final walk through of the Project to determine completion and to record the Notice of Completion shall occur only upon a valid claim by CONTRACTOR that the Project is complete except for minor corrective items. Any erroneous claims of completion by CONTRACTOR resulting in a premature walk through shall be at CONTRACTOR's sole cost and expense and DISTRICT shall make adjustments to the contract price by reducing the amount thereof to pay for any costs incurred by the DISTRICT due to the erroneous claims by the CONTRACTOR that the Project is complete. Minor corrective items shall be identified in the final walk through of the Project.

(d) If the CONTRACTOR fails to complete the minor corrective items prior to the expiration of the thirty-five (35) day period immediately following recording of the Notice of Completion, the DISTRICT shall withhold from the final payment an amount equal to one hundred fifty percent (150%), as determined by the DISTRICT, of the amount of each item until such time as the item is completed. Public Contract Code Section 7107. At the end of such 35-day period, if there are items remaining to be corrected, the DISTRICT may elect to proceed as provided in Article 61(b) entitled "Adjustments to Contract Price."

ARTICLE 61. ADJUSTMENTS TO CONTRACT PRICE

(a) If CONTRACTOR defaults or neglects to carry out the work in accordance with the Project Documents or fails to perform any provision thereof, DISTRICT may, after ten (10) days written notice to the CONTRACTOR and without prejudice to any other remedy it may have, make good such deficiencies.

(b) The DISTRICT shall adjust the total contract price by reducing the amount thereof by the cost of making good such deficiencies. If DISTRICT deems it inexpedient to correct work not done in accordance with the Project Documents, an equitable reduction in the contract price shall be made therefore.

ARTICLE 62. CORRECTION OF WORK

(a) CONTRACTOR shall promptly remove all work identified by DISTRICT as failing to conform to the Project Documents, whether incorporated or not. CONTRACTOR shall promptly replace and re-execute its own work to comply with Project Documents without additional expense to DISTRICT and shall bear the expense of making good all work of other contractors destroyed or damaged by such removal or replacement.

(b) If CONTRACTOR does not remove such work within a reasonable time, fixed by written notice, DISTRICT may remove it and may store the material at CONTRACTOR's expense. If CONTRACTOR does not pay expenses of such removal within ten (10) days' time thereafter, DISTRICT may, upon ten (10) days written notice, sell such materials at auction or at private sale and shall account for net proceeds thereof, after deducting all costs and expenses that should have been borne by CONTRACTOR.

ARTICLE 63. EXTENSION OF TIME - LIQUIDATED DAMAGES

(a) The CONTRACTOR and DISTRICT hereby agree that the exact amount of damages for failure to complete the work within the time specified is extremely difficult or impossible to determine. CONTRACTOR shall be assessed liquidated damages for each and every day the work required under the Project Documents remains unfinished past the time for completion, as set forth in the Agreement, and any extensions of time granted by the DISTRICT to the CONTRACTOR under the terms of the Project Documents. The CONTRACTOR will pay to the DISTRICT or DISTRICT may retain from amounts otherwise payable to the CONTRACTOR, said amount for each day after failure to meet the

requirements of the contract completion as scheduled in the Agreement. Government Code Section 53069.85 For purposes of this article, the work shall be considered "complete" in accordance with the provisions of Article 60, "COMPLETION", except that the work may be considered complete without formal acceptance by the DISTRICT Governing Board so long as the Governing Board, at its next regularly scheduled meeting, accepts the work.

(b) CONTRACTOR shall not be charged for liquidated damages, as set forth above, because of any delays in completion of work which are not the fault or negligence of CONTRACTOR, including but not restricted to acts of God. CONTRACTOR shall within ten (10) days of beginning of any such delay, notify DISTRICT in writing of causes of delay. CONTRACTOR shall provide documentation and justification to substantiate the delay and its relation to the Project's critical path. DISTRICT shall ascertain the facts and extent of delay and grant extension of time for completing work when, in its judgment, the findings of fact justify such an extension. The DISTRICT's finding of fact thereon shall be final and conclusive on the parties hereto. Extension of time shall apply only to that portion of work affected by the delay, and shall not apply to other portions of work not so affected.

ARTICLE 64. PAYMENTS WITHHELD

(a) In addition to amount which DISTRICT may retain under Article entitled "COMPLETION" and Article entitled "PAYMENTS," DISTRICT may withhold a sufficient amount or amounts of any payment or payments otherwise due to CONTRACTOR, as in its judgment may be necessary to cover:

(1) Payments which may be past due and payable for just claims against CONTRACTOR or any subcontractors, or against and about the performance of work on the Project, including, without limitation, payments made pursuant to the Article entitled "PAYMENTS BY CONTRACTOR."

(2) The cost of defective work which CONTRACTOR has not remedied.

(3) Liquidated damages assessed against CONTRACTOR.

(4) Penalties for violation of labor laws.

(5) The cost of materials ordered by the DISTRICT pursuant to Article 33 entitled "MATERIALS AND WORK."

(6) The cost of completion of this Agreement if there exists a reasonable doubt that this Agreement can be completed for the balance then unpaid to CONTRACTOR.

(7) Damage to DISTRICT, another contractor, or subcontractor.

(8) Site clean-up as provided in Article 44 entitled "CLEANING UP."

(9) Payments to indemnify, defend, or hold harmless the DISTRICT.

(10) Any payments due to the District including but not limited to payments for failed tests, utilities or imperfections.

(11) Extra services for ARCHITECT.

(12) Extra services for the INSPECTOR including but not limited to reinspection required due to CONTRACTOR's failed tests or installation of unapproved or defective materials and CONTRACTOR's requests for inspection and CONTRACTOR□s failure to attend the inspection.

(13) Failure of CONTRACTOR to submit on a timely basis, proper and sufficient documentation required by the Project Documents, including without limitation, monthly progress schedules, shop drawings, submittal schedules, schedule of values, product data and samples, proposed product lists, executed change orders and verified reports.

(14) Any other obligation(s) of the DISTRICT which the DISTRICT is authorized and/or compelled by law to perform.

(b) If the above grounds are in the opinion of the DISTRICT removed by or at the expense of CONTRACTOR, payment shall be made for amounts withheld because of them.

(c) DISTRICT may apply such withheld amount or amounts to payment of such claims or obligations at its discretion. In so doing, DISTRICT shall make such payments on behalf of CONTRACTOR. If any payment is so made by DISTRICT, then such amount shall be considered as a payment made under contract by DISTRICT to CONTRACTOR and DISTRICT shall not be liable to CONTRACTOR for such payments made in good faith. Such payments may be made without prior judicial determination of claim or obligations. DISTRICT will render CONTRACTOR an accounting of such funds disbursed on behalf of CONTRACTOR.

(d) As an alternative to payment of such claims or obligations, DISTRICT, in its sole discretion, may reduce the total contract price as provided in Article 61 entitled "ADJUSTMENTS TO CONTRACT PRICE."

ARTICLE 65. TAXES

(a) CONTRACTOR will pay all applicable federal, state and local taxes on all materials, labor, or services furnished by it, and all taxes arising out of its operations under the Project Documents.

(b) If under federal excise tax law any transaction hereunder constitutes a sale on which a federal excise tax is imposed and the sale is exempt from such excise tax because it is a sale to a state or local government for its exclusive use, the DISTRICT, upon request, will execute documents necessary to show (1) that the DISTRICT is a political subdivision of the

State for the purposes of such exemption and (2) that the sale is for the exclusive use of the DISTRICT. No excise tax for such materials shall be included in any bid price.

ARTICLE 66. NO ASSIGNMENT

The CONTRACTOR shall not assign, transfer, convey, sublet or otherwise dispose of this Agreement or of its rights, title or interest in or to the same or any part thereof. If the CONTRACTOR shall assign, transfer, convey, sublet or otherwise dispose of the Agreement or its right, title or interest therein, or any part thereof, such attempted or purported assignment, transfer, conveyance, sublease or other disposition shall be null, void and of no legal effect whatsoever; and the Agreement may, at the option of the DISTRICT, be terminated, revoked and annulled, and the DISTRICT shall thereupon be relieved and discharged from any and all liability and obligations growing out of the same to the CONTRACTOR, and to its purported assignee or transferee.

ARTICLE 67. NOTICE

Any notice from one party to the other or otherwise under the Agreement shall be in writing and shall be dated and signed by party giving such notice or by a duly authorized representative of such party. Any such notice shall not be effective for any purpose whatsoever unless served in one of the following manners:

(1) If notice is given to DISTRICT, by personal delivery thereof to DISTRICT, or by depositing same in United States mail, enclosed in a sealed envelope addressed to DISTRICT, and sent by registered or certified mail with postage prepaid;

(2) If notice is given to CONTRACTOR, by personal delivery thereof to said CONTRACTOR, or to CONTRACTOR's superintendent at site of Project, or by depositing same in United States mail, enclosed in a sealed envelope addressed to said CONTRACTOR at its regular place of business or at such address as may have been established for the conduct of work under this Agreement, and sent by registered or certified mail with postage prepaid;

(3) If notice is given to surety or other persons, by personal delivery to such surety or other person, or by depositing same in United States mail, enclosed in a sealed envelope, addressed to such surety or person at the address of such surety or person last communicated by surety or other person to party giving notice, and sent by registered or certified mail with postage prepaid.

ARTICLE 68. NO WAIVER

The failure of the DISTRICT in any one or more instances to insist upon strict performance of any of the terms of this Agreement or to exercise any option herein conferred shall not be construed as a waiver or relinquishment to any extent of the right to assert or rely upon any such terms or option on any future occasion.

ARTICLE 69. NON-UTILIZATION OF ASBESTOS MATERIAL

(a) The CONTRACTOR will be required to execute and submit the Certificate Regarding Non-Asbestos Containing Materials.

(b) Should asbestos containing materials be installed by the CONTRACTOR in violation of this certification, or if removal of asbestos containing materials is part of the Project, decontaminations and removals will meet the following criteria:

(1) Decontamination and removal of work found to contain asbestos or work installed with asbestos containing equipment shall be done only under the supervision of a qualified consultant, knowledgeable in the field of asbestos abatement and accredited by the Environmental Protection Agency (EPA).

(2) The asbestos removal contractor shall be an EPA accredited contractor qualified in the removal of asbestos and shall be chosen and approved by the asbestos consultant who shall have sole discretion and final determination in this matter.

(3) The asbestos consultant shall be chosen and approved by the DISTRICT who shall have sole discretion and final determination in this matter.

(4) The work will not be accepted until asbestos contamination is reduced to levels deemed acceptable by the asbestos consultant.

(c) Cost of all asbestos removal, including, but not necessarily limited to the cost of the asbestos removal contractor, the cost of the asbestos consultant, analytical and laboratory fees, time delays and additional costs as may be incurred by the DISTRICT shall be borne entirely by the CONTRACTOR.

(d) Hold Harmless: Interface of work for the Project with work containing asbestos shall be executed by the CONTRACTOR at his/her risk and at his/her discretion with full knowledge of the currently accepted standards, hazards, risks and liabilities associated with asbestos work and asbestos containing products. By execution of the Agreement, the CONTRACTOR acknowledges the above and agrees to hold harmless the DISTRICT, its Governing Board, employees, agents, and ARCHITECT and assigns for all asbestos liability which may be associated with this work. The CONTRACTOR further agrees to instruct his/her employees with respect to the above mentioned standards, hazards, risks and liabilities.

ARTICLE 70. LEAD

Pursuant to the Lead-Safe Schools Protection Act (Education Code Sections 32240, et seq.) and other applicable law, the CONTRACTOR shall not use lead-based paint, lead plumbing and solders, or other potential sources of lead contamination in the construction of any new school facility or the modernization or renovation of any existing school facility.

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ARTICLE 71. GOVERNING LAW

The laws of the State of California shall govern the Project and the Agreement.

SECTION 01010-SUMMARY OF PROJECT

PART 1-GENERAL

1.01 SUMMARY

A. Section Includes:
1. Work covered by Contract Documents for this portion of the project.
2. Contracts.
3. Administrative and procedural sections applicable to all Contracts.

1.02 RELATED SECTIONS

A. General Conditions, Supplementary Conditions, Special Conditions or such other Conditions/Provisions as may be applicable to this Contract.

1.03 PROJECT-WORK COVERED BY ALL CONTRACT DOCUMENTS

A. Work of the prime Contract shall include the construction of:
1. Project Title: Saddleback College - James B. Utt Memorial Learning Resource Center Renovation

2. Project Location: South Orange County Community College District
Saddleback College
28000 Marguerite Parkway
Mission Viejo, California

3. Project Description:
a. Alterations to the "Existing" Library Building on the "Existing" Saddleback College campus.

b. The project consists of 1 building containing 3 stories.

c. The scope of work includes alterations to each floor to accommodate the following spaces:
1. (25) classrooms
2. (1) learning resource Center (LRC) - Second floor
3. (1) library - Third floor
4. (35) offices
5. (16) Study rooms/areas
6. (5) meeting rooms
7. Various associated spaces

d. Alterations at the site and building exterior to:
1. Upgrade accessible path of travel.
2. Reconfiguration of south and east plazas.

e. Demolition and removal of the CC Building

f. Demolition and removal of the SA Building

g. Modifications to existing Parking Lots 7, 7A, 9, and 10.

4. Special Notification:
   a. The original DSA project is A# 34021 (June 9, 1971).

5. Deferred Approvals:
   a. Interior Curtain Wall Glazing System (at Central Stair).
   b. Exterior Curtain Wall Glazing System over 10'-0" in height.
   c. Above ground Exterior piping for Fire Sprinkler System.
   d. Rooftop Skylight Framing & Glazing.

1.04 WORK INCLUDED IN THE CONTRACT

A. The Work Includes: Architectural, Civil, Structural, Mechanical, Electrical, Plumbing and Landscape.

B. District may award separate Contracts for products and installation for work as may be indicated on Drawings as NIC (Not in Contract), including but not limited to:
   1. Exterior and interior signage.
   2. Furniture and furnishings.
   3. Movable equipment.

C. Cooperate fully with separate Contractors so that work under those Contracts may be carried out smoothly, without interfacing with or delaying work under this Contract.

D. The District may award separate Contracts for additional work to be performed at the site followings Substantial Completion.

1.05 CONTRACT

A. Perform Work of this Contract under a stipulated sum with the District.

1.06 DOCUMENTS

A. The Contract shall consist of the execution and completion of all work described in the Project Manual and the Drawings, including:
   1. Owner-Contractor Agreement.
   2. General Conditions.
   3. Drawings: All those sheets titled and numbered on the Title Sheet.
   4. Project Manual.
   5. Specifications: All those sections titles and numbered in the table of contents in the forepart of the Project Manual.
   6. Addenda issued prior to execution of the Contract.
   7. Modifications issued after execution of the Contract.
   8. Performance Bond, when required by District.
   9. Labor and Material Bond, when required by District.

1.07 CONTRACT DRAWINGS

A. The Drawings provided with and identified in the Project Manual are the Drawings referenced in the Agreement.

B. The location, extent and configuration of the required construction and improvements are shown and noted on Drawings. The Drawings are referenced in the Agreement. An index of Drawings is included on the title page of the Drawings.

C. Drawings are arranged into series according to design discipline. Such organization and all references to trades, sub-contractors, specialty contractors or suppliers shall not

control the Contractor in assigning the Work among sub-contractors or in establishing the extent of the work to be performed by any trade.

D. Where the terms "as shown," "as indicated," "as noted," "as detailed," "as scheduled," or terms of like meaning are used in the Drawings or Specifications, it shall be understood that reference is being made to the Drawings references in the Agreement.

E. Where reference to the word "plans" is made anywhere in Drawings, Specifications and related Contract Documents, it shall be understood to mean the Drawings references in the Agreement.

1.08 CONTRACT SPECIFICATIONS

A. The Specifications provided in the Project Manual are the Specifications referenced in the Agreement.

B. Specifications are organized by Divisions and Sections in accordance with the recommended practices of the Construction Specifications Institute, Such organization shall not control the Contractor in assigning the work among subcontractors or in establishing the extent of work to be performed by any trade.

C. Specifications are included in the Project Manual, which also may include other documents related to the project, including, but not limited to, Information for Bidders, Proposal Form or Bid Form, Agreement, Certifications and Attachments, Soils and Geotechnical Data, Sample Forms and Schedules.

1.09 GENERAL CONSTRUCTION CONSIDERATIONS

A. Provide all Work identified in Divisions 1 through 16 except Work specifically assigned to other Contractors as may be specified.

PART 2-PRODUCTS

Not Used.

PART 3-EXECUTION

3.01 USE OF PREMISES

A. CONTRACTOR shall coordinate the Work of all trades, with DISTRICT and/or Separate Work Contract. CONTRACTOR shall sequence, coordinate, and perform the Work to impose minimum hardship on the operation and use of the existing facilities and/or Project site. CONTRACTOR shall install all necessary protection for existing improvements, Project site, property, and new Work against dust, dirt, weather, damage, vandalism, and maintain and relocate all protection to accommodate progression of the Work.

B. CONTRACTOR shall confine entrance and exiting to the Project site and/or facilities to routes designated by the District.

C. Within existing facilities, DISTRICT will remove portable equipment, furniture, and supplies from Work areas prior to the start of Work. CONTRACTOR shall cover and protect remaining items in areas of the Work

D. CONTRACTOR shall utilize all available means to prevent generation of unnecessary noise and maintain noise levels to a minimum. When required by the District, CONTRACTOR shall immediately discontinue noise-generating activities and/or provide alternative methods to minimize noise generation. CONTRACTOR shall install and maintain air compressors, tractors, cranes, hoists, vehicles, and other internal combustion engine equipment with mufflers, including unloading cycle of compressors. CONTRACTOR shall discontinue operation of equipment producing objectionable noise as required by the District.

E. CONTRACTOR shall furnish, install, and maintain adequate supports, shoring, and bracing to preserve structural integrity and prevent collapse of existing improvements and/or Work modified and/or altered as part of the Work.

F. CONTRACTOR shall secure building entrances, exits, and Work areas with locking devices as required by the District.

G. CONTRACTOR assumes custody and control of DISTRICT property, both fixed and portable, remaining in existing facilities vacated during the Work.

H. CONTRACTOR shall cover and protect surfaces of rooms and spaces in existing facilities turned over for the Work, including DISTRICT property remaining within as required to prevent soiling or damage from dust, dirt, water, and/or fumes. CONTRACTOR shall protect areas adjacent to the Work in a similar manner. Prior to DISTRICT occupancy, CONTRACTOR shall clean all surfaces including DISTRICT property.

I. CONTRACTOR shall not use or allow anyone other than DISTRICT employees to use facility telephones and/or other equipment, except in an emergency. CONTRACTOR shall reimburse DISTRICT for telephone toll charges originating from the facility except those arising from emergencies or use by DISTRICT employees.

J. CONTRACTOR shall protect all surfaces, coverings, materials, and finished Work from damage. Mobile equipment shall be provided with pneumatic tires.

3.02 PROPERTY INVENTORY

A. Property, DISTRICT intends to remove, will be removed by DISTRICT before a room or space is vacated for the Work. Before performing Work in each room or space, DISTRICT and CONTRACTOR shall prepare a detailed initial written inventory of DISTRICT property remaining within, including equipment and telephone instruments and the condition thereof. DISTRICT and CONTRACTOR shall retain a signed copy of the inventory dated and signed by both parties. Prior to subsequent DISTRICT occupancy of each such room or space, DISTRICT and CONTRACTOR shall perform a final inventory of DISTRICT property and all discrepancies between the initial inventory and final inventory shall be the responsibility of CONTRACTOR.

3.03 FURNITURE, FIXTURES, AND EQUIPMENT

A. Certain furniture, fixtures, and equipment identified in the Contract Documents may be furnished and delivered to the Project site by DISTRICT and installed by the CONTRACTOR.

B. If designated in the Contract Documents to be DISTRICT furnished CONTRACTOR installed (OFCI), CONTRACTOR shall unload, store, uncrate, assemble, install, and connect DISTRICT supplied furniture, fixtures, and equipment.

C. Ninety (90) days prior to Substantial Completion, CONTRACTOR shall notify DISTRICT of the scheduled date for installation of furniture, fixtures, and equipment. Upon delivery to the Project site, CONTRACTOR shall store furniture, fixtures, and equipment inside rooms and/or protected spaces. DISTRICT will sign receipt or bill of lading as applicable.

D. CONTRACTOR shall, within ten (10) days after delivery, uncrate and/or unpack furniture, fixtures, and equipment in presence of IOR who shall inspect the delivered items. IOR shall prepare an inspection report listing damaged or missing parts and accessories. IOR shall transmit one copy of the report to DISTRICT and CONTRACTOR. DISTRICT will procure and/or replace missing and or damaged furniture, fixtures, and equipment.

E. CONTRACTOR shall install furniture, fixtures, and equipment in the locations and orientation as indicated in the Contract Documents. CONTRACTOR shall verify exact locations with DISTRICT prior to final installation of furniture, fixtures, and equipment.

F. If required, DISTRICT will furnish setting and or placement drawings for furniture, fixtures, and equipment.

G. CONTRACTOR shall install furniture, fixtures, and equipment by proper means and methods to ensure an installation as recommended by the manufacturer. CONTRACTOR shall furnish and install all necessary fasteners and required blocking to properly install furniture, fixtures, and equipment.

H. CONTRACTOR shall install furniture, fixtures, and equipment with manufacturer recommended fasteners for the type of construction the furniture, fixtures, and equipment are being fastened and/or anchored to.

I. CONTACTOR shall provide final connections of any electrical, signal, gas, water, waste, venting and/or similar items to furniture, fixtures, and equipment. CONTRACTOR shall, prior to final connection, verify the operating characteristics of furniture, fixtures, and equipment are consistent with the designated supply.

END OF SECTION 01010

NOTE TO CONTRACTOR: PRIOR TO THE START OF SOIL DISTURBING ACTIVITIES A STORM WATER POLLUTION PREVENTION PLAN (SWPPP) MUST BE IN PLACE AT THE CONSTRUCTION SITE AND A COMPLETED NOTICE OF INTENT (NOI) MUST HAVE BEEN SENT TO THE STORM WATER QUALITY CONTROL BOARD. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE PREPARATION & IMPLEMENTATION OF THE SWPPP & NOI, INCLUDING ALL APPLICABLE PERMIT & PREPARATION FEES. THIS INCLUDES MAINTENANCE OF EROSION AND SEDIMENT CONTROL DURING THE LIFE OF THE PROJECT.

SECTION 01055 - STORM WATER POLLUTION PREVENTION

PART 1 – GENERAL

1.01 APPLICATION

A. This Section addresses the preparation, implementation and monitoring of a Storm Water Pollution Prevention Plan (SWPPP) & Water Pollution Control Drawings (WPCD's) for the purpose of preventing the discharge of pollutants from the construction site into the receiving waters. This includes the elimination of pollution discharges such as improper dumping, spills or leakage from storage tanks or transfer areas. If a SWPPP is required, the Owner will not issue a Notice to Proceed until the Contractor has prepared and obtained approval of the SWPPP from the Owner. The Contractor shall also secure a certification that the construction project has met all of the conditions of the General Construction Activity Storm Water Permit and comply with all applicable local, state and federal regulations governing storm water pollution prevention.

B. A Waste Discharger Identification (WDID) number will be issued to the project within 10 business days after the SWRCB receives a complete NOI package (original signed NOI, vicinity map, and check).

C. Penalties: Failure to comply with this Section may result in significant fines and possible imprisonment. The Regional Water Quality Control Board (RWQCB) or other prosecuting authority may assess fines of up to $32,500 per day for each violation. Should the District be fined or penalized as a result of the Contractor failing to comply with this Section, the Contractor shall reimburse the District for any and all fines, penalties and related costs.

D. Payment: All costs for work required for compliance with this Section shall be included within the Bid Prices.

1.02 REFERENCES

A. State Water Resources Control Board (SWRCB) Order No. 99-08-DWQ National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002, Waste Discharge Requirements for Discharges of Storm Water Runoff Associated with Construction Activity.

B. California Stormwater Quality Association, Stormwater Best Management Practice Handbook, Construction, January 2003 Edition.

PART 2 – PRODUCTS / SUBMITTALS

2.01 MATERIALS

A. Storm Water Pollution Prevention Plan: Provide the quality, grade and type of materials as specified in Stormwater Best Management Practice Handbook, Construction, January 2003 Edition and General Permit No. CAS000002.

B. Water Pollution Control Drawings (WPCDs) in conformance with these specifications, the Stormwater Best Management Practice Handbook, Construction, January 2003 Edition, and the requirements of the General Construction Permit requirements for a site map. Include the WPCD's as Attachment B to the SWPPP.

PART 3 - EXECUTION

3.01 PREPARATION AND APPROVAL

A. The Contractor shall prepare the Storm Water Pollution Prevention Plan (SWPPP) as required to comply with storm water pollution regulations for project sites with storm water discharges associated with construction activity such as clearing or demolition, grading, excavation and other land disturbances.

For project sites, new or existing, with land disturbance of 1 or more acres (or less than 1 acres if part of a common plan for development), the Contractor shall prepare and submit to the Owner the SWPPP for review and approval. The Contractor shall also pay annual renewal fee(s) until the contract is completed and make all such checks payable to the State Water Resources Control Board.

The Contractor shall prepare the SWPPP by following the SWPPP template provided in the California Stormwater Quality Association, Stormwater Best Management Practice Handbook, Construction, January 2003 Edition.

This template is available in Microsoft Word or pdf downloadable format, free of charge, at the following web site:

http://www.cabmphandbooks.com/Construction.asp#SWPPP

B. Within ten (10) days after Award of Contract, the Contractor shall submit to the Owner, two (2) copies of the SWPPP for review by the Project Civil Engineer. After the Owner's & Engineer's approval, the Contractor shall provide approved copies of the SWPPP as follows: one (1) copy each to the Owner, the Owner's Construction Inspector, Project Architect, and Project Civil Engineer.

C. The Contractor shall fill out and submit the Notice of Intent (NOI) and the applicable application fee, made payable to: "State Water Resources Control Board", no later than 48 hours before the commencement of construction begins. It is advised that the NOI be submitted 30 days prior to the date the receipt letter is needed. A copy of the NOI can be downloaded from the world wide web at the following web address:

http://www.swrcb.ca.gov/stormwtr/docs/finalconstpermit.pdf

D. When construction is complete the Contractor will file a Notice of Termination (NOT) with the local Regional Water Quality Control Board (RWQCB) and provide a copy to the Owner. A copy of the Notice of Termination format can be downloaded from the world wide web at the following web address:

http://www.swrcb.ca.gov/stormwtr/docs/constnot.pdf

3.02 WATER POLLUTION CONTROL DRAWINGS

A. The Contractor shall prepare Water Pollution Control Drawings (WPCDs) in conformance with these specifications, the Stormwater Best Management Practice Handbook, Construction, January 2003 Edition, and the requirements of the General Construction Permit requirements for a site map. Include the WPCDs as Attachment B to the SWPPP.

B. Guidance on preparing the WPCDs can be found in the Stormwater Best Management Practice Handbook, Construction, January 2003 Edition, Appendix B, Section 500.4. or the SWPPP template available in Microsoft Word or pdf downloadable format, free of charge, at the following web site: http://www.cabmphandbooks.com/Construction.asp#SWPPP.

C. Use grading sheets, drainage sheets or erosion control sheets as base sheets for the WPCDs. Select BMPs that are appropriate for the site and show their locations on the WPCDs.

3.03 IMPLEMENTATION

A. Install perimeter controls prior to starting other construction work at the site.

B. Contain on-site storm water at the jobsite. Do not drain on-site water directly into the storm drain.

C. Designate trained personnel for the proper implementation of the SWPPP.

D. Revise SWPPP to suit changing site conditions and also when properly installed systems are ineffective.

E. At the end of Construction Contract:

1. Leave in place storm water pollution prevention controls needed for post-construction storm water management and remove those that are not needed as determined by the Owner. Thereafter, remaining controls will be maintained by the Owner.

2. Provide Site Monitoring Reports, SWPPP revisions, Compliance Certifications and related documents to the Owner.

3. Post-construction storm water operation and management plan as described in the compliance certifications are considered to be in place at the end of the Construction Contract.

3.04 MONITORING

A. The Contractor shall conduct examination of storm water pollution prevention controls monthly, as well as before and after each storm and each 24-hour period during extended storm events. The Contractor shall also prepare and maintain, at the jobsite, a log of each inspection using Site Monitoring Report Forms.

3.05 LIABILITIES AND PENALTIES

A. Review of the SWPPP and inspection logs by the Owner's Inspector shall not relieve the Contractor from liabilities arising from non-compliance of storm water pollution regulations.

B. Payment of penalties for non-compliance by the Contractor shall be the sole responsibility of the Contractor and will NOT be reimbursed by the Owner.

C. Compliance with the Clean Water Act pertaining to construction activity is the sole responsibility of the Contractor. For any fine(s) levied against the Owner due to non-compliance by the Contractor, the Owner will deduct from the final payment due the Contractor the total amount of the fine(s) levied on the Owner, plus legal and associated costs.

END OF SECTION 01055

SECTION 01230 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.

2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. The Contract may include an amount for the extended cost of each Alternate or Unit Price Alternate listed below. Adjustment of the contract sum shall occur by Owner Change Order to increase/decrease the contract amount due to final quantity on the Unit Price Alternate. On the bid form enter Price/Unit Price for each of the following

1. **Add Alternate No. 1**: Slurry-Seal Parking Lots 9, 10, and 12 – Reference Drawing A-0.01

   a. Base Bid: Slurry-Seal Area of Work at Parking Lots 9, 10, and 12 per Drawing A-0.01 and Specification Section 02066; no change.

   b. Alternate:

      1.) Drawings A-0.01 & A-0.10: Slurry-Seal Entire Area of Parking Lots 9, 10, and 12 per the requirements of Specification Section 02066.

      2.) Drawings A-0.01, A-0.10, and A-1.03: Provide new pavement markings for path-of-travel, and parking stalls for entire parking lot, less Base Bid Work described in Drawings, Specifications, and above.

END OF SECTION 01230

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination Drawings.
2. Administrative and supervisory personnel.
3. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

C. Related Sections include the following:

1. Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
2. Division 1 Section "Closeout Procedures" for coordinating Contract closeout.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Pre-installation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.4 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include special personnel required for coordination of operations with other contractors.

1.5 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner, Construction Manager, and Architect, but no later than 10 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

   a. Tentative construction schedule.
   b. Phasing.
   c. Critical work sequencing and long-lead items.
   d. Designation of key personnel and their duties.
   e. Procedures for processing field decisions and Change Orders.
   f. Procedures for requests for interpretations (RFIs).
   g. Procedures for testing and inspecting.
   h. Procedures for processing Applications for Payment.
   i. Distribution of the Contract Documents.
   j. Submittal procedures.
   k. LEED requirements.
   l. Preparation of Record Documents.
   m. Use of the premises.
   n. Work restrictions.
   o. Owner's occupancy requirements.
   p. Responsibility for temporary facilities and controls.
   q. Construction waste management and recycling.
   r. Parking availability.
   s. Office, work, and storage areas.
   t. Equipment deliveries and priorities.
   u. First aid.
   v. Security.
   w. Progress cleaning.
   x. Working hours.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Construction Manager of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

   a. The Contract Documents.
   b. Options.

c. Purchases.
d. Deliveries.
e. Submittals.
f. Review of mockups.
g. Possible conflicts.
h. Compatibility problems.
i. Time schedules.
j. Weather limitations.
k. Manufacturer's written recommendations.
l. Warranty requirements.
m. Compatibility of materials.
n. Acceptability of substrates.
o. Temporary facilities and controls.
p. Space and access limitations.
q. Regulations of authorities having jurisdiction.
r. Testing and inspecting requirements.
s. Installation procedures.
t. Coordination with other work.
u. Required performance results.
v. Protection of adjacent work.
w. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at biweekly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.
15) Requests for interpretations (RFIs).
16) Status of proposal requests.
17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) Documentation of information for payment requests.

3. Minutes: Construction Manager will record and distribute to Contractor the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

   a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include the following:

1. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
2. Division 1 Section "Quality Requirements" for submitting test and inspection reports.
3. Division 1 Section "Closeout Procedures" for submitting warranties.
4. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
5. Division 1 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
6. Division 1 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.
7. Divisions 2 through 16 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's and Construction Manager's responsive action.

B. Informational Submittals: Written information that does not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Submittals Schedule: Provide list of submittals and time requirements for scheduled performance of related construction activities.

C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal from Construction Manager. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 14 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

D. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Construction Manager.
3. Include the following information on label for processing and recording action taken:

a. Project name.
b. Date.
c. Name and address of Architect and Construction Manager.
d. Name and address of Contractor.
e. Name and address of subcontractor.
f. Name and address of supplier.
g. Name of manufacturer.
h. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

E. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect or Construction Manager observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect and Construction Manager.
2. Additional copies submitted for maintenance manuals will not be marked with action taken.

G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Construction Manager will return submittals, without review, received from sources other than Contractor.

1. Transmittal Form: Provide locations on form for the following information:

a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Drawing number and detail references, as appropriate.
j. Remarks.
k. Signature of transmitter.

2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating from Architect's and Construction Manager's action stamp taken by Architect and Construction Manager.

1.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: At Contractor's written request, copies of Architect's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:

1. General: Electronic copies of CAD Drawings of the Contract Drawings can be purchased from the Architect for Contractor's use in preparing submittals.

2. A Third Party Waiver and Release Regarding Use Of Electronic Machine-Readable Instruments of Service shall be required from Contractor to Architect. Form is available from Architect.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Standard color charts.
e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operation and maintenance manuals.
k. Compliance with specified referenced standards.
l. Testing by recognized testing agency.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.
5. Number of Copies: Submit six (6) copies of Product Data, unless otherwise indicated. Architect, through Construction Manager, will return three (3) copies. Mark up and retain one returned copy as a Project Record Document.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings.

d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Design calculations.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.
m. Relationship to adjoining construction clearly indicated.
n. Seal and signature of professional engineer if specified.
o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
3. Number of Copies: Submit six (6) opaque (bond) copies of each submittal. Architect, through Construction Manager, will return three (3) copies.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit two full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit six (6) sets of Samples.

      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

   1. Number of Copies: Submit three (3) copies of each submittal, unless otherwise indicated. Architect and Construction Manager will not return copies.
   2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
   3. Test and Inspection Reports: Comply with requirements specified in Division 1 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

G. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

K. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

L. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."

M. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

N. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."

Q. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load

diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

T. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

U. Material Safety Data Sheets (MSDSs): Submit information directly to Construction Manager; do not submit to Architect, except as required in "Action Submittals" Article.

2.3 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three (3) copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S / ACTION

A. General: Architect and Construction Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.

1. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.

C. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01330

SECTION 01420 - TESTING AND INSPECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Testing and inspection services to meet requirements of the California Building Code (CBC), Title 24, Parts 1 and 2, as indicated on the Drawings.

B. One or more DSA certified inspectors employed by the OWNER in accordance with the requirements of California Building Standards Administrative Code will be assigned to the Work with their duties as specifically defined in Section 4-333(b).

C. Tests of materials are required by a DSA certified testing agency as set forth in Section 4-335 of the California Building Standards Administrative Code.

1.02 RELATED SECTIONS

A. Section 01020: Project Forms
B. Section 01120: Cutting and Patching
C. Section 01300: Submittals
D. Section 01360: Construction Schedule
E. Section 01450: Test and Balance
F. Section 01500: Construction Facilities and Temporary Controls
G. Section 01600: Materials and Equipment
H. Section 01700: Contract Closeout
I. Section 01740: Warranties

PART 2 – PRODUCTS (Not applicable)

PART 3 – EXECUTION

3.01 TESTS

A. OWNER will select an independent testing agency to conduct tests, sampling, and testing of materials. Selection of material to be tested shall be by the agency and not by CONTRACTOR.

B. Any material shipped from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from IOR such testing and inspection is not required shall not be incorporated into the Work.

C. OWNER will select and directly reimburse testing agency the costs for all DSA and/or DSA required tests and inspections, but may be reimbursed by CONTRACTOR for such costs as noted in related sections of the Contract Documents.

D. The independent testing agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work. The agency shall not perform any duties of CONTRACTOR.

E. CONTRACTOR shall provide an insulated curing box for concrete cylinders and will relocate said box and cylinders as rapidly as required in order to provide for progress of the Work.

3.02 TEST REPORTS

A. Test reports shall include all tests performed, regardless of whether such tests indicate the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations as required shall also be reported. Reports shall indicate the material or materials were sampled and tested in accordance with requirements of CBC, Title 24, Parts 1 and 2, as indicated on the Drawings. Test reports shall indicate specified design strength. They shall also definitely state whether or not material or materials tested comply with the specified requirements.

3.03 VERIFICATION OF TEST REPORTS

A. Each testing agency shall submit to the Division of the State Architect, Architect, and Construction Manager, a verified report in duplicate covering tests which are required to be performed by that agency during progress of the Work. Such report shall be furnished each time construction on the Work is suspended, covering tests up to that time, and prior to Final Completion of the Work, covering all tests.

3.04 INSPECTION BY OWNER

A. OWNER and its representatives shall at all times have access, for purpose of inspection, to all parts of the Work and to shops wherein the Work is in preparation, and CONTRACTOR shall at all times maintain proper facilities and provide safe access for such inspection.

B. OWNER shall have the right to reject materials and/or workmanship deemed defective Work, and to require correction. Defective workmanship shall be corrected in a satisfactory manner and defective materials shall be removed from the premises and legally disposed of, all without charge to OWNER. If CONTRACTOR does not correct such defective Work within a reasonable time, fixed by written notice and in accordance with the terms and conditions of the Contract Documents, OWNER may correct such defective Work and proceed in accordance with related Articles of the Contract Documents.

C. CONTRACTOR is responsible for compliance to all applicable local, state, and federal regulations regarding codes, regulations, ordinances, restrictions, and requirements.

3.05 INSPECTOR OF RECORD

A. Inspector of Record is employed by OWNER in accordance with requirements of Title 24 of the California Code of Regulations with their duties specifically defined therein.

B. Inspection of Work shall not relieve CONTRACTOR from any obligation to fulfill all of the terms and conditions of the Contract Documents.

C. CONTRACTOR shall be responsible for scheduling times of inspection, tests, sample taking, and similar activities of the Work.

3.06 TESTS AND INSPECTIONS

A. The following tests and inspections do not limit inspection of the Work but are required by DSA, other agencies, or are required in related Sections of the Contract Documents.

B. Excavations, Foundations and Retaining Walls - CBC, Chapter 18A:

1. Inspection:
   a. All excavation foundation work and soil compaction shall be inspected by the ~~soils engineer~~ **Geotechnical Engineer**.

C. Concrete – CBC, Chapter 19A:

1. Materials:

a.	Test of Materials	1903A.1
b.	Portland Cement Tests	1903A.2, 1929A.1
c.	Concrete Aggregate	1903A.3
d.	Shotcrete Aggregate	1903A.3; 1924A.3
e.	Reinforcing Bars	1903A.5.1; 1903A.5.2; 1903A.5.3; 1903A.5.4; 1929A.2
f.	Structural Steel, Steel Pipe or tubing	1903A.5.6
g.	Admixtures	1903A.6

2. Quality:

a.	Proportions of Concrete	1905A.1; 1905A.2; 1905A.3; 1905A.4; 1905A.5; 1905A.6; 1904A
b.	Mixing and Placing	1905A.1.1; 1905A.1.2; 1905A.1.3
c.	Concrete Testing	1905A.6;
d.	Composite Construction Cores	1929A.8

3. Inspection:

a.	Project Site Inspection	1905A.7.1
b.	Batch Plant or Weigh-master Inspection	1929A.4, 1929A.5; 1929A.6

c.	Reinforcing Bar Welding Inspection	1929A.12, 1903A.10

D. Masonry - CBC, Chapter 21A:

1. Materials:

a.	Masonry Units	2102A.2(4,5,6)
b.	Portland Cement	2102A.2.2
c.	Mortar & Grout Aggregates	2102A.2.1; 2103A.3, A.4
d.	Reinforcing Bars	2102A.2(10); 1903A5,

2. Quality:

a.	Portland Cement Tests	1903A.2, 1929A.1
b.	Mortar & Grout Tests	2105A.3.4.(2)
c.	Masonry Prism Tests	2105A.3.2; 2105A3.3; 2105A3.5
d.	Masonry Core Tests	2105A 3.1
e.	Reinforcing Bars	2102A.2.10; 1929A.2

3. Inspection:

a.	Reinforced Masonry	2105A.7
b.	Reinforcing Bar Welding Inspection	1903A.10; 1929A.12

E. Steel - CBC, Chapters 17A & 22A:

1. Materials:

a.	Structural Steel	2202A.1
b.	Material Identification	2203.A4

2. Inspection and Tests:

a.	Test of Structural Steel	2231.A
b.	Tests of High Strength Bolts, Nuts, and Washers	2231.A.2
c.	Tests of End Welded Studs	2231.A.3
d.	Shop Fabrication Inspection	2231.A.4

e.	Welding Inspection	2231.A.5
f.	High Strength Bolt Inspection	2231A.6
g.	Spray applied fire resistance materials	1701.5.10

F. Exterior Wall Coverings - CBC, Chapter 14A, 25A:

1. Materials:

a.	Portland Cement Plaster	2508A, 2509A, 2510A

F. Site work, Demolition & Construction

1. Inspection

a.	Excavation and fulls	3301.1

END OF SECTION 01420

SECTION 01400 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include the following:

1. Division 1 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
2. Divisions 2 through 16 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where

indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Accepted mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by a District approved testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the <u>most stringent</u> requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.

f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect or Construction Manager.
2. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's and Construction Manager's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 2 through 16.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 72 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.

1. Distribution: Distribute schedule to Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency and required special inspector(s) to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.
7. Submit Final Verified Report (DSA-6) at completion of accepted work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's and Construction Manager's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01430

SECTION 01524 - CONSTRUCTION WASTE MANAGEMENT

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Waste Management Objective for the Project:

1. This Project shall minimize the generation of construction and demolition waste at the site. Factors that contribute to waste, such as over-packaging, improper storage, ordering error, poor planning, breakage, mishandling, and contamination shall be minimized.

2. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be reused or recycled. Waste disposal in landfills shall be minimized.

B. Diversion From Landfill: Waste categories appropriate for diversion from landfill shall include, but not be limited to, the following:

1. Land clearing debris
2. Soil
3. Wood: Clean dimensional wood, palette wood
4. Sheet Wood: Plywood, OSB and particle board
5. Concrete
6. Concrete Masonry Units (CMU)
7. Asphalt Concrete
8. Paper
   a. Bond
   b. Newsprint
   c. Cardboard and paper packaging materials
9. Cement Fiber Products: panels,
10. Metals
    a. Ferrous
    b. Non-ferrous
11. Paint
12. Rigid Foam
13. Glass
14. Plastics
15. Beverage containers
16. Insulation
17. Gypsum Board
18. Porcelain Plumbing Fixtures
19. Fluorescent Light Tubes (per Dept. of Toxic Substances Control regulations)

1.02 RELATED REQUIREMENTS

A. General & Supplementary Conditions

1.03 REFERENCES

A. The California Integrated Waste Management Board (CIWMB); including the California Materials Exchange (CalMAX), Telephone 877-520-9703; www.ciwmb.ca.gov/calmax/.

B. Local Integrated Waste Management Programs and Re-Use Programs in the Project area.

C. The Department of Toxic Substances Control (DTSC)

1.04 WASTE MANAGEMENT

A. Waste management goals:

1. The Owner has established that this Project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.

2. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.

B. Manager: Contractor shall designate on-site party (or parties) responsible for instructing workers and subcontractors, and overseeing and documenting results of Waste Management for the Project.

C. Distribution: Contractor shall distribute copies of the Construction Waste Estimate and Waste Management Report forms to the Job Site Foreman, each Subcontractor, and the State's Representative.

D. Meetings: Contractor shall conduct Waste Management meetings with subcontractors who generate construction waste. Contractor shall present current status of the Waste Management Report at regular job-site meetings.

E. Field Measurements: Contractor is to verify that field measurements are as indicated on construction and/or shop drawings before confirming product orders or proceeding with work, in order to minimize waste due to excessive materials.

F. Materials Handling Procedures: Provide means by which waste materials will be protected from contamination, and means to be employed in reuse or recycling of waste material consistent with requirements for acceptance by receiving facilities.

1. Separation Facilities: Contractor shall lay out and label a specific area to facilitate separation of materials for reuse and recycling. Recycling and waste bin areas shall be kept neat and clean and clearly marked in order to avoid contamination of materials.

2. Hazardous Wastes: Hazardous wastes shall be separated, stored, and disposed of according to local regulations, and in accordance with specifications for such work as may be included in this Project.

3. Instruction: Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at appropriate stages of the Project.

G. PACKING AND SHIPPING:

1. Shipping: Coordinate the schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

2. Packing: Arrange for the return of packing materials, such as wood pallets, where economically feasible.

1.05 WASTE MANAGEMENT PLAN

A. Draft Waste Management Plan: Within 10 calendar days after receipt of Notice of Award of Bid, or prior to any waste removal, whichever occurs sooner, the Contractor shall submit to the Owner and Architect a Draft Waste Management Plan.

B. The Draft Plan shall contain the following:

1. Analysis of the proposed jobsite waste to be generated, including types and quantities.
2. Landfill options: The name of the landfill(s) where trash will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all Project waste in the landfill(s).
3. Alternatives to Landfilling: A list of each material proposed to be salvaged, reused, or recycled during the course of the Project, the proposed local market for each material, and the estimated net cost savings or additional costs resulting from separating and recycling (versus landfilling) each material.
4. "Net" means that the following have been subtracted from the cost of separating and recycling: (a) revenue from the sale of recycled or salvaged materials and (b) landfill tipping fees saved due to diversion of materials from the landfill. The list of these materials is to include, at minimum, the following materials:

    a. Cardboard.
    b. Clean dimensional wood.
    c. Beverage containers.
    d. Land clearing debris.
    e. Concrete.
    f. Bricks.
    g. Concrete Masonry Units (CMU).
    h. Asphalt.
    i. Metals from banding, stud trim, ductwork, piping, rebar,
    j. Roofing, other trim, steel, iron, galvanized sheet steel,
    k. Stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

C. Resources for Development of Waste Management Plan: The following sources may be useful in developing the Draft Waste Management Plan:

1. Triangle J Council of Governments
2. Recycling Haulers and Markets

D. Final Waste Management Plan: Once the Owner has determined which of the recycling options addressed in the draft Waste Management Plan are acceptable, the Contractor shall submit, within 10 calendar days a Final Waste Management Plan.

E. The Final Waste Management Plan shall contain the following:

1. Analysis of the proposed jobsite waste to be generated, including types and quantities.
2. Landfill options: The name of the landfill(s) where trash will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all Project waste in the landfill(s).
3. Alternatives to Landfilling: A list of the waste materials from the Project that will be separated for reuse, salvage, or recycling.
4. Meetings: A description of the regular meetings to be held to address waste management.
5. Materials Handling Procedures: A description of the means by which any waste materials will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.
6. Transportation: A description of the means of transportation of the recyclable materials (whether materials will be site separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site) and destination of materials.

1.06 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: The Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.

B. Distribution: The Contractor shall distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner, and the Architect.

C. Instruction: The Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.

D. Separation facilities: The Contractor shall lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

E. Hazardous wastes: Hazardous wastes shall be separated, stored, and disposed of according to local regulations.

F. Application for Progress Payments: The Contractor shall submit with each Application for Progress Payment a Summary of Waste Generated by the Project. Failure to submit this information shall render the Application for Payment incomplete and shall delay Progress Payment. The Summary shall be submitted on a form acceptable to the Owner and shall contain the following information:

1. The amount (in tons or cubic yards) of material land filled from the Project, the identity of the landfill, the total amount of tipping fees paid at the landfill, and the total disposal cost.
2. Include manifests, weight tickets, receipt, and invoices.
3. For each material recycled, reused, or salvaged from the Project, the amount (in tons or cubic yards), the date removed from the jobsite, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of salvage or recycling each material. Attach manifests, weight tickets, receipts, and invoices.

1.07 WASTE MANAGEMENT REPORT

A. Provide a Monthly Waste Management Report.

B. Upon completion of Work, including final cleanup, provide a final Waste Management Report.

1. The total quantity of each waste material generated; and the date(s) removed from the job-site.

2. The percent of the total quantity generated of each material sent to landfill, the identity of the landfill (receiving facility), handling costs, transport costs, tipping fees paid at the landfill, and total landfill costs. Attach copies of manifests, weight tickets, receipts, and invoices.
3. For each material reused or recycled from the Project, include the percent of the total quantity generated, the identity of the receiving facility, the total costs of handling and transportation, and income. Attach manifests, weight tickets, receipts, and/or invoices.

1.08 PREPARATION

A. Storage and Protection: Designate receiving/storage areas for incoming material to be delivered according to installation schedule and to be placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and handle materials in a manner as to prevent loss from weather and other damage. Keep materials, products, and accessories covered and off the ground, and store in a dry, secure area.

C. Prevent contact with material that may cause corrosion, discoloration, or staining.

D. Protect all materials and installations from damage by the activities of other trades.

1.09 INSTALLATION

A. Install product(s) per manufacturer's recommendations to reduce damage to or waste of materials by required replacement.

1.10 WASTE MANAGEMENT

A. Source separation: Separate, store, protect, and handle at the site identified recyclable and salvageable waste products in order to prevent contamination of materials and to maximize recyclability and salvageability of identified materials.

B. Return: Set aside and protect misdelivered and substandard products and materials and return to supplier for credit.

C. Reuse and Salvage: Set aside, sort, and protect separated products and materials for collection, re-use, and/or salvage.

D. Recycling: Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclables.

END OF SECTION

SECTION 01600 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:

1. Division 1 Section "Closeout Procedures" for submitting warranties for Contract closeout.
2. Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

   a. Specification Section number and title.
   b. Generic name used in the Contract Documents.
   c. Proprietary name, model number, and similar designations.
   d. Manufacturer's name and address.
   e. Supplier's name and address.
   f. Installer's name and address.
   g. Projected delivery date or time span of delivery period.
   h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within 10 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

   a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed List: Within 30 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Architect's Action: Architect will respond in writing to Contractor within 14 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

   a. Statement indicating why specified material or product cannot be provided.
   b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor, through Construction Manager, of acceptance or rejection of proposed substitution within 14 days of receipt of request.

   a. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor, through Construction Manager, of approval or rejection of proposed comparable product request within 14 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

   a. Form of Approval: As specified in Division 1 Section "Submittal Procedures."
   b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.

3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

    a. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 10 days prior to Bid Opening. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect

for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents,that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01600

SECTION 01700 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Sections include the following:

1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 1 Section "Submittal Procedures" for submitting surveys.
3. Division 1 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
4. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 SUBMITTALS

A. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

   a. Description of the Work.
   b. List of detrimental conditions, including substrates.
   c. List of unacceptable installation tolerances.
   d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Construction Manager that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility

appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Construction Manager and Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Construction Manager and Architect promptly.

B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 9 feet in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01700

SECTION 01731 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. Division 1 Section "Selective Demolition" for demolition of selected portions of the building.
2. Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
3. Division 7 Section "Through-Penetration Firestop Systems" for patching fire-rated construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the Work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated

and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

A. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include but are not limited to the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise- and vibration-control elements and systems.

B. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01731

SECTION 01732 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Sections include the following:

1. Division 1 Section "Summary" for use of premises, and phasing, and Owner-occupancy requirements.
2. Division 1 Section "Construction Waste Management" for disposal of demolished materials.
3. Division 1 Section "Cutting and Patching" for cutting and patching procedures.
4. Division 2 Section "Building Demolition" for demolition of entire buildings, structures, and site improvements.
5. Division 2 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, clean, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1.5 SUBMITTALS

A. Qualification Data: For demolition firm and or refrigerant recovery technician.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure District on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of stairs.
5. Locations of proposed dust- and noise-control temporary partitions and means of egress.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
7. Means of protection for items to remain and items in path of waste removal from building.

C. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

D. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Standards: Comply with ANSI A10.6 and NFPA 241.

E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Owner may occupy or store items in portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

1. Comply with requirements specified in Division 1 Section "Summary."

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, District will remove and salvage items listed in Bid Documents.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is expected that hazardous materials will be encountered in the Work.

1. Hazardous materials shall be removed by Contractor and are part of the total Scope of Work and General Contract.
2. If additional materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Construction Manager. Additional materials will be addressed via Change Order.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer to survey unknown conditions of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

1. Subsidence monitoring of the remaining building structure as demolition proceeds, shall be monitored / performed by a registered surveyor on a weekly basis.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings preconstruction photographs or preconstruction digital video.

1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

G. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

1. Surveys of the remaining building structure as demolition proceeds, shall be performed by a registered surveyor on a weekly basis.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

1. Comply with requirements for existing services/systems interruptions specified in Division 1 Section "Summary."

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. When notified in writing by the Contractor, the Construction Manager will arrange to shut off indicated services/systems when requested by Contractor.

a. Contractor to notify Construction Manager a minimum of fourteen (14) days prior.

2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass

area of selective demolition and that maintain continuity of services/systems to other parts of building.

4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

   a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

   1. Comply with requirements for access and protection specified in Division 1 Section "General Conditions."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   4. Cover and protect furniture, furnishings, and equipment that have not been removed.
   5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 1 Section "General Conditions."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

   1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and

chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Construction Manager.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

F. Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

G. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 01732

SECTION 01770 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Warranties.
3. Final cleaning.

B. Related Sections include the following:

1. Division 1 Section "General Conditions" for requirements for Applications for Payment for Substantial and Final Completion.
2. Division 1 Section "Execution Requirements" for progress cleaning of Project site.
3. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
4. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
5. Division 1 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
6. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "General Conditions."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Architect and Construction Manager.
d. Name of Contractor.
e. Page number.

1.6 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Submit three copies of each warranty. Additional copies of the each warranty to be include in operation and maintenance manuals. Refer to Section 01782; Operation & Maintenance Data for additional requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   g. Sweep concrete floors broom clean in unoccupied spaces.
   h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
   i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
   j. Remove labels that are not permanent.
   k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Replace parts subject to unusual operating conditions.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean ducts, blowers, and coils if units were operated without filters during construction.
q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
r. Leave Project clean and ready for occupancy.

C. The Contractor shall finish, burnish, seal, wax, etc. all installed finishes per the recommendations/specifications of each material manufacturer.

D. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

E. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01770

SECTION 01781 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Sections include the following:

1. Division 1 Section "Closeout Procedures" for general closeout procedures.
2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 2 through 16 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up Record Prints.

    1) Electronic Media: Digital "Thumb" Drive(s).

B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one copy of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an understandable drawing technique.
   c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following District's and/or Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings, whichever is most capable of showing actual physical conditions, completely and accurately.
4. Mark record sets with revisions in red. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Transparencies: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Inspector-of-Record, Architect and Construction Manager. When authorized, prepare a full set of corrected transparencies of the Contract Drawings and Shop Drawings.

1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.

2. Refer instances of uncertainty to Architect through Construction Manager for resolution.
3. Owner will furnish Contractor one set of transparencies of the Contract Drawings for use in recording information.
4. Print the Contract Drawings and Shop Drawings for use as Record Transparencies. Architect will make the Contract Drawings available to Contractor's print shop.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

1. Construction Manager and Inspector-of-Record to review on a weekly basis.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's and Construction Manager's reference during normal working hours.

END OF SECTION 01781

SECTION 01782 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.

B. Related Sections include the following:

1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.
3. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
4. Divisions 2 through 16 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Submit three copies of each manual in final form at least 14 days before final inspection. Architect will return copy with comments within 14 days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit three copies of each corrected manual within 14 days of receipt of Architect's comments.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
6. **Provide all data in PDF format on a CD (compact disk) to be included in each binder.**

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."

G. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01782

SECTION 01820 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training videos.

B. Related Sections include the following:

1. Division 1 Section "Project Management and Coordination" for requirements for preinstruction conferences.
2. Divisions 2 through 16 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 SUBMITTALS

A. Instruction Program: Submit three copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. At completion of training, submit three complete training manual(s) for Owner's use.

B. Demonstration and Training Materials: Submit three copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of photographer.
c. Name of Architect and Construction Manager.
d. Name of Contractor.
e. Date video was recorded.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

2. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video. Include name of Project and date of video on each page.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

1. Motorized doors.
2. Equipment.
3. Fire-protection systems.
4. Intrusion detection systems.
5. HVAC systems.
6. HVAC instrumentation and controls.
7. Electrical service and distribution systems.
8. Lighting equipment and controls.
9. Communication systems.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

2. Documentation: Review the following items in detail:

   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project Record Documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Construction Manager, with at least 14 days advance notice.

3.3 DEMONSTRATION AND TRAINING MATERIALS

A. General: Engage a qualified commercial photographer to record demonstration and training videos. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video Format: Provide Digital "Thumb" Drive(s).

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

D. Narration: Describe scenes on video by audio narration by microphone while, or dubbing audio narration off-site after video is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

E. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from video opposite the corresponding narration segment.

END OF SECTION 01820

SECTION 02066 - EMULSION-AGGREGATE SLURRY SEAL

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of the General and Supplementary Conditions and Division 01 apply to this section.

B. Section Includes:

1. Asphalt emulsion slurry seal over existing asphalt paved surfaces.

C. Related Sections:

1. Section 02741 Hot-Mix Asphalt Paving.

1.02 REFERENCES

A. Standard Specifications for Public Works Construction (S.S.P.W.C.), 2003 Edition "Green Book"

B. The Asphalt Handbook, Manual Series No. 4 (MS-4) 1989 Edition, Asphalt Institute.

C. ASTM D 3910 "Standard Practices for Design, Testing and Construction of Slurry Seal"

1.03 SUBMITTALS

A. Product Data: Contractor shall follow the mix design requirements stated in the Green Book, Section 203-5.4(A) and submit to the Civil Engineer for approval prior to installation.

1.04 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, 2003 Edition "Green Book", Section 203-5 "Emulsion-Aggregate Slurry."

D. Obtain materials from same source throughout.

E. Schedule a pre-construction conference at jobsite in advance of beginning of Work.

F. Review and resolve conflicts involving requirements of specifications. Record discussions and furnish copies to all attendees.

G. Beginning of Work means Contractor accepts all conditions.

1.05 REGULATORY REQUIREMENTS

A. Comply with local air quality management district regulations for emissions maximums.

B. Maintain control of vehicular and pedestrian traffic during paving operations as required for other construction activities and in accordance with local traffic authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Slurry Seal: Provide the following material grades in accordance with Section 203-5 – Emulsion-Aggregate Slurry of the Standard Specification for Public Works Construction, 2003 edition.

1. Asphalt emulsion shall be a cationic quick-setting type conforming to the requirements for CQS-1H grade under the Standard Specifications for Public Works Construction, "Greenbook" 2003 Edition, Quick Set Emulsion, per section 203-5.2.

2. Water shall be potable, free of harmful salts and shall be of such quality that the asphalt will not separate from the emulsion before the slurry seal is in place in the work.

3. Aggregate shall consist of sound, durable, crushed stone or crushed gravel and approved mineral filler. The material shall be free from vegetable matter and other deleterious substances. Aggregates shall be 100% crushed with no rounded particles. The percentage composition by weight of the aggregate shall conform to the Standard Specifications for Public Works Construction, "Greenbook" 2003 Edition, **Type I**, per section 203-5.3.

The aggregate shall also conform to the following quality requirements:

TESTS	CALIF. TEST	ASTM TEST	REQUIREMENTS
Sand Equivalent	217	D2419	55 Min.

PART 3 - EXECUTION

3.01 REPAIRING AND ASPHALT CONCRETE SLURRY OF EXISTING SURFACES

A. Preparation of Surfaces:

1. Before placing the slurry seal, the pavement surface shall be cleaned by sweeping, flushing or other means necessary to removal all loose particles of paving, all dirt, and all other extraneous material. This shall include vegetation in pavement cracks and between pavement and curb/gutter. Prior to removal an approved herbicide, which leaves behind a visible blue marker dye, shall be

sprayed where vegetation exists. Surface contaminates, grease or oil spots shall be cleaned to allow for proper adhesion.

2. Sandblast existing painted lines and remove entirely.

3. Immediately before commencing the slurry seal operations, all surface metal utility covers (including survey monuments) shall be protected by thoroughly covering the surface with an appropriate adhesive and oiled or plastic paper. No adhesive material shall be permitted to cover, seal or fill the joint between the frame and cover of the structure. A vertical tab shall be placed on each cover for locating after the seal application is complete. The tab shall extend at least 3" above the existing pavement surface. Covers are to be uncovered and cleaned of slurry material by the end of the same work. Inspector shall inspect surfaces before the installation of slurry seal.

4. Dampen surface to receive slurry seal with a light application of water to ensure coverage and proper bond but with no free water in front of the slurry machine .

5. Install barricades as required to divert traffic from operations. Install temporary "no parking" signs and similar notices.

B. Repair of Existing Surfacing: Cracks more than 1/4 inch wide, low areas, holes or depressions in existing surfacing shall be repaired or filled prior to the installation of slurry seal.

C. Tack Coat: Normally, a tack coat is not required unless the surface to be covered is extremely dry and raveled, or is concrete or brick. If required, the tack coat should consist of one part emulsified asphalt/three parts water. The emulsified asphalt should be the same as used in the mix. The distributor shall be capable of applying the dilution evenly at a rate of 0.05 to 0.10 gal/yd2. The tack coat shall be allowed to cure before application of the slurry seal.

D. Emulsion-Aggregate Slurry: Work shall be performed in accordance to Sub-section 302-4, Emulsion-Aggregate Slurry, of the Standard Specifications for Public Works Construction, 2003 edition except as noted herein.

1. The slurry seal shall not be placed if either the pavement or the air temperature is below 55 degrees F and falling, but may be applied when both the air and pavement temperature is 45 degrees F or above and rising. The mixture shall not be applied if high relative humidity prolongs the curing beyond a reasonable time

2. Hand tools shall be available in order to remove spillage. Ridges or bumps in the finished surface will not be permitted. The mixture shall be uniform and homogeneous after spreading on the surface and shall not show separation of the emulsion and aggregate after setting.

3. Areas which cannot be reached with slurry seal machines shall be surfaced using hand squeegees to provide complete and uniform coverage. The area to be handworked shall be lightly dampened prior to mix placement and the slurry worked immediately.

Care shall be exercised to leave no unsightly appearance from handwork. The same type finish as applied by the spreader box shall be required. Handwork shall be completed during the machine applying process.

E. Rolling:

1. Roll slurry surfacing with a 10-ton pneumatic roller with a tire pressure of 50 psi and equipped with a water spray system. Roll as soon as the surfacing is sufficiently cured and will not pick up on tires of roller. Surfaced areas shall receive a minimum of 2 coverage passes by roller. Provide a smooth surface free from ridges or surface variations.

2. Depressions occurring in cracks after initial slurry seal installation shall be filled with sand slurry before rolling and seal coat installation.

3.02 TRAFFIC CONTROL

A. A newly placed slurry should not be opened to ANY traffic until it has completely cured, normally about 48 hours. Adequate means shall be provided to protect the slurry seal from damage from traffic until such time that the mixture has cured sufficiently so that the slurry seal will not adhere to and be picked up by the tires of the vehicles.

3.03 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

B. One (1) week after the initial installation the contractor will come back and sweep up any sands and fines that have appeared during the course of the week. The contractor shall use power broom machinery and hand brooms to accomplish task.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION 02066

SECTION 02210 - LANDSCAPE FINISH GRADING

1.00 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, appliances and necessary incidentals for the complete installation of all landscape finish grading as shown on the drawings and as specified herein.

1. Preliminary Grading: Grades in all planting areas will be established to within ∀1/10 foot by others prior to beginning of landscape construction.

2. Weeding: Before and during finish grading, all weeds and grasses shall be dug out by the root and disposed of off the site.

3. Finish Grading: Finish grading shall consist of finishing surfaces by raking smoothly and evenly, removing and disposal of all extraneous matter to facilitate natural run-off water. All extraneous matter shall be disposed of off the site.

4. Moisture Content: The soil shall not be worked when the moisture content is so great that excessive compaction will occur; nor when it is so dry that a dust will form in the air or that clods will not break readily. Water shall be applied, if necessary, to provide ideal moisture content for tilling and for planting herein specified.

1.02 RELATED WORK IN OTHER SECTIONS

A. Landscape irrigation

B. Landscape planting

1.03 JOB CONDITIONS

A. Verification of existing conditions

1. Visit the site to determine existing conditions, including access to the site and the nature and extent of existing improvements upon adjacent public and private property, nature of materials to be encountered and other factors that may affect the work of this section.

2. Additional compensation resulting from the alleged ignorance of local conditions, and their effect upon the cost of the work will not subsequently be approved.

B. Protection:

1. Protect the Owner's property from injury or loss. All damage to existing property (buildings, utilities, etc.) or planting (trees, shrubs, lawn or ground cover) caused by the Contractor during his operation or as a result of malfunction of installed work during the warranty period shall be repaired at contractor's expense.

2. Cause minimum interference with workers, materials, or other equipment of other trades on the project.

2.00 PRODUCTS

NO MATERIALS ARE REQUIRED OF THIS SECTION.

3.00 EXECUTION

3.01 SURFACE CONDITION

A. Observation

1. Prior to commencing work required by this section, observe the work of other trades and verify that such work has been properly completed and installed to allow for proper installation of all materials and methods required of this section.

2. All landscape finish grading shall be installed in accordance with the requirements of all governing authorities, the original design, and the referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Landscape Architect.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 PERFORMANCE

A. Finish Grading

1. General: When preliminary grading and weeding has been completed and the soil has dried sufficiently to be readily worked, all lawn and planting areas shall be graded to the elevations indicated on the drawings. Grades not otherwise indicated shall be uniform levels or slopes between points where elevations are given. Minor adjustments of finish grades shall be made at the direction of the Landscape Architect if required. Finish grade shall be smooth, even, and uniform plane with no abrupt change of surface. Soil areas adjacent to building shall slope away from the buildings to allow a natural run-off of water, and surface drainage shall be directed as indicated on the drawings by remodeling surfaces to facilitate the natural run-off water. Low spots and pockets shall be graded to drain properly.

2. Shrubs And Ground Cover: The finish grade of all shrubbery and ground cover areas shall be 1-1/2 in. below the grade of adjacent pavement, walks, curbs, or headers and 3 in. below adjacent walls. An exception to the above requirements shall be made wherever drainage conditions may require flush grades as directed by the Landscape Architect.

3. Lawn Areas: The finish grade of all lawn areas shall be 1-1/2 in. below the grade of adjacent pavement walks, curbs, or headers. An exception to the above requirements shall be made wherever drainage conditions may require flush grades as directed by the Landscape Architect.

4. Drainage: Contractor is to finish grade with proper slope to drains. All flow lines, designated or not, shall be graded and maintained to allow free flow of surface water, and shall conform to the intent of all plans and sections after thorough settlement and compactment of the soil.

B. Observations

1. All observations herein specified shall be made by the Landscape Architect. Request observations at least twenty-four hours in advance of the time observation is desired. Observation is required as follows:

   a. When finish grading is completed.

2. No observations will commence without an as-built drawing. In the event the Contractor calls for an observation without as-built drawings, without completing previously noted corrections, or without preparing the work for observation, he shall be responsible for reimbursing the Landscape Architect at the rate of two and one-half times the normal office hourly rate per hour portal to portal (plus transportation costs) for the inconvenience no further observation will be scheduled until this charge has been paid.

END OF SECTION

SECTION 02221 - BUILDING DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of buildings and structures.
2. Demolition and removal of site improvements adjacent to a building or structure to be demolished.
3. Disconnecting, capping or sealing, and removing site utilities.

B. Related Sections include the following:

1. Division 1 Section "General Conditions" for use of the premises and phasing requirements.
2. Division 1 Section "Selective Demolition" for partial demolition of buildings, structures, and site improvements.
3. Division 2 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of building demolition.
4. Division 15 Sections for demolishing or relocating site mechanical items.
5. Division 16 Sections for demolishing or relocating site electrical items.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or recycled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or recycled.

1.4 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be encountered during building demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1.5 SUBMITTALS

A. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
2. Interruption of utility services.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Locations of temporary protection.
5. Coordination of Owner's continuing occupancy of adjacent buildings and partial use of premises.

B. Inventory: After building demolition is complete, submit a list of items that have been removed and salvaged.

C. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by building demolition operations. Submit before Work begins.

D. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Standards: Comply with ANSI A10.6 and NFPA 241.

E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of Work.

B. Owner will occupy another building immediately adjacent to demolition area. Conduct building demolition so Owner's operations will not be disrupted.

1. Provide not less than fourteen (14) days notice to Owner of activities that will affect Owner's operations.
2. Maintain access to existing walkways, exits, and other adjacent occupied or used facilities.

    a. Do not close or obstruct walkways, exits, or other occupied or used facilities without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for buildings and structures to be demolished.

D. Storage or sale of removed items or materials on-site is not permitted.

1.8 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS (Not Used)

2.1 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Division 2 Section "Earthwork."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Survey existing conditions and correlate with requirements indicated to determine extent of building demolition required.

B. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are the same as those indicated in Project Record Documents.

C. When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to Construction Manager and Architect.

3.2 PREPARATION

A. Refrigerant: Remove and store refrigerant according to 40 CFR 82 and regulations of authorities having jurisdiction.

B. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.

1. Construction Manager will arrange to shut off indicated utilities when requested in writing by Contractor, a minimum of fourteen (14) days, prior.
2. Arrange to shut off indicated utilities with utility companies.
3. If utility services are required to be removed, relocated, or abandoned, before proceeding with building demolition provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
4. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

C. Existing Utilities: Refer to Division 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

1. Remove and recycle refrigerant from air-conditioning equipment before starting demolition.

D. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

E. Removed and Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site designated by Owner.
5. Protect items from damage during transport and storage.

3.3 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during demolition and cleaned and reinstalled in their original locations after demolition operations are complete.

C. Existing Utilities: Maintain utility services indicated to remain and protect them against damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.

D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated.

1. Protect existing site improvements, appurtenances, and landscaping to remain.
2. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
4. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
5. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
6. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise from occupied portions of adjacent buildings.

3.4 DEMOLITION, GENERAL

A. General: Demolish indicated existing buildings and structures and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
2. Maintain adequate ventilation when using cutting torches.
3. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Engineering Surveys: Engage a professional engineer to survey unknown conditions of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

1. Subsidence monitoring of the remaining building structure as demolition proceeds, shall be monitored / performed by a registered surveyor on a weekly basis.

C. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

1. Surveys of the remaining building structure as demolition proceeds, shall be performed by a registered surveyor on a weekly basis.

D. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

3.5 MECHANICAL DEMOLITION

A. Remove buildings and structures and site improvements intact when permitted by authorities having jurisdiction.

B. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

C. Remove debris from elevated portions by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact or dust generation.

D. Concrete: Cut concrete full depth at junctures with construction indicated to remain, using power-driven saw, then remove concrete between saw cuts.

E. Masonry: Cut masonry at junctures with construction indicated to remain, using power-driven saw, then remove masonry between saw cuts.

F. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished at junctures with construction indicated to remain, then break up and remove.

G. Structural Steel: Dismantle field connections without bending or damaging steel members. Do not use flame-cutting torches unless otherwise authorized by Construction Manager and authorities having jurisdiction.

H. Below-Grade Construction: Abandon foundation walls and other below-grade construction. Cut below-grade construction flush with grade.

I. Below-Grade Construction: Demolish foundation walls and other below-grade construction that is within 10 feet outside of footprint indicated for new construction. Abandon below-grade construction outside this area.

1. Remove below-grade construction, including basements, foundation walls, and footings, completely to at least 12 inches below grade.

J. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

1. Piping: Disconnect piping at unions, flanges, valves, or fittings.
2. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

3.6 EXPLOSIVE DEMOLITION

A. Explosives: Use of explosives is not permitted.

3.7 SITE RESTORATION

A. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

B. Provide new landscaping and irrigation per Drawings.

3.8 REPAIRS

A. General: Promptly repair damage to adjacent construction caused by building demolition operations.

B. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

C. Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

3.10 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

END OF SECTION 02221

SECTION 02230 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Protecting existing trees and shrubs to remain.
2. Removing existing groundcovers and grass.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and abandoning site utilities in place.
7. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:

1. Division 1 Section "General Conditions" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities.
2. Division 1 Section "Selective Demolition" for partial demolition of buildings or structures undergoing alterations.
3. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings; according to Division 1 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction and the specific to the site, that complies with requirements of authorities having jurisdiction, whichever is more stringent.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within fenced area.
2. Do not permit vehicles, equipment, or foot traffic within fenced area.
3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

1. Trade Contractor to replace trees that cannot be repaired and restored to full-growth status, as determined by District's Construction Manager.

3.4 UTILITIES

A. District's Construction Manager will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. When notified in writing by the Contractor, the Construction Manager will arrange to shut off indicated services/systems when requested by Contractor.

a. Contractor to notify Construction Manager a minimum of fourteen (14) days prior.

2. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.

2. District's Construction Manager will arrange to shut off indicated utilities when requested by Contractor.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify District's Construction Manager not less than 72 hours in advance of proposed utility interruptions.

D. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
4. Use only hand methods for grubbing within tree protection zone.
5. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within tree protection zones.
3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above and below grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated and as required for new work shown.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 02230

SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for walks, pavements, lawns and grasses and exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Subsurface drainage backfill for walls and trenches.
5. Excavating and backfilling for utility trenches.
6. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
2. Division 2 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping, topsoil, and removal of above- and below-grade improvements and utilities.
3. Division 3 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
4. Divisions 2, 15, and 16 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,090 lbf (125 kN) and stick-crowd force of not less than 18,650 lbf (83 kN); measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp (157-kW) flywheel power and developing a minimum of 48,510-lbf (216-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.

I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by an independent geotechnical testing agency, according to ASTM D 1586.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. Sub-base Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

L. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below sub-base, drainage fill, or topsoil materials.

M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Each type of plastic warning tape.
2. Geotextile.
3. Controlled low-strength material, including design mixture.
4. Geofoam.

B. Samples: 12-by-12-inch Sample of sub-drainage geotextile.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.

D. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

B. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by College Maintenance & Operations Department and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify College, in writing, Construction Manager and Maintenance & Operations Department not less than fourteen (14) days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Maintenance & Operation's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater

than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf ; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf ; ASTM D 4632.
4. Tear Strength: 56 lbf ; ASTM D 4533.
5. Puncture Strength: 56 lbf ; ASTM D 4833.
6. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.5 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing," during earthwork operations.

D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system[, specified in Division 2 Section "Dewatering,"] to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches outside of concrete forms other than at footings.
b. 12 inches outside of concrete forms at footings.
c. 6 inches outside of minimum required dimensions of concrete cast against grade.
d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
e. 6 inches beneath bottom of concrete slabs on grade.
f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

   a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

   a. 24 inches outside of concrete forms other than at footings.
   b. 12 inches outside of concrete forms at footings.
   c. 6 inches outside of minimum required dimensions of concrete cast against grade.
   d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
   e. 6 inches beneath bottom of concrete slabs on grade.
   f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

A. Notify the Geotechnical Engineer of Record when excavations have reached required subgrade.

B. If the Geotechnical Engineer of Record determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section "Cast-in-Place Concrete."

D. Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

G. Place and compact final backfill of satisfactory soil to final subgrade elevation.

H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot (3-m) straightedge.

3.17 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Division 2 Section "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
2. Place and compact impervious fill over drainage backfill in 6-inch-thick compacted layers to final subgrade.

3.18 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase and base course to required crown elevations and cross-slope grades.
4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.19 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

B. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02300

SECTION 02515 - MASONRY PAVING

PART 1 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. Brick pavers
2. Setting materials and grout
3. Sand bed and geotextile fabric
4. Sealants
5. Sealer

B. Related work:

1. Concrete Paving
2. Sealer on other brick and materials
3. Sealants other than for pavers

1.02 SUBMITTALS

A. Procedure: In compliance with Section 01330

B. Samples: Submit samples of pavers, showing the full color rang to be expected on the Project and manufacturer's data on the sealer.

1.03 QUALITY ASSURANCE

A. Sample panel:

1. Following approval of samples submitted, construct a 4' square sample at the job site, in the pattern and in the location directed by the Architect. Seal one half of the panel; identify the coated side.
2. Modify, or replace sample panel when the first one is not satisfactory to the Architect.
3. Approved panel shall remain in place until its removal is directed or its incorporation in the Work is authorized by the Architect. Retain on the job as a standard reference for materials, workmanship and appearance until removal is authorized.

1.04 HANDLING

A. Procedure: In compliance with Section 01700.

B. Storage

1. Stack brick above ground on level platform and in a dry location. Protect from spoilage.

2. Store cementitious and reinforcing materials off the floor or ground, under cover in a dry location.

PART 2 PRODUCTS

2.01 MATERIALS

A. Brick: To be selected

B. Mortar and grout materials:

1. Portland cement: ASTM C150, Type I or II

2. Hydrated lime: ASTM C 207, Type S

3. Sand for job-mixed grout: ASTM Cl44

4. Aggregate for mortar bed: ASTM C144

5. Water: Potable, fresh

6. Setting bed reinforcement: 2 x 2 x 16 x 16 galvanized wire fabric complying with ASTM A 185.

7. Coloring pigments for job-mixed grout: Non-fading, non-reactive, chemically inert standard commercial brand pigments in the color and quantity required to obtain a mortar color acceptable to the Architect.

8. Admixtures: Do not use admixture unless authorized by the Architect.

9. Pre-mixed grout: By Mapei, Bostick, Bonsal or HB Fuller Co., colors as selected by the Architect from the manufacturer's palette.

C. Sand setting bed: Clean washed concrete sand passing a No. 4 sieve size and a maximum of 3% passing a No. 200 sieve. Do not use mason sand and stone screenings.

D. Geotextile fabric: Mirafi 700X by Mirafi Inc., or equal.

E. Sealant: As specified in Section 07920.

F. Brick masonry cleaner: Sure Klean No. 600 detergent by ProSoCo., Inc., or equal.

G. Sealer: Stand-Off by ProSoCo.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify conditions and measurements affecting the work of this Section at site. Make sure that detrimental conditions are corrected before proceeding with installation.

B. Verify that concrete is clean, free of oil, grease, paint, curing compound and other contaminants, flat within 1/4 in. per 10 feet, or sloped to drainage fittings as indicated.

3.02 GENERAL

C. Install proprietary materials in compliance with their manufacturer's printed instructions.

D. Maintain temperature limits and installation practices recommended by grout manufacturer when using pre-mixed grout.

E. Terminate work neatly at obstructions edges and corners without disruption of pattern or joint alignment.

F. Layout work and center pavers so that perimeter units are of equal size. Adjust pavers to minimize cutting and provide uniform joints. Use plastic spacers to maintain uniform joint width.

G. Do not use bricks with chips, cracks, voids, discolorations and other defects which might be visible or cause staining in the finished work.

H. Cut bricks with motor-driven saw designed to cu masonry with clean, sharp, unchipped edges, as required to provide pattern shown and to fit adjoining work neatly. Use full size bricks without cutting wherever possible.

3.03 SETTING BRICK PAVERS IN MORTAR

A. Mix setting bed mix in the proportion of one part portland cement, 6 parts sand by volume to which 1/10 part lime maximum may be added.

B. Spread and screed setting bed to a uniform thickness, except for minor variations required to produce a true surface, level in plane or uniformly sloped for drainage as indicated.

1. Setting bed shall be a minimum of 3/4 in. to a maximum of 1 1/4 in. thick.

2. Place reinforcement in center of setting bed where shown.

C. Wet bricks to reduce suction. The amount of wetting will depend on the rate of absorption of the brick at time of laying.

1. When being laid, the brick shall have sufficient suction to hold the mortar and still be sufficiently damp so that the mortar will remain plastic enough to permit the brick to be leveled after being laid without breaking the mortar bond.

2. Do not lay brick with free water on the surface.

D. Apply a thin layer of neat cement paste by brushing or troweling over setting bed, or apply to bottom of brick.

E. Tamp and beat brick for full contact with setting bed. Set and level each brick as it is laid. Do not set large areas of brick and later level.

F. Set brick with uniform joints 3/8 in. wide unless otherwise indicated.

G. Grouting joints

1. At the Contractor's option, the pre-mixed grout or a job-mixed grout, consisting of 1 part portland cement to 2 parts graded sand and coloring pigments, may be used if a uniform color acceptable to the Architect can be obtained.

2. Grout joints as soon as possible after initial set of setting bed. Force grout into joints and toll slightly concave.

3. Remove grout spillage promptly from face of brick as work progresses.

3.04 SETTING BRICK PAVERS ON SAND SETTING BED

A. Install geotextile material at locations where sand base is not secured at the perimeter to prevent sand base from dissipating.

B. Spread damp sand bed, vibrate and screed to a uniform thickness.

C. Start paving installation from a corner or straight edge and proceed forward over the undisturbed sand bed.

D. Where required, cut pavers to fit with a masonry saw to obtain clean, straight, sharp, unbroken edges.

E. Pavers

1. Blend pavers by using units alternatively from a minimum of 3 pallets in any one area, working from top to bottom of each pallet stack.

2. Install hand tight and level on the undisturbed sand laying course. Use string line to hold pattern lines.

3. Spread plaster sand over the installed pavers, then use a roller or plate vibrator to compact the pavers and to vibrate the sand into the joints between the pavers.

4. Sweep excess sand into the joints or dispose of.

3.05 TOLERANCES

A. Tolerances for completed paver work shall not exceed the following:

1. 1/8 in. in 2 ft. and 1/4 in. in 10 ft. from level or slope indicated.

2. Lippage between adjacent brick shall not exceed 1/16 in.

B. Completed paving shall properly coincide and align with adjacent work.

3.06 CONTROL JOINTS

A. Provide control joints in brick pavers at locations indicated on drawings.

1. Insert preformed joint filler or backup material in joints at proper depth to allow the correct cavity depth for the sealant.

2. The joint width shall be the same as mortar joint.

3. Keep control joints open and clean by stuffing with polypropylene rope or other material to prevent filling with dirt, grout or mortar.

4. After brick is grouted and completely dry, remove temporary filler; clean joins with compressed air and fill joints with the specified backup material and sealant as specified.

5. Sand the sealant after tooling to match grouted joints; remove loose sand when sealant has cured.

3.07 CLEANING/CURING

A. Promptly clean pavers as work progresses. Do not leave grout to dry on brick faces; use the specified cleaner on stubborn stains.

B. Curing

1. After cleaning, damp cure pavers. Keep traffic off floors during the curing period.

2. Seal impermeable covers such as polyethylene or waterproof paper over each stage of the work as it is completed.

3. Check conditions daily, and if drying, wet with fog spray and maintain in damp condition.

C. Remove and replace pavers which are loose, chipped, broken, stained or otherwise damaged, or if pavers do not match adjoining units. Provide new units to match adjoining pavers and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

D. After pavers have been cleaned, dried and grout joints cured, apply sealer in compliance with its manufacturer printed instructions leaving no bare spots or sealer residue.

E. When the installation is completed, conduct a water test to verify that all pavers have been sealed (as evidenced by darker color where water is absorbed), then wash the paving clean.

END OF SECTION

SECTION 02630 – STORM DRAINAGE

1.1 GENERAL

A. Section Includes: drain inlets & basins, grates and frames, and storm drainage pipes located outside the building perimeter.

B. Submittals:
   1. Product Data: Manufacturer's catalog data for all required materials. Include technical data for pipe, drains, concrete catch basins, grates, drainage fabric, information concerning gaskets, joints and couplings.
   2. Certificates: Certificates attesting that tests set forth in referenced publication have been performed and the results required by design have been met.

C. Trenching Requirements: Conform to the requirements of Section 02300 – Earthwork.

1.2 QUALITY ASSURANCE

A. The "Standard Specifications for Public Works Construction" or "Greenbook Standards" and the "Standard Plans for Public Works Construction", latest edition, which are written and promulgated by the Joint Cooperative Committee of the Southern California Chapter American Public Works Association and Southern California Districts Associated General Contractors of California. Copies of these documents may be obtained at the BNI Building News, 1612 S. Clementine Street, Anaheim, CA. 92802, phone 1-888-264-7483 or available on the internet at: http://www.bnibooks.com/.

1.3 GUARANTEES (Also see Division I)

A. The Contractor shall guaranty the work against defective material or workmanship for a period of one (1) year from the date of completion of the contract and/or acceptance for the work by the School District. Damage due to acts of God or from sabotage and/or vandalism is specifically exempted from the guaranty. When defective material and/or workmanship are discovered which require repairs to be made under this guaranty, all such work shall be done by the Contractor at his own expense and shall being within five (5) working days after written notice of such defects has been given to him/her by the School District. Should the Contractor fail repair such defective material or workmanship within five (5) working days thereafter, the School District may cause the necessary repairs to be made and charge the Contractor with the actual cost of all labor and materials required.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship and shall not be less than one (1) year. See specific equipment specifications for extended warranty requirements.

1.4 PRODUCTS

A. Piping Materials

1. Where noted on Construction Documents install Poly Vinyl Chloride (PVC) Plastic Pipe, Schedule 80, meeting ASTM D 1785 standards. Fittings shall conform to ASTM D 2467 "Socket-Type PVC Plastic Type Fittings, Schedule 80.
   a. Pipe Joints shall be solvent cement joints conforming to ASTM D 2564, primer according to ASTM F 656.

2. Where noted on Construction Documents install cast iron soil, hubless, with stainless steel-banded hubless couplings. No-hub cast iron soil pipe and fittings shall conform to ASTM A 888 and/or standard specifications 301 of the Cast Iron Soil Pipe Institute. No-hub joints shall conform to specification 310 of the Cast Iron Soil Pipe Institute and/or ASTM C 1277. Joints shall be installed according to manufacturer's recommendations. Manufactured by American Foundry, Tyler, or equal.

3. Perforated Polyvinyl Chloride Pipe: ASTM D 2729 or as described on Construction Documents.

B. Pre-cast Concrete Catch Basins: Contact Brooks Products, Inc. 1850 Parco Avenue, Ontario, CA. 91761. Phone: (909) 947-7470, Toll Free: (888) 307-7470, Fax: (909) 947-7741.

C. Concrete, Mortar and Related Materials: Conform to Section 02520 Portland Cement Concrete.

D. Manhole Brick Mortar, Grout, and Plaster: Conform to Standard Specifications for Public Works Construction, Section 202 - Masonry Materials.

E. Steel Reinforcing Bars: ASTM A 615 deformed grade 40 billet steel, plain finish, unless otherwise specified on Construction Document.

F. Trench Drain Grates & Frames: Contact Alhambra Foundry Company, 1147 Meridian Avenue, Alhambra, CA. 91802. Phone: (626) 289-4294, Fax: (626) 289-3078.

G. Catch Basin Grates and Frames: Vandal-proof design. Maximum spacing between grating bars in accessible path of travel is 1/2 inch in the direction of travel, or 1/2 inch in either direction when the path of travel is not limited to one direction.

H. Filter Fabric: Manufacturer's standard nonwoven pervious geotextile fabric of polypropylene geotextiles, "Mirafi 140N" or approved equal.
   1. Provide filter fabric that meets or exceeds the listed minimum physical properties determined according to ASTM D 4759 and the referenced standard test method in parentheses:
      a. Grab Tensile Strength (ASTM D 4632): 100 lb.
      b. Apparent Opening Size (ASTM D 4751): #70 U.S. Standard sieve.
      c. Permeability (ASTM D 4491): 135 gallons per minute per sq. ft.

J. Paint and Protective Coatings

2. All storm drain hardware, including manhole frames and covers, grates, protection bars, steps, etc., shall be protected from corrosion. Storm drain hardware made of cast iron shall be protected by painting with, or dipping in, a commercial grade asphalt paint. Storm drain hardware made of steel shall be galvanized.

2. Hot-dip galvanize steel parts after fabrication and before installation, in accordance with Section 210 - Paint and Protective Coating of the Standard Specifications for Public Works Construction.

1.5 EXECUTION

A. Install pipeline in a practical alignment and uniform slope to the point of connection as indicated on Construction Document. **Prior to trench excavation, verify size, material, depth, and location of the point of connection.** Notify Civil Engineer if point of connection elevation is different then that shown on construction drawing as it may affect the design of the system.

B. Excavating, trenching, and backfilling are specified in Section 02300: Earthwork.

C. All storm drain pipelines shall be staked by a licensed surveyor when slope of grade is less than 2% and a complete set of cut sheets shall be supplied to the Inspector. All construction staking shall be installed and verified for grade and alignment prior to the start of construction.

D. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

E. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

F. Refer to ASTM D 2321-00 "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications" or Uni-Bell PVC Pipe Association UNI-PUB-6 "Installation Guide for PVC Solid-Wall Sewer Pipe" for installation information on SDR-35 pipe.

G. For cast iron pipe underground installation procedures, contractor shall follow the Cast Iron Soil Pipe Institute (CISPI'S), "Chapter 4 – Installation of Cast Iron Soil Pipe & Fittings."

H. Pipe Joint Construction and Installation: Join and install pipe and fittings according to installations indicated.

1. Thermoplastic Drain Pipe and Fittings: As follows:

a. See ASTM D 3212, "Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals".

b. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.

c. Install according to ASTM D 2321.

2. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

I. Concrete Placement: Place cast-in-place concrete according to ACI 318 and ACI 350R.

J. Make connections to existing piping and underground structures so finished work complies as nearly as practical with requirements specified for new work.

K. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

1.6 FIELD INSPECTION FOR PLASTIC PIPE & FITTINGS

A. Inspect interior of storm drain piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place with the use of closed circuit television (cctv), and again at completion of Project. The final video inspection shall be performed after the successful completion of the air or water pressure test and mandrel test and prior to the certificate of occupancy by the School District for the new building. All mains and sewer laterals shall be video inspected. The Contractor shall give the District Inspector a minimum of 48 hours notice prior to this video inspection. A video tape of the inspected pipeline shall be delivered to the District Inspector for approval.

1. Defects requiring correction include the following:
a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Crushed, broken, cracked, or otherwise damaged piping.
c. Infiltration: Water leakage into piping.
d. Exfiltration: Water leakage from or around piping.

2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
3. Re-inspect and repeat procedure until results are satisfactory.

B. Deflection Test: All flexible and semi-rigid storm drain pipe shall be tested in accordance with S.S.P.W.C. Sections 306-1.2.12 and 306-1.2.13 for deflection, joint displacement, or any other obstruction by passing a rigid mandrel through the pipe by hand, not less than 30 days after completion of the trench backfill, but prior to permanent resurfacing. The mandrel shall be a full circle, solid cylinder, or a rigid, non-adjustable, odd-numbered leg (9 leg minimum) steel cylinder, accepted by the ENGINEER as to design and manufacture. The circular cross section of the mandrel shall have a diameter of at least 95 percent of the specified average inside diameter of the pipe and the minimum length of the circular portion of the mandrel shall be equal to the nominal diameter of the pipe. Obstructions encountered by the mandrel shall be corrected by the CONTRACTOR.

C. All costs incurred by the Contractor attributable to cctv, mandrel & deflection testing, including any delays, shall be borne by the Contractor at no cost to the Owner.

1.7 CLEANUP

A. All existing and new storm drain pipes shall be thoroughly cleaned after all testing has occurred. Cleaning shall be performed by the Contractor by means of an inflatable rubber ball. The ball shall be of a size that will inflate to fit snugly into the pipe to be tested. The ball shall be controlled with a tag line. The ball shall be placed in the last maintenance hole on the pipe to be cleaned, and water shall be introduced behind it. The ball shall pass through the pipe with only the pressure of the water impelling it. All debris flushed

out ahead of the ball shall be removed at the first maintenance hole where its presence is noted. In the event cement or wedged debris or a damaged pipe shall stop the ball, the Contractor shall remove the obstruction.

B. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION 02630

SECTION 02741 – HOT-MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 REQUIREMENT

A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the work as indicated in the Contract Documents and specified herein.

B. The following types of pavement shall be covered in this Section:

1. Paving for fire lane, parking areas, areas between buildings, adjacent to planting and turf areas, as indicated on Construction Documents.
2. Parking stripes, markings and accessibility symbols, as indicated on drawings in paved areas.

1.2 QUALITY ASSURANCE

A. Work of this section shall be performed in accordance with The "Standard Specifications for Public Works Construction" or "Greenbook Standards" and the "Standard Plans for Public Works Construction", latest edition, which are written and promulgated by the Joint Cooperative Committee of the Southern California Chapter American Public Works Association and Southern California Districts Associated General Contractors of California. Copies of these documents may be obtained at the BNI Building News, 1612 S. Clementine Street, Anaheim, CA. 92802, phone 1-888-264-7483 or available on the internet at: http://www.bnibooks.com/.

B. The Owner's inspector shall test the temperature of each batch of asphaltic concrete prior to placement. At the time of delivery to the work site, the temperature of mixture shall not be lower than 260 degrees F or higher than 320 degrees F, the lower limit to be approached in warm weather and the higher in cold weather. If asphaltic concrete temperature is not within these tolerances the affected batch shall be rejected. Any and all costs due to the rejected asphaltic concrete shall be the responsibility of the paving contractor.

1.3 ESTABLISHMENT OF GRADES

A. The Contractor's Surveyor will set grade stakes. The Surveyor shall be a California registered land surveyor or licensed Civil Engineer. The Surveyor shall be hired and paid by the Contractor, and shall be subject to the approval of the District. Contractor shall notify the District at least 48 hours before staking is to be started. The District will determine if work is ready for staking.

B. All work shall conform to the lines, elevations, and grades shown on the Construction Plans. Three consecutive points set on the same slope shall be used together so that any variation from a straight grade can be detected. Any such variation shall be reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.

C. Protect and maintain stakes in place until their removal is approved by the District. Grade or location stakes lost or disturbed by Contractor, shall be reset by the Surveyor at the expense of Contractor.

D. Areas having drainage gradients of 2% or more shall have elevation stakes, set with instrument, at grid intervals of 25 feet. Intermediate stakes may be set by using a tightly-drawn string line over the tops of adjacent stakes. Grade stakes must be set at all grade breaks, grade changes, etc.

E. Areas having drainage gradients of less than 2 percent shall have elevation stakes, set with instrument, at 10 foot intervals. Grade stakes must be set at all grade breaks, grade changes, etc.

1.4 SUBMITTALS

A. Mix Designs: The CONTRACTOR shall formulate a job-mix formula using the Hveem method in accordance with S.S.P.W.C. Section 203-6.2 and submit it to the ENGINEER for approval. The resultant mixture shall have Hveem properties conforming to S.S.P.W.C. Section 203-6.4.3.

B. Prior to import, Contractor shall submit written certification to the Owner's Project Manager that Crushed Miscellaneous Base (CMB) does not contain Polychlorinated biphenyls (PCB) above laboratory detection limits when tested in accordance with EPA Method 8082.

C. Crushed aggregate base (CAB) shall consist of native rock from pre-evaluated commercial source. The Contractor shall submit written documentation, which identifies the source, volume, and proposed transport date of the material for review and approval by the Owner's Project Manager prior to importing the material. A list of pre-evaluated sources is as follows:

1. Hanson Aggregates – 13550 Live Oak Avenue, Irwindale, CA. 91706, contact: Mike Gagliano (626) 358-1811.
2. Vulcan Material, Reliance Rock – 16001 Foothill Boulevard, Irwindale, CA. 91702, contact: Donna Hall (626) 856-6143 or Rick Hofmans (626) 633-4257.
3. Vulcan Materials, Durbin Rock Plant – 13000 E. Los Angeles Street, Irwindale, CA. 91705, contact: Rick Hofmans (626) 633-4257 or (626) 856-6150.

D. Samples:

1. Prior to the delivery of specified aggregate to the site, the CONTRACTOR shall submit samples of the material for the INSPECTOR's acceptance in accordance with S.S.P.W.C. Section 4-1.4. Samples shall be typical of materials to be furnished from the proposed source and in conformance with the specified requirements.

E. Certificates

1. Twenty days prior to the delivery of aggregates, asphalt materials, and paving mixes to the project site, the Contractor shall submit to the Engineer certificates and test results of compliance of such materials with these specifications.
2. Submit certificates of compliance from the supplier for bituminous materials for paint binder, asphaltic concrete, and seal coat.
3. Submit weigh master's certificates or certified delivery tickets for each truck load of asphaltic material delivered to the project site.

4. Upon completion of the weed control treatment, and as a condition for final acceptance, furnish a written certificate stating the brand name of the sterilant and the manufacturer, and that the sterilant used had at least the minimum required concentration, and that the rate and method of application complied in every respect with the conditions and standards contained herein.

1.5 QUALITY CONTROL

A. Asphaltic Concrete Producers Qualifications: Use only materials furnished by a bulk asphaltic concrete producer regularly engaged in production of hot mix, hot laid bituminous concrete.

B. Standard Specifications for Public Works Construction (S.S.P.W.C.) – Green Book, 2003 Edition with supplements.

C. Applicator Qualifications: Paving machine and roller operators shall be fully trained and experienced in the installation of asphaltic concrete paving on projects of similar size and complexity.

D. Regulatory Requirements: The quantity of volatile organic compounds (V.O.C.) used in weed killer, seal coat, primer and other materials shall not exceed the limits permitted under the current regulations of the local authorities having jurisdiction.

1.6 ENVIRONMENTAL LIMITATIONS

A. Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Tack Coats: Minimum surface temperature of 60 deg F.
2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

1.7 PAVEMENT-MARKING PAINT

A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Base Course Material: Crushed aggregate for the base course shall consist of materials that meet the Standard Specifications for Public Works Construction listed below.

1. Crushed aggregate base per Section 200-2.2, ¾" max. - this is the preferred choice.

2. Crushed miscellaneous base per Section 200-2.4, fine grade - this is the alternative choice.

B. Asphalt Surfacing Materials: Furnish asphalt surfacing for wearing surface meeting the following requirement, furnished from a commercial asphalt central mixing plant.

1. Paint Binder/Tack Coat: Asphalt emulsion shall be CSS-1 or CSS-1h and shall conform to the requirements of SSPWC Section 203-3 Emulsified Asphalt.
2. Composition & Grading:

   a. Base Course: Asphalt concrete shall conform to the Standard Specifications for Public Works Construction, 2003 Edition, Section 203-6.4.3. Use class C2-AR-4000 asphalt, with asphalt content of 4.6% to 6.0%.
   b. Wearing Course: Asphalt concrete shall conform to the Standard Specifications for Public Works Construction, 2003 Edition, Section 203-6.4.3. Use class C2-AR-4000 asphalt, with asphalt content of 4.6% to 6.0%.
   c. At least two courses shall be laid when the new AC pavement is thicker than 4 inches. <u>The top course shall be a surface course a minimum of 2" (inches) thick</u>.

3. Seal Coat: Provide one of the following surface seals:

Product Name	Manufacturer
GuardTop	Vulcan Materials Company
Over Kote	Diversified Asphalt Product
Park Top	Western Colloid Products
Sure Seal	Asphalt Coating Engineering
MasterSeal	SealMaster Pavement Products & Equipment

C. Weed Control:

1. The soils sterilant shall be in accordance with current EPA acceptable standard and the California Department of Pesticide Regulations for soils sterilant. Sterilant shall be selected as appropriate for the environment in which is it to be placed. Contractor shall be licensed with the State of California to apply sterilant. Sterilant shall be commercial grade for commercial application. Payment for soil sterilization will include full compensation for application and all materials and incidental work required.
2. Apply <u>Dow Elanco Spike 80DF</u>, or approved equal, to subgrade prior to asphalt paving at locations shown on plan. Spike 80DF weed control should be applied at the rate of seven pounds per acre. If another manufacturer is used follow their recommendations.

D. Headers and Stakes:

1. Headers: Redwood, Construction Heart Grade, size 2 x 6, unless otherwise indicated on construction drawings
2. Stakes: 2 x 4 redwood or 2 x 3 Douglas fir, Construction Grade.
3. Nails: Common, galvanized, 12d minimum.

E. Wheel Stops:

1. Precast concrete, smooth and free of pits and rock pockets, providing a minimum 28-day compressive strength of 3,500 psi. Size at least 8 inches wide, 6 inches high and 6 feet

long. Reinforce with 2-#5 reinforcing bars 24" long. Provide 2-3/4 inch diameter pre-drilled holes for anchor installation.

2. Bumper Anchors: Provide ½-inch diameter x 18-inch long galvanized steel pipe.
3. Bumper Adhesive: Provide adhesive recommended by bumper manufacturer/installer for fastening bumpers to concrete pavement.

PART 3 - EXECUTION

3.1 HEADERS

A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of adjacent undisturbed earth.

C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid grade a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header. Provide a minimum of 2-12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.

E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.

F. Provide additional stakes and anchorage as required to fasten headers in place

3.2 SUBGRADE PREPARATION

A. Subgrade Preparation: Prior to placing asphalt pavement the existing native soil must be scarified to a depth of 12 inches, watered or aerated as required, thoroughly mixed to a uniform near optimum moisture condition, and re-compacted to at least 90 percent of the ASTM D-1557 laboratory test standard. All material should be moisture conditioned and compacted by mechanical means in approximate 8-inch thick lifts. The Geotechnical Engineer should monitor the compaction of the sub grade soils and perform testing to verify that proper compaction has been obtained. Subgrade soils should exhibit a firm, unyielding surface in addition to the recommended compaction.

B. The above subgrade preparation recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. For this reason, the actual scarification or overexcavation depths will have to be determined on the basis of in-grading observations and testing performed by representatives of the project geotechnical consultant. The over-excavated materials may be moisture conditioned and re-compacted meeting engineered fill requirements in Specification 02300, Section 2.1, part G.

C. Subgrade tolerances: Subgrade for pavement shall not vary more than 0.02' from the specified grade and cross section. Subgrade for subbase or base material shall not vary more than 0.04' from the specified grade and cross section. Variations within the above specified tolerances shall be compensating so that the average grade and cross section specified are met.

D. Correct irregularities by dressing down or filling as may be required, to bring areas to true subgrade elevations.

E. Where filling is required, scarify the subgrade to bond the new material to the in place material; use additional material as required, subject to the approval of the Architect, and provided by the Contractor.

F. Remove excess material from the site to a legal disposal area.

3.3 APPLICATION GENERAL

A. Finish elevations, extent of asphalt paving and locations of type of asphalt and class of base shall be as indicated and specified herein and on the Construction Documents. Bring subgrade elevations sufficiently below the finish elevations of the paving so as to accommodate the thickness of paving and base.

3.4 STERILANT APPLICATION

A. Place herbicide below base course. Meet the applicable environmental control requirements. Apply as directed by the manufacturer's printed instructions just before application of the base course. Sterilant shall not be applied within two feet of planting areas.

3.5 APPLICATION OF BASE COURSE

A. Install base course material, encompassing spreading and compacting, in accordance with the S.S.P.W.C. Section 301-2, Untreated Base.

B. After preparing the subgrade as specified in 3.5.A, all traffic on the subgrade shall be avoided. Should it be necessary to haul over the prepared subgrade, the CONTRACTOR shall drag and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface. All cuts, ruts, and breaks in the surface of the subgrade that are not removed by the above operations shall be raked and hand tamped. All equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires.

C. Continued use of sections of prepared subgrade for hauling, so as to cut up or deform it from the true cross-section, will not be permitted. The CONTRACTOR shall protect the prepared subgrade from all traffic.

D. Maintain the surface in its finished condition until the succeeding layer is placed.

3.6 PLACING ASPHALT CONCRETE SURFACING:

A. Paint Binder/Tack Coat: A tack coat shall be applied in conformance with S.S.P.W.C. Section 302-5.4.

B. Asphalt Concrete Pavement:

1. The method of proportioning, mixing, transporting, laying, processing, rolling the material, and the standards of workmanship shall conform to the applicable requirements of S.S.P.W.C. Section 302-5 ASPHALT CONCRETE PAVEMENT. At no time shall the coarse aggregate that has segregated from the mix be scattered across the paved mat.
2. The Inspector will examine the base before the paving has begun. The Contractor will correct any deficiencies before the paving is started.
3. Asphalt concrete of the class indicated in Section 2.B.2 shall be laid in courses conforming to S.S.P.W.C. Table 302-5.5(A) unless otherwise stated herein.
4. At least two courses shall be laid when the new AC pavement is thicker than 4 inches. The top course shall be a wearing surface course a minimum of 2 inches thick.
5. Successive courses may be laid upon previously laid courses as soon as the previous course has cooled sufficiently to show no perceivable displacement under equipment or loaded material delivery trucks.
6. Wherever AC pavement does not terminate against a curb, gutter, or another pavement, the Contractor shall provide and install a redwood or pressure treated Douglas fir header at the line of termination.

3.7 FLOOD TESTING

A. Flood Test: Before seal coat is applied, a water flood test shall be done in the presence of the Inspector. The flooding shall be done by water tank truck. Depressions where the water ponds to a depth of more than 1/8-inch shall be filled or the slope corrected to provide proper drainage. The edges of the fill shall be feathered and smoothed so that the joint between the fill and the original surface is invisible.

3.8 SEAL COAT

A. Allow new asphalt to cure 30 days before application of seal coat.

B. Apply to all new asphaltic concrete paving, in accordance with Standard Specifications for Public Works Construction, Section 302-8. Apply to all existing asphaltic concrete paving where indicated, in accordance with S.S.P.W.C., Section 302-8. Dilute emulsion as directed with water not to exceed 20% of the total volume.

C. Follow manufacturers application guidelines in addition to S.S.P.W.C. Section 302-8.

D. Apply 2 coats of seal coat unless otherwise specified on construction documents.

E. Thoroughly clean surfaces to remove dirt, debris, excessive oil and grease, or other foreign matter. This is best accomplished by a power broom, power blower or by flushing with high pressure water.

F. Follow manufacturer recommended application rates.

G. Extra Materials: Provide 10 gallons in unopened containers for maintenance purposes.

H. Striping for parking or traffic flow should be done only after the second coat of seal coat has thoroughly dried.

I. Protect sealed and unsealed surfaces from damage and traffic during performance of the Work of this section and until surface seal has thoroughly set and cured. Do not permit traffic of any kind for at least 24 hours after completion of installation.

J. Protect the Work of this section until Substantial Completion.

3.9 FIELD QUALITY CONTROL

A. Replace or repair deficient and damaged asphalt paving.

B. All paving shall drain properly before being accepted. Upon completion, the pavement shall be true to grade and cross section. When a 10 foot straightedge is laid on the finished surface parallel to the centerline of the roadway, the surface shall not vary from the edge of the straightedge more than 1/8 inch, except at intersections or at changes of grade. Any areas that are not within this tolerance shall be brought to grade immediately following the initial rolling. There shall be no variation greater than 1/4 inch plus or minus from a 10 foot straight edge, except at grade changes. The paving material in the area to be repaired shall be removed, by an approved method, to provide a minimum laying depth of 1 inch, or 2 times the maximum size aggregate, whichever is greater, of the new pavement at the join line. Repairs shall not be made to pavement surface by feather-edging at the join lines. All expenses for pavement repair up shall be borne by the Contractor at NO cost to the Owner.

3.10 INSTALLATION OF PARKING BUMPERS

A. Install bumpers as indicated on the Drawings. On bituminous paving, install anchors through pavement and into the ground a minimum of 12 inches. On concrete pavement, install bumpers in a continuous bed of adhesive recommended by manufacturer.

3.11 STRIPING AND/OR PAINTING DIRECTIONS

A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 50 deg F for water-based materials, and not exceeding 95 deg F.

B. Striping for parking lots, traffic flow, and playgrounds should be done only after the sealcoat has thoroughly dried. It is recommended that a high quality water based Traffic Line Paint be used for best results

C. All stripes and markings shall be painted with two (2) coats of either:

1. W801 Vin-L-Stripe Traffic Paint, manufactured by Dunn-Edwards, www.dunnedwards.com
2. 502 Traffic Line Paint-Vinyl, manufactured by Frazee, www.frazeepaint.com.

D. Painted lines and markings on pavement at accessible parking stalls shall be 3-inch minimum wide (blue in color) equal of Color No. 15090 per Federal Standard 595B.

E. Parking spaces for persons with disabilities shall be marked according to CBC Section 1129B.5.

F. Tactile warning lines shall be in conformance to CBC Section 1133B.8.3 and 1133B.8.4.

G. Paint curb red at fire lanes.

3.12 PROTECTION

B. Protect the Work of this section until Substantial Completion.

3.13 CLEAN UP

A. Clean all debris and unused materials from the paving operation. Clean all surfaces that have been spattered or defaced as a result of the paving operation. Asphalt or asphalt stains which are noticeable upon surfaces of concrete, or materials which will be exposed to view, shall be promptly and completely removed. Cleaning shall be done in a manner that will not result in any discharge of contaminated materials into any catch basin. All expenses for clean up shall be borne by the Contractor at NO cost to the Owner.

END OF SECTION 02741

SECTION 02760 - PAVEMENT MARKING

PART 1 - GENERAL

1.01 SUMMARY

A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, Special Conditions and Division 1.

B. Section Includes:
1. Painted traffic and parking control markings.
2. Traffic symbols, directional arrows, lettering and safety zones.
3. Miscellaneous exterior signage on horizontal surfaces, and as indicated on Drawings.

1.02 REFERENCES

A. Standard Specifications for Public Works Construction.
1. SSPWC - Section 310 Painting.
a. Wherever term "Agency" occurs in SSPWC, it shall be construed to mean Owner, for purposes of this Section.
b. Wherever term "Engineer" occurs in SSPWC, it shall be construed to mean Architect, for purposes of this Section.

B. Federal Standards.
1. Fed. Std 595B - Colors Listed in Government Procurement.

C. California Code of Regulations.
1. CBC - Part 2, Title 24, CCR, 2001 California Building Code (CBC), (1997 Uniform Building Code Volumes 1-3 and 2001 California Amendments) – Accessibility

D. Americans with Disabilities Act.
1. ADA - Title III.

E. California Department of Transportation.
1. CALTRANS – Section 84 Traffic Control Markings.

F. South Coast Air Quality Management District.
1. SCAQMD – Rule 1113.

1.03 SUBMITTALS

A. Submit under provisions of Section 01330.

B. Submit shop drawing layout of all signage required under this Section, including complete parking lot, indicating stalls, lettering, safety zones, directional arrows, fire lane signage and widths of lines and colors.

1.04 FIELD SAMPLES

A. Provide field sample in the form of one parking lot stall, illustrating coating color, width of stroke, thickness of application and dimensioning.

B. Locate where approved.

C. Accepted sample may remain as part of the Work.

D. Do not proceed with pavement marking until sample panel has been approved.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in sealed and labeled containers.

B. Container labeling to include manufacturers name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation and instructions for mixing and reducing.

C. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, unless otherwise recommended by the manufacturer.

1.06 EXTRA STOCK

A. Provide a one gallon unopened container of each color to the Owner.

B. Label each container with color in addition to the manufacturer's label.

1.07 QUALITY ASSURANCE

A. Regulatory Requirements, State: Comply with CALTRANS Section 84.

B. Regulatory Requirements, Local: Comply with SSPWC Section 310.

C. Comply with SCAQMD Rule 1113 for maximum volatile emissions requirements.

D. Perform off-site Work in public rights-of-way in accordance with requirements of authorities having jurisdiction. For conditions not indicated otherwise on Drawings, comply with standard details adopted by authorities having jurisdiction, including standard details for SSPWC, as amended and adopted by those authorities.

E. Perform on-site Work as indicated and referenced on the Drawings and as specified herein.

F. Manufacturer: Company specializing in manufacturing quality traffic line paint products with minimum ten years experience.

G. Applicator: Company regularly engaged in pavement marking, with minimum 3 years experience in use of machine-applied painted stripes, signage and graphics and other markings.

1.08 PROJECT CONDITIONS

A. Do not apply marking or signage paint when weather is foggy or rainy, or when ambient or pavement temperatures are below 40 degrees F., or when such conditions are anticipated within eight hours of application.

B. Do not apply marking paint or signage when wind velocity causes uncontrollable overspray or excessively rapid drying.

C. Sequence and Schedule: Apply pavement markings after asphaltic concrete and/or Portland cement concrete paving Work are complete.
   1. Substrate materials shall be thoroughly cured.
   2. Sealers, when specified, shall be applied and cured prior to application of pavement markings.
   3. Landscaping, when applicable, shall be complete.
   4. Apply other signage only when substrate is cured, dry, firm and ready for application.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved Manufacturers:
   1. Frazee Paint and Wallcovering, Inc., City of Commerce, CA. Product: No. 502 TRAFFIC LINE PAINT –ACRYLIC.
   2. Dunn-Edwards Corporation, Los Angeles, CA. Product: No. W801 VIN-L-STRIPE TRAFFIC PAINT, ACRYLIC-EPOXY TRAFFIC PAINT.
   3. ICI/Sinclair Paint, Los Angeles, CA. Product: No. 160 VINYL TRAFFIC PAINT.

2.02 MATERIALS

A. Paint for Traffic Striping and Marking and Miscellaneous Signage: Rapid dry, oil base or vinyl acrylic base, meeting requirements of local air quality management district for volatile emissions maximums, manufactured specifically for application to asphalt and concrete traffic surfaces.
   1. If required by authorities having jurisdiction for Work in public rights-of-way, include reflective material in paint and/or thermoplastic paint, with reflective additives.
   2. Paint for marking curbs shall not require reflective material.

2.03 COLORS

A. Provide standard factory-mixed, quick drying and non-bleeding colors, complying with SSPWC Section 310 and adopted by the City and/or County in which the project is located, as applicable.

B. Accessible Stalls and Signage: Blue, complying with Fed. Std. 595B No. 15090.

C. Parking stalls, lettering, arrows and traffic signage: White.

D. Other Signage: Colors as indicated on approved shop drawings.

E. Paint curb red at fire lanes.

PART 3 - EXECUTION

3.01 PREPARATION

A. Allow substrates to cure before painting as recommended by manufacturer of paint.

B. Thoroughly power and hand broom clean surfaces free of dirt, sand, gravel, oil and other foreign matter. Wash down surfaces to dustfree condition and allow to thoroughly dry.

C. Lay out markings as shown on Drawings. Use guide lines, templates and forms for precise edges and spacings.

D. At off-site and on-site public rights-of-way, obtain review and approval of layout by authorities having jurisdiction.

3.02 APPLICATION

A. Using proper masking, stencils and application equipment, apply paint at rate recommended by paint manufacturer to produce minimum 12 mils DFT average.

B. Traffic Striping: Uniform line width, 3-inches minimum wide, unless otherwise indicated, with uniform, straight edges without overspray. Provide reflective materials in striping when required by authorities having jurisdiction.

1. Accessible pavement markings shall be marked with painted lines and markings on pavement. Provide 3" minimum wide and blue in color equal to Color No. 15090 per Federal Standard 595B.

C. Traffic Directional Markings and Accessible Logo: Provide minimum of two applications of paint. Provide reflective material in traffic directional markings when required by authorities having jurisdiction.

D. Curbs: Paint full vertical face and first 6-inches of horizontal plane at top of curb or combination curb/paving.

E. Hatching: Provide hatching in parking areas, including accessible parking stalls, as indicated on Drawings or as required by CBC and ADA.

F. Stall Marking:
1. Use single-line style striping between parking stalls, unless otherwise indicated.
2. Identify compact parking stalls and reserved stalls with text as indicated on Drawings.
3. Parking stalls for the disabled shall be marked in accordance with CBC 1129B.5.

G. Tactile warning lines shall be in conformance to CBC Section 1133B.8.3. and 1133B.8.4.

3.03 PROTECTION AND TOUCH-UP

A. Prevent construction activities over completed signage and markings, to prevent damage to applied work.

B. Touch-up paint as required to provide clean, straight lines and full coverage of surfaces.

C. Clean up all oil, paint splatters and other stains from surfaces in preparation for Substantial Completion review.

3.04 DEFECTIVE WORK

A. Remove any paint which demonstrates evidence of checking, cracking, peeling, discoloration, lack of bonding or poor coverage.

B. Misplaced lines shall be completely removed by paint remover or sandblasting. Painting over misplaced lines will not be permitted. Comply with SSPWC Section 310.

END OF SECTION 02760

SECTION 02764 - PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.
2. Joints between cement concrete and asphalt pavement.

B. Related Sections include the following:

1. Division 2 Section "Hot-Mix Asphalt Paving" for constructing joints between concrete and asphalt pavement.
2. Division 2 Section "Sitework Concrete" for constructing joints in concrete pavement.
3. Division 7 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
3. When joint substrates are wet or covered with frost.
4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: **As selected by Architect from manufacturer's full range.**

2.3 COLD-APPLIED JOINT SEALANTS

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

1. **Available** Products:

a. Crafco Inc.; RoadSaver Silicone.
b. Dow Corning Corporation; 888.
c. Approved Equal

B. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

1. **Available** Products:

a. Crafco Inc.; RoadSaver Silicone SL.
b. Dow Corning Corporation; 890-SL.
c. Approved Equal

C. Multi-component Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.

1. **Available** Products:

a. Meadows, W. R., Inc.; Sof-Seal.
b. Approved Equal

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform

beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 02764

SECTION 02765 - PAVEMENT REPAIR

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Bituminous Surfacing Repair: Areas removed for utility trenches, heaved by tree roots, cracked areas, protruding areas where pavement meets hard surfaces, depressed areas, holes and areas around new structures, and raveled bituminous pavement.

1.02 SUBMITTALS

A. Product Data:

1. Submit manufacturer's technical data for materials and products.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. Standard Specifications for Public Works Construction, current edition.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials specified in Division 2 Section "Hot-Mix Asphalt Paving".

2.02 HEADERS AND STAKES

A. Headers: Redwood, Construction Heart Grade, size 2 x 6, unless otherwise indicated on Drawings.

B. Stakes: 2 x 4 Redwood, Construction Grade.

C. Nails: Common, galvanized, 12d minimum.

2.03 SLURRY

A. Cement-sand slurry; minimum ~~two~~ **one** sack of cement per cubic yard of mixture.

PART 3 - EXECUTION

3.01 PAVEMENT REMOVAL

A. Remove bituminous and concrete pavement in accordance with applicable provisions of

Section 300 - "Earthwork" of the Standard Specifications for Public Works Construction.

B. Pavement Heaved By Roots: Remove pavement to limits of distortion and expose roots. Trim roots to provide at least 12 inch clearance to pavement.

C. Remove protruding bituminous surfaces flush with the surrounding grade using a suitable tool or equipment so that adjacent finishes will not be blackened.

D. Remove raveled and depressed bituminous pavement to limits indicated or required.

E. Trim holes and trenches in bituminous and concrete pavement to size big enough to allow mechanical hand tampers to compact the fill and to a neat even line by saw-cutting.

F. Remove broken concrete by saw-cutting. If cut would fall within 30 inches of a score line, joint line or edge, remove to the score, joint or edge.

3.02 EXCAVATING, BACKFILLING AND COMPACTING

A. Conform to applicable requirements in Section 02300 - Earthwork.

B. Where subgrade or base is determined to be unstable, excavate such materials to firm earth and replace with a suitable approved material. Spread and compact fill materials in accordance with requirements of applicable specifications sections.

3.03 HEADERS

A. Install headers along edge of bituminous surfacing where it abuts lawn, dirt or planting area, unless indicated otherwise.

B. Place headers so that bottom has continuous bearing on solid earth. Where excavation for headers is undercut, tamp earth under the header thoroughly. Compact backfill on both sides of header to the density of the adjacent undisturbed earth.

C. Hold headers in place with Redwood or Douglas fir stakes of length necessary to extend into solid earth a minimum of 12 inch. All stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set 1 inch below top of header. Use minimum of 2-12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is placed to join existing surfacing.

E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.

F. Provide additional stakes and anchorage as required to hold headers in place.

3.04 RESURFACING

A. Holes and Trenches: Remove loose dirt and backfill with cement-sand slurry allowing for

asphalt surfacing one-inch thicker than existing. Unless otherwise indicated on Drawings, resurface flush with existing adjoining pavement using the same type of materials used in original work.

B. Where bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, free of differences in elevation. Tamp and smooth while materials before asphalt is allowed to cool.

3.05 PATCHING

A. The material in the area to be repaired should be removed to the depth necessary to reach firm support and the subgrade compacted to 90% relative density. The excavation should also extend at least 1 foot into the good pavement surrounding the area to be patched. Holes should be square-edged and the cuts rectangular in shape.

B. The vertical faces of the hole are then given a tack coat as specified in Division 2 Section "Hot-Mix Asphalt Paving".

C. If the bottom of the hole or patch area is a granular base that is part of the pavement structure, it should be primed before the asphalt patching mix is placed. If the depth of the hole or patch extends to or into the subgrade and a full-depth asphalt patch is contemplated, a prime coat is not necessary.

D. The hole should be backfilled with a hot-asphalt mix as specified in Division 2 Section "Hot-Mix Asphalt Paving", spread carefully to prevent segregation.

E. Compact the asphalt flush with the surrounding pavement surface. The patch should not be overfilled in anticipation of traffic compaction. A straightedge or stringline should be used to check the evenness of the surface.

3.06 REPAIRING AND RESEALING EXISTING SURFACES

A. Preparation of Surfaces:

1. Prior to filling cracks, clean existing bituminous surfacing of loose and foreign materials and coat with a film of asphalt emulsion.

B. Repair of Existing Surfacing:

1. Fill cracks 1/2 inch wide and less with RS-1 emulsion and silica sand or other similar material. Cracks more than 1/2 inch wide shall be filled with Type C2 or D1 Asphalt Concrete as specified in Division 2 Section "Hot-Mix Asphalt Paving". Cracks shall be filled to level of adjacent surfacing.

2. Where low areas, holes or depressions occur in existing surfacing, repair with emulsified asphalt. After placing, strike off the emulsified asphalt with a straight-edge, flush with adjoining surfacing. Finish with a steel trowel, and after dehydration, compact by rolling or tamping.

C. Flood Testing: After the District Inspector has reviewed and approved repairs, flood test entire area in presence of the District Inspector. Entire area tested shall be free of standing water or puddles.

D. Seal Coat: After surface has been repaired and tested, apply seal coat over entire area. Seal coat shall be as specified in Division 2 Section "Hot-Mix Asphalt Paving".

3.07 CLEANING

A. Remove all stains on the Project site and adjacent properties caused by or attributed to the Work of this section.

B. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.08 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION 02765

SECTION 02770 - SITE CONCRETE WORK

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall furnish all materials for concrete in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete, in accordance with the requirements of the Contract Documents.

B. Provide curb cuts meeting the accessibility requirements of the California Code of Regulations (CCR) Title 24 Part 2, 1127B.5, and ramps complying with CCR, T24, CCR, Part 2, 1003.3.4 and 1133B.5.

C. The following types of concrete shall be covered in this Section:

1. Portland cement concrete pavement, cement walks, curbs, gutters, swales, trash pick-up areas, ramps, mowing strips, fence post footings, sliding gate concrete tracks, catch basins, pipe bedding and encasements, transition structures, flagpoles and light standard bases and footings, splash blocks and equipment pads.

1.2 SUMMARY

A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, Special Conditions and Division 1.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Comply with the reference specifications of the GENERAL REQUIREMENTS.

B. The "Standard Specifications for Public Works Construction" or "Greenbook Standards" and the "Standard Plans for Public Works Construction", latest edition, which are written and promulgated by the Joint Cooperative Committee of the Southern California Chapter American Public Works Association and Southern California Districts Associated General Contractors of California. Copies of these documents may be obtained at the BNI Building News, 1612 S. Clementine Street, Anaheim, CA. 92802, phone 1-888-264-7483 or available on the internet at: http://www.bnibooks.com/.

C. Comply with the current provisions of the following Codes and Standards.

1. Federal Specifications:

a. UU-B-790A (Int.Amd. 1) Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellant and Fire Resistant).

2. Commercial Standards:

a. ACI 214 Recommended Practice for Evaluation of Strength Test Results of Concrete.
b. ACI 301 Specifications for Structural Concrete for Buildings.
c. ACI 315 Details and Detailing of Concrete Reinforcement.
d. ACI 318 Building Code Requirements for Reinforced Concrete.
e. ACI 347 Recommended Practice for Concrete Formwork.
f. ACI 350 Recommended Practice for Sanitary Structure.
g. ASTM C 31 Practices for Making and Curing Concrete Test Specimens in the Field.
h. ASTM C 33 Specification for Concrete Aggregates.
i. ASTM C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens.
j. ASTM C 40 Test Method for Organic Impurities in Fine Aggregates for Concrete.
k. ASTM C 42 Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
l. ASTM C 78 Specification for Flexural Strength.
m. ASTM C 88 Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate.
n. ASTM C 94 Specification for Ready-Mixed Concrete.
o. ASTM C 114 Method for Chemical Analysis of Hydraulic Cement.
p. ASTM C 131 Test Method for Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
q. ASTM C 136 Method for Sieve Analysis of Fine and Coarse Aggregate.
r. ASTM C 143 Test Method for Slump of Portland Cement Concrete.
s. ASTM C 150 Specification for Portland Cement.
t. ASTM C 156 Test Method for Water Retention by Concrete Curing Materials.
u. ASTM C 157 Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.
v. ASTM C 172 Specification for Sampling Fresh Concrete.
w. ASTM C 192 Method of Making and Curing Concrete Test Specimens in the Laboratory.
x. ASTM C 260 Specification for Air-Entraining Admixtures for Concrete.
y. ASTM C 289 Test Method for Potential Reactivity of Aggregates (Chemical Method).
z. ASTM C 311 Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.
aa. ASTM C 494 Specification for Chemical Admixtures for Concrete.
bb. ASTM C 618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
cc. ASTM D 1751 Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
dd. ASTM E 119 Method for Fire Tests of Building Construction and Materials.

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with Section 01330.

B. The following submittals and specific information shall be provided.

1. Mix Designs: Prior to beginning the WORK, the CONTRACTOR shall submit to the ENGINEER, for review, and approval, preliminary concrete mix designs for each class and type of concrete specified herein. The mix designs shall be designed by an independent testing laboratory acceptable to the ENGINEER. All costs related to such mix design shall be borne by the CONTRACTOR.

   a. Each concrete mix submittal shall contain the following information:

      1) Slump on which the design is based.
      2) Total gallons of water per cubic yard.
      3) Brand, type, composition and quantity of cement.
      4) Brand type, composition and quantity of fly ash.
      5) Specific Gravity and gradation of each aggregate.
      6) Ratio of fine to total aggregate per cubic yard.
      7) Weight (surface dry) of each aggregate per cubic yard.
      8) Brand, type, and ASTM designation, active chemical ingredients and quantity of each admixture.
      9) Copy of the Building and Safety Research Report Approval for each concrete admixture.
      10) Air content.
      11) Compressive strength based on 7 day and 28 day compression tests, including standard deviation calculations, corroborative data (if applicable), and required average comprehensive strength per ACI 318, Section 5.
      12) Time of initial set.
      13) Certification stamp and signature by a Civil or Structural engineer registered in state of California.
      14) Certificate of Compliance for Cement.

2. Certified Delivery Tickets: Where ready-mix concrete is used, the CONTRACTOR shall provide certified weighmaster delivery tickets at the time of delivery of each load of concrete. Each certificate shall show the public weighmaster's signature, and the total quantities, by weight of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate and added at the batching plant as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.
3. When a water reducing admixture is to be used, the CONTRACTOR shall furnish mix designs for concrete both with and without the admixture.
4. The CONTRACTOR shall furnish a Certificate of Compliance signed by the supplier identifying the type of fly ash and stating that the fly ash complies with ASTM C 618 and these Specifications, together with all supporting test data prior to the use of the fly ash the sample represents. The supporting data shall also contain test results confirming that the fly ash in combination with the cement and water to be used meets all strength requirements and is compatible with air-entraining agents and other admixtures.
5. The CONTRACTOR shall submit to the ENGINEER for review the design mix for fly ash concrete together with the design mix for portland cement (non-fly ash) concrete as specified in this Section.

1.5 QUALITY ASSURANCE

A. Testing for Portland Cement Concrete shall be sampled and tested in accordance with the ASTM and California Tests listed in the Standard Specifications for Public Works Construction, 2003 Edition, Section 201-1.1.5.

B. Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

C. The cost of all laboratory tests on cement, aggregates, and concrete, will be borne by the CONTRACTOR.

D. Concrete for testing shall be supplied by the CONTRACTOR at no cost to the DISTRICT, and the CONTRACTOR shall provide assistance and facilities to the INSPECTOR in obtaining samples, and disposal and cleanup of excess material.

E. Curbs and gutters shall be staked by a Land Surveyor licensed to practice in the State of California.

F. Construction Tolerances: The CONTRACTOR shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 347.

G. The following construction tolerances are hereby established and apply to finished walls and slab unless otherwise shown:

Item	Tolerance
Variation of the constructed linear outline from the established position in plan.	In 10 feet: 1/8-inch; In 20 feet or more: 1/4-inch
Variation from the level or from the grades shown.	In 10 feet: 1/8-inch; In 20 feet or more: 1/4-inch
Variation from the plumb	In 10 feet: 1/8-inch; In 20 feet or more: 1/4-inch
Variation in the thickness of slabs and walls.	Minus 1/8-inch; Plus 1/4-inch
Variation in the locations and sizes of slabs and wall openings	Plus or minus 1/8-inch

PART 2 - PRODUCTS

2.1 CONSTRUCTION MATERIALS

A. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.

B. All materials furnished for the work shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.

C. Storage of materials shall conform to the requirements of Section 205 of ACI 301.

D. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces. Conform to Section 303-5.2 of the Standard Specifications for Public Works Construction, 2003 edition.

1. Use flexible or curved forms for curves of a 100-foot or less radius.

E. Reinforcing Materials: As follows:

1. Steel Reinforcing Bars: ASTM A 615 deformed grade 40 billet steel, plain finish, unless otherwise specified on Construction Document.
2. Welded Steel Wire Fabric: ASTM A 185, flat sheets, not rolls, unfinished.
3. Plain, Cold-Drawn Steel Wire: ASTM A 82.
4. Dowels: ASTM A 615, Grade 40, plain steel, unfinished.

F. Concrete Materials: As follows:

1. Cement shall be standard brand portland cement conforming to ASTM C 150 for Type II. Portland cement shall contain not more than 0.60 percent alkalies. The term "alkalies" referred to herein is defined as the sum of the percentage of sodium oxide and 0.658 times the percentage of potassium oxide (Na20 + 0.658 K20). These oxides shall be determined in accordance with ASTM C 114. A single brand of cement shall be used throughout the work, and prior to its use, the brand shall be acceptable to the ENGINEER. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports for each shipment of cement to be used shall be submitted to the INSPECTOR.
2. Concurrent with strength design criteria, concrete shall also be proportioned to provide the requisite durability to satisfy the exposure conditions imposed by either environment and/or service. Durability, in this context, refers to the ability of the concrete to resist deterioration from the environment or service in which it is placed. Concrete proportioned in accordance with ACI 318, chapter 4, Durability Requirements, will meet this criteria.
3. Combined Aggregate: 3/8" maximum coarse aggregate size conforming to Grading C of Standard Specifications for Public Works Construction, Section 201-1.3.2(A). Aggregates shall be obtained from pits acceptable to the INSPECTOR, shall be non-reactive, and shall conform to ASTM C 33.

4. Water: Shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts and other impurities. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies.

G. Admixtures:

1. The ENGINEER may require the use of admixtures or the CONTRACTOR may propose to use admixtures to control the set, effect water reduction, and increase workability. In either case, the addition of an admixture shall be at the CONTRACTOR's expense. The use and continued use of an admixture shall be approved by the ENGINEER. Admixtures specified herein, other than calcium chloride, shall conform to the requirements of ASTM C 494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used. Admixtures shall contain no free chloride ions, be non-toxic after 30 days, and shall be compatible with and made by the same manufacturer as the air entraining admixture.
2. These admixtures shall not be used in greater doses than those recommended by the manufacturer or permitted by the ENGINEER. The permitted dosage of the admixture shall not exceed that which will result in an increase in the driving shrinkage of the concrete in excess of 20 percent when used in precast or prestressed concrete, or 10 percent when used in any other structural concrete. The strength of concrete containing the admixture in the amount of proposed shall, at the age of 48 hours and longer be not less than that of similar concrete without the admixture. The admixture shall not adversely affect the specified air content, unless permitted by the ENGINEER.
3. Set controlling admixture shall be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture such as Sika Chemical Corporation's Plastiment, Master Builder's Pozzolith 300R, or equal shall be used. Where the air temperature at the time of placement is expected to be consistently under 40 degrees F, a set accelerating admixture such as Sika Chemical Corporation's Plastocrete 161FL, Master Builder's Pozzolith 50C, or equal shall be used.
4. Low range water reducer shall conform to ASTM C 494, Type A. It shall be either a hydroxylated carboxylic acid type or a hydroxylated polymer type. The quantity of admixture used and the method of mixing shall be in accordance with the manufacturer's instructions and recommendations.
5. High range water reducer shall be sulfonated polymer conforming to ASTM C 494, Type F or G.

   a. If the high range water reducing agent is added to the concrete at the batch plant, it shall be second generation type, [Daracem 100, as manufactured by W.R. Grace & Co.]; [Pozzolith 430R, as manufactured by Masterbuilders]; or equal. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified.
   b. If the high range water reducer is added to the concrete at the job site, it shall be used in conjunction with a low range water reducer and shall be [Pozzolith 400N and Pozzolith MBL82, as manufactured by Masterbuilders]; [WRDA 19 and WRDA 79, as manufactured by W.R. Grace & Co.]; or equal. Concrete shall have a slump of 3-inches ± 1/2-inch prior to adding the high range water reducing admixture at the job site. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single

dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system.

6. Air-entraining agent meeting the requirements of ASTM C 260, shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 3 to 4 percent; provided that, when the mean daily temperature in the vicinity of the worksite falls below 40 degrees F for more than one day, the total air content provided shall be 5 to 6 percent. The Owner reserves the right, at any time, to sample and test the air-entraining agent received on the job by the CONTRACTOR. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement.
7. Calcium Chloride: Except as otherwise provided herein, calcium chloride will not be permitted to be used in concrete.
8. Fly ash/pozzolan shall conform to ASTM C 618 and the following supplementary requirements:

   a. Class F fly ash

o Loss on ignition,	maximum 4 percent
o S03 content,	maximum 3 percent
o Moisture content,	maximum 1 percent
o R = (CaO - 5%)/(Fe203),	maximum 0.75 percent

   b. Class F fly ash, as a percent by weight of total cementitious material, <u>shall not exceed 15 percent</u>.

H. Curing Materials:

1. Concrete curing compound shall conform to the requirements of ASTM C309 Type 1-D (clear or translucent with a fugitive dye), Class B (Resin Type Only), except the loss of water shall not exceed 0.15 kilograms per square meter in 24 hours nor 0.45 kilograms per square meter in 72 hours when tested in accordance with ASTM C 156. The CONTRACTOR shall provide, when requested by the ENGINEER, certified copies of vendor's test report showing compliance with ASTM C 309 and these specifications. The testing and the report shall be supplied without cost to the Agency. All compounds shall be furnished by the CONTRACTOR in sealed original containers labeled in accordance with ASTM C 309 and with the date of manufacture.
2. Polyethylene sheet for use as concrete curing blanket shall be white and conform to ASTM C 171. The loss of moisture when determined in accordance with the requirements of ASTM C 156 shall not exceed 0.055 grams per square centimeter of surface.
3. Polyethylene-coated burlap for use as concrete curing blanket shall conform to ASTM C 171. The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 grams per square centimeter of surface.

I. Expansion Joint Filler Material

1. Curb & Gutter: Nonextruding and Resilient Filler: Celotex "Flexcell", or approved equal, 1/4-inch thick material conforming to ASTM D 1751-99.

2. Concrete Walk and Slab: "Homex 300", or approved equal, as manufactured by Homasote Company, material conforming to ASTM D 1751-99.
3. Elastomeric Sealant: Premium-grade, high-performance, moisture-cured, single-component, polyurethane-based, non-sag elastomeric sealant, ASTM C-920, Type S, Class 25; Grade NS, Use NT, Sikaflex-15 LM by Sika Corporation, Elasto-thane 230 by Pacific Polymers International, Inc.

J. Related Materials: As follows:
1. Damp-proofing agent shall be an asphalt emulsion, such as Sonneborn Hydrocide 660, Flintkote C-13-E Foundation Coating, or equal.
2. Epoxy adhesives shall be the following products for the applications specified:

   a. For bonding freshly-mixed, plastic concrete to hardened concrete, Sikadur Hi-Mod Epoxy Adhesive, as manufactured by Sika Chemical Corporation; Concresive 1001-LPL, as manufactured by Adhesive Engineering Company; or equal.
   b. For bonding hardened concrete or masonry to steel, Colma-Dur Gel, Sikadur Hi-Mod Gel, or equal.

K. Flatwork Mix Design: Special exposure mixes should be proportioned in accordance with ACI 318, Chapter 4, Durability Requirements. Admixtures containing calcium chloride are prohibited for use in concrete exposed to sulfates. Concrete for flatwork shall conform to the Standard Specifications for Public Works Construction, 2003 Edition, Section 201-1.1.2, mix class 560-C-3250:

1. Compressive Strength: minimum of 3250 psi at 28 days compressive strength.
2. Water-Cement Ratio: 0.45 maximum gal/sack.
3. Slump Limit: 4 inches at point of placement.
4. Cement per cu yard (sacks): 6.0 (minimum).
5. Air Content: 4% +/- 1% percent.

L. Curbs & Curb/Gutter Mix Design: At a minimum, concrete shall conform to the Standard Specifications for Public Works Construction, 2003 Edition, Section 201-1.1.2, mix class 520-C-2500:
1. Compressive Strength: minimum 2500 psi at 28 days compressive strength.
2. Water-Cement Ratio: 0.45 maximum gal/sack.
3. Slump Limit: 4 inches at point of placement.
4. Cement per cu yard (sacks): 5.5.

M. Slurry Mix Design:

1. Compressive Strength: 100 psi at min. 28 days compr. strength.
2. Water-Cement Ratio: 3.300 gal/sack
3. Slump Limit: 5 inches at point of placement.
4. Cement per cu yard (sacks): 1.0
5. Air Content: 4% +/- 1% percent.

N. Concrete Splash Block: Pre-cast reinforced concrete splash block, 12" x 24", Christy Concrete Products Inc, ordering code M50SPB1, or approved equal. Contractor can view this product at the following web site: http://www.christyconcrete.com/html/splash_blocks.html.

PART 3 - EXECUTION

3.1 PREPARATION OF SURFACES FOR CONCRETING

A. General: Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.

B. Subgrade Preparation: Prior to placing concrete the existing native soil must be scarified to a depth of 12 inches, watered or aerated as required, thoroughly mixed to a uniform near optimum moisture condition, and re-compacted to at least 90 percent of the ASTM D-1557 laboratory test standard. All material should be moisture conditioned and compacted by mechanical means in approximate 8-inch thick lifts. The Geotechnical Engineer should monitor the compaction of the sub grade soils and perform testing to verify that proper compaction has been obtained. Subgrade soils should exhibit a firm, unyielding surface in addition to the recommended compaction.

C. The above subgrade preparation recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. For this reason, the actual scarification or overexcavation depths will have to be determined on the basis of in-grading observations and testing performed by representatives of the project geotechnical consultant.

D. Joints in Concrete: Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, as determined by the ENGINEER, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material. Such cleaning shall be accomplished by sandblasting followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

E. Embedded Items: No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and ACCEPTED by the INSPECTOR at least 24 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.

F. All inserts or other embedded items shall conform to the requirements herein.

G. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown or by shop drawings and shall be acceptable to the INSPECTOR before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.

H. Where concrete is to be cast against old concrete, (greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by sand-blasting, exposing the aggregate. In concrete shear-walls, suspended slabs and roof slabs, the

interface surface at construction joints shall be roughened to a full amplitude of one quarter inch. The hardened surface shall be cleaned of all latent foreign material and washed clean, prior to the application of an epoxy bonding agent.

I. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the ENGINEER.

J. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2-inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

K. Openings for pipes, inserts for pipe hangers and brackets, and the setting of anchors shall, where practicable, be provided for during the placing of concrete.

L. Anchor bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.

M. Cleaning: The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.2 HANDLING, TRANSPORTING, AND PLACING

A. General: Placing of concrete shall conform to the applicable requirements of ACI 301 and the requirements of this Section.

B. Non-Conforming Work or Materials: Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced by and at the expense of the CONTRACTOR.

C. Concrete shall not be placed until the forms and reinforcement have been inspected, all preparations for the placement have been completed, and the preparations have been checked by the project inspector, all subject to the observation of the engineer or architect.

D. Casting New Concrete Against Old: An approved epoxy adhesive bonding agent shall be applied to the old surfaces according to the manufacturer's written recommendations. This provision shall not apply to joints where waterstop is installed.

E. Conveyor Belts and Chutes: All ends of chutes, hopper gates, and all other points of concrete discharge throughout the CONTRACTOR'S conveying, hoisting and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall

be of a type acceptable to the INSPECTOR. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the specified consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.

F. Placement in Slabs: Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the pour. As the work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

G. Temperature of Concrete: The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 40 degrees F in moderate weather, and not less than 50 degrees F in weather during which the mean daily temperature drops below 40 degrees F. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the CONTRACTOR shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The CONTRACTOR shall be entitled to no additional compensation on account of the foregoing requirements.

H. Cold Weather Placement: Earth foundations shall be free from frost or ice when concrete is placed upon or against them. Fly ash concrete shall not be placed when the air temperature falls below 50 degrees F.

I. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. The finished surface shall be free from humps, sags, blemishes or other irregularities Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.

1. Medium-to-Broom Finish required on surfaces up to 6% slope: Draw a soft bristle broom across concrete surface, perpendicular to line of traffic, to provide a uniform fine line texture.
2. Ramps/ Slopes over 6%: Provide a heavy broom finish by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

J. Joints:

1. Joints: Joints in concrete curb, gutter, and walk shall be designated as expansion joints and weakened plane/score joints. Joints for concrete flatwork shall be provided every five (5) feet or less. Expansion joints for curbs / curb & gutter shall be placed at no greater than 24 feet on center or as indicated on construction drawings.

   a. Expansion Joints: Provide 1/4" premolded joint filler, material meeting Section 2.1I herein. Construct expansion joints in conformance with S.S.P.W.C. Section 303-5.4.2.

1) Extend expansion joint fillers full-width and depth of joint, and 1/4" below finished surface where joint filler is indicated. If no joint sealer is called for, place top of premolded joint filler flush with top of concrete or curb.

2) Where elastomeric sealer is noted on the construction documents, the premolded joint filler strips shall be placed ½" below the surface of the concrete or curb, the full width of the expansion joint. The remainder of all joints shall be filled to the surface of the concrete with the elastomeric sealant.

3) Joint filler strips between walk and curb shall be the depth of the walk plus 1 inch with the top set flush with the specified grade of the top of curb.

b. Weakened Plane/Score Joints:

1) Weakened plane joints in sitework concrete shall comply with SSPWC subsection 302-6.5.4 except that the configuration of the joint shall be as indicated on the architectural drawings or geotechnical report.

2) Weakened plane joints in concrete curbs, sidewalks and gutters shall comply with SSPWC subsection 303-5.4.3 except that the joint configuration shall be as indicated.

3) Location: As shown on architectural drawings, but in any case not more than five (5) feet O.C. both ways in concrete sidewalks. In gutter, including gutter integral with curb, joints shall be at regular intervals not exceeding eight (8) feet. Where integral curb and gutter is adjacent to concrete pavement, the joint shall be aligned with the pavement joints where practical.

K. Protection: In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control film. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.

3.3 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be high speed power vibrators (8000 to 10,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required.

B. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration, over

and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.4 CURING

A. Comply with 2001 California Building Code, Title 24, Part 2, Volume 2, Section 1905A.11.

1. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least seven (7) days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by curing as herein specified.

1. Provide moisture-curing by the following methods:

   a. Keep concrete surface continuously wet by covering with water.
   b. Continuous water-fog spray.
   c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4 inch lap over adjacent absorptive covers.

2. Provide curing and sealing compound to exposed exterior slabs, walks, and curbs, as follows:

   a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Re-coat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
   b. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid, floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

C. Concrete slabs and paving shall be properly cured and protected against damage and defacement of nature during construction operations. If weather is hot or surface has dried out, spray surface with fine mist of water starting not later than two hours after final troweling. Surface of finish shall be kept continuously wet for at least ten days. Wetting is

considered emergency work and shall be performed on weekends and holidays if necessary.

D. The CONTRACTOR shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the CONTRACTOR'S expense. Exclude traffic from concrete paving for at least 7 days after placement.

E. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

3.5 PUMPING OF CONCRETE

A. General: If the pumped concrete does not produce satisfactory end results, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. Pumping Equipment: The pumping equipment must have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the CONTRACTOR may have a standby pump on the site during pumping.

C. The minimum diameter of the hose (conduits) shall be 4-inches.

D. Pumping equipment and hoses (conduits) that are not functioning properly, shall be replaced.

E. Aluminum conduits for conveying the concrete will not be permitted.

F. Proportioning: Minimum compressive strength, cement content, and maximum size of aggregates shall be as specified herein.

G. Gradation of coarse aggregates shall conform to ASTM C 33 and shall be as close to the middle range as possible.

H. Gradation of fine aggregate shall conform to ASTM C 33, with 15 to 30 percent passing the number 50 screen and 5 to 10 percent passing the number 100 screen. The fineness modulus of sand used shall not be over 3.00.

I. Water and slump requirements shall conform to the requirements of this Section.

J. Cement and admixtures shall conform to the requirements of this Section.

K. Field Control: Concrete samples for slump per ASTM C 143 and test cylinders per ASTM C 31 and C 39.

3.6 TREATMENT OF SURFACE DEFECTS

A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the ENGINEER. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall have them repaired as specified herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced.

1. All repairs and replacements herein specified shall be promptly executed by the CONTRACTOR at its own expense.

B. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to overcome the suction upon which a good bond depends. The material used for repair purposes shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white portland cement as is required to make the color of the patch match the color of the surrounding concrete.

C. Holes left by tie-rod cones shall be reamed so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with non-shrink grout. Holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed but shall be repaired in an approved manner with non-shrink grout.

D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

E. Prior to filling any structure with water, all cracks that may have developed shall be repaired to the satisfaction of the ENGINEER. This repair method shall be done on the water bearing face of members. Prior to backfilling, faces of members in contact with fill, which are not covered with a waterproofing membrane, shall also have cracks repaired as specified herein.

3.7 FIELD QUALITY CONTROL

A. Flood Tests: Concrete gutters and concrete pavement shall be given a flood test in the presence of the Inspector. Concrete work where water ponds and does not run off in a reasonable amount of time, shall be removed to the nearest score or joint line and replaced to provide proper drainage.

3.8 OFF-SITE CONCRETE WORK

A. Concrete driveway aprons, street sidewalks, curbs and gutters, etc., indicated to be constructed outside of property lines shall conform to the standards and specifications of the public agency having jurisdiction and shall be subject to inspection by its representative. The CONTRACTOR shall obtain and pay for necessary permits and inspection fees. The Owner shall reimburse the Contractor for said permits and all necessary inspection fees.

3.9 CARE AND REPAIR OF CONCRETE

A. General: The CONTRACTOR shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the CONTRACTOR'S expense.

B. The contractor shall barricade and protect placed Portland Cement Concrete from all damage, marks, mars and/or graffiti. Any Portland Cement Concrete damaged, defaced, discolored or defective shall be replaced at the contractor's expense.

END OF SECTION 02770

SECTION 02796 - DECOMPOSED GRANITE

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section includes:

1. Furnish and install decomposed granite with stabilizer.

C. Related Sections:

1. Section 02230: Site Clearing.

2. Section 02515: Masonry Paving.

3. Section 02770: Site Concrete Work.

1.02 SYSTEM DESCRIPTION

A. Unless otherwise indicated on the Drawings, a 4" layer of crushed aggregate base shall be installed and rolled to a uniform finish grade. A 3" layer of decomposed granite with soil stabilizer shall be installed, moistened, and rolled to a uniform finish grade.

1.03 SUBMITTALS

A. Submit in accordance with Division 01.

B. Product Data: Submit manufacturer's material safety data, product literature, mixing, and application procedures for soil stabilizer.

A. Submit a one pound Sample and sieve analysis per ASTM C 136 for decomposed granite.

1.04 QUALITY ASSURANCE

A. Comply with the Standard Specifications for Public Works Construction, current edition, except as modified herein.

B. If required during construction, provide evidence to the Architect of successful experience by the installer in the Work of this section.

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not install stabilized decomposed granite during rainy conditions.

1.07 EXCESS MATERIALS

A. Provide the following additional materials for decomposed granite repair, deliver and offload to a designated Owner storage area as required:

40 -50 pound bags of the decomposed granite
1 - 10 pound bag of stabilizer additive

PART 2 - PRODUCTS

2.01 DECOMPOSED GRANITE WITH SOIL STABILIZER

A. Disintegrated granite shall be a naturally decomposed material conforming to Subsection 400-2.3 of the Standard Specifications for Public Works Construction, and shall comply with the following gradations:

Sieve Designation	% Passing
3/8"	100
No. 4	95-100
No. 8	70-80
No. 16	50-70
No. 30	35-50
No. 50	25-35
No. 100	15-25
No. 200	5-15

B. Soil stabilizer shall be a non-toxic, colorless, odorless, organic powder that binds decomposed granite screenings. The stabilizer shall be manufactured by Stabilizer Solutions (800) 336-2468, or equal. Stabilizer shall be blended at the rate of 10 pounds per ton of material. Blending with a bucket loader or similar equipment is not permitted. Stabilizer shall be blended at the manufacturer's recommended rate with a truck mounted mixer or portable mixer for a minimum of 15 minutes.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE

A. The sub-grade shall be graded to an elevation 7" lower in the running track area, and 4" below finish grade in the tree grove courtyard area, than the finish grades indicated on the Drawings. After the running track, straight-aways, and tree courtyard areas are graded to the required elevations, they shall be compacted

and/or rolled as required by Section 02310. Sub-grade shall then be dragged or floated to provide a uniform surface, free from any irregularities.

3.02 INSTALLATION OF CRUSHED AGREGATE BASE

A. A 4" layer of crushed aggregate base material shall be installed in the decomposed granite area. Grade to indicated levels or grades, and roll until the surface is true to line and required section.

3.03 INSTALLATION OF DECOMPOSED GRANITE WITH STABILIZER

A. A 3" finish layer of decomposed granite with stabilizer shall then be spread over the entire track and straightaway to finish grades. The entire surface shall then be moistened to provide full depth moisture penetration. While the stabilized decomposed granite is still thoroughly moist, roll the material with suitable compaction equipment to provide at least 90% relative compaction. Surface shall be filled as required and again rolled to a uniform plane with proper drainage and slopes. Compaction with a wacker or vibratory roller is not permitted.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 02810 - LANDSCAPE IRRIGATION SYSTEM

1.00 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, appliances and necessary incidentals for the complete installation of all landscape irrigation system as shown on the drawings and as specified herein.

1.02 RELATED WORK IN OTHER SECTIONS

A. Landscape finish grading

B. Brick paving

C. Landscape planting

D. Cast-in-place concrete

E. Unit masonry

1.03 QUALITY ASSURANCE AND REQUIREMENTS

A. Permits and fees: The Contractor shall obtain and pay for any and all permits and all observations as required.

B Manufacturer's directions: Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturers of articles used in this contract furnish directions covering points not shown in the drawings and specifications.

C. Ordinances and regulations: All local, municipal and state laws, and rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations or requirements of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.

D. Explanation of drawings:

1. Due to the scale of drawings, it is not possible to indicate all offsets, fittings, sleeves, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all his work and plan his work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and Landscape Architectural features.

2. The word Landscape Architect as used herein shall refer to the Owner's authorized representative.

3. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications.

4. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Owner's authorized representative. In the event this notification is not performed, the irrigation Contractor shall assume full responsibility for any revision necessary.

1.04 SUBMITTALS

A. Material List:

1. The Contractor shall furnish the articles, equipment, materials, or processes specified by name in the drawings and specifications. No substitution will be allowed without prior written approval by the Landscape Architect.

2. Complete material list shall be submitted prior to performing any work. Material list shall include the manufacturer, model number and description of all materials and equipment to be used.

3. Equipment or materials installed or furnished without prior approval of the Landscape Architect may be rejected and the Contractor required to remove such materials from the site at his own expense.

4. Approval of any item, alternate or substitute indicates only that the product or products apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted.

5. Manufacturer's warranties shall not relieve the Contractor of his liability under the warranty. Such warranties shall only supplement the warranty.

B. Record ("As-Built") Drawings:

1. Submit in accordance with Division 01.

2. The Contractor shall provide and keep up to date a complete 'as-built' record set of black line prints which shall be corrected daily and show every change from the original drawings and specifications and the exact 'as-built' locations, sizes, and kinds of equipment. Prints for this purpose may be obtained from the Landscape Architect with the Owners approval at cost. This set of drawings shall be kept on the site and shall be used only as a record set.

3. These drawings shall also serve as work progress sheets and shall be the basis for measurement and payment for work completed. The Contractor shall make neat

and legible annotations thereon daily as the work proceeds, showing the work as actually installed. These drawings shall be available at all times for observation and shall be kept in a location designated by the Landscape Architect.

4. Before the date of the final observation, the Contractor shall transfer all information from the 'as-built' prints to a sepia mylar, procured from the Landscape Architect with Owner's approval at cost. All work shall be neat, in ink, and subject to the approval of the Landscape Architect.

5. The Contractor shall dimension from two (2) permanent points of reference, building corners, sidewalk, or road intersections, etc., the location of the following items:

   a. Connection to existing water lines.

   b. Connection to existing electrical power.

   c. Gate valves.

   d. Routing of irrigation pressure lines (dimension max. 100 ft. along routing).

   e. Irrigation control valves.

   f. Routing of control wiring.

   g. Quick coupling valves.

   h. Other related equipment as directed by the Landscape Architect.

5. On or before the date of the final observation, the Contractor shall deliver the corrected and completed sepias to the Landscape Architect. Delivery of the Record Drawings will not relieve the Contractor of the responsibility of furnishing required information that may be omitted from the prints.

C. Controller Charts:

1. As-built drawings shall be approved by the Landscape Architect before controller charts are prepared.

2. Provide one controller chart for each controller supplied.

3. The chart shall show the area controlled by the automatic controller.

4. The chart is to be a 50% reduced drawing of the actual as-built system. However, in the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced.

5. The chart shall be a blackline or blueline ozalid print and a different color shall be used to indicate the area of coverage for each station.

6. When completed and approved, the chart shall be hermetically sealed between two

pieces of plastic, each piece being a minimum of 10 mils.

7. These charts shall be completed and approved prior to final observation of the irrigation system.

D. Operation and Maintenance Manuals: Prepare and deliver to the Landscape Architect within ten calendar days prior to completion of construction, two hard cover binders with three rings containing the following information:

1. Index sheet stating Contractor's address and telephone number, list of equipment with name and addresses of local manufacturer's representative.
2. Catalog and parts sheets on every material and equipment installed under this contract.
3. Warranty statement.
4. Complete operating and maintenance instruction on all major equipment.
5. In addition to the above mentioned maintenance manuals, provide the Owner's maintenance personnel with instructions for major equipment and show evidence in writing to the Landscape Architect at the conclusion of the project that this service has been rendered.

E. Equipment to be furnished

1. Supply as a part of this contract the following tools:

   a. Two (2) sets of special tools required for removing, disassembling and adjusting each type of irrigation and valve supplied on this project.
   b. Two (2) five ft. long valve keys for operation of gate valves.
   c. Two (2) keys for each automatic controller.
   d. Six (6) quick coupler keys and matching hose swivels for each type of quick coupling valve installed.

2. The above mentioned equipment shall be turned over to the Owner at the conclusion of the project. Before final observation can occur, evidence that the Owner has received material must be shown to the Landscape Architect.

1.05 JOB CONDITIONS

A. Verification of Existing Conditions

1. Visit the site to determine existing conditions, including access to the site and the nature and extent of existing improvements upon adjacent public and private property. Nature of materials to be encountered and other factors that may affect the work of this section.

2. Additional compensation resulting from the alleged ignorance of local conditions, and their effect upon the cost of the work will not subsequently be approved.

B. Protection

1. Protect the Owner's property from injury or loss. All damage to existing property (buildings, utilities, etc.) or planting (trees, shrubs, lawn or ground cover) caused by the Contractor during his operation or as a result of malfunction of installed work during the warranty period shall be repaired at Contractor's expense.

2. Cause minimum interference with workmen, materials, or other equipment of other trades on the project.

C. Irrigation work shall not begin until all construction adjacent to the areas has been completed unless otherwise directed.

D. Contractor shall apply for and secure all required permits.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handling of PVC Pipe and Fittings: The Contractor is cautioned to exercise care in handling, loading, unloading, and storing of PVC pipe and fittings. All PVC pipe shall be transported in a vehicle which allows the length of pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged will be discarded and, if installed, shall be replaced with new piping.

1.07 WARRANTY

A. The warranty for the irrigation system shall be made in accordance with the attached form. The general conditions and supplementary conditions of these specifications shall be filed with the Owner or his representative prior to acceptance of the irrigation system.

B. A copy of the warranty form shall be included in the operations and maintenance manual.

C. The warranty form shall be re-typed onto the Contractor's letterhead and contain the following information:

WARRANTY FOR IRRIGATION SYSTEM

We hereby warranty that the irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defects in material or workmanship which may develop during the period of one year from date of acceptance and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice. In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from the Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

Project
Location
Signed
Address
Phone
Date of Acceptance

2.00 PRODUCTS

2.01 GENERAL

A. Use only new materials or brands and types noted on drawings, specified herein, or approved equals.

2.02 PRESSURE MAIN LINE PIPE AND FITTINGS

A. Pressure main line piping for sizes 2 in. and larger, shall be PVC Class 315.

B. Pipe shall be made from an NSF approved type I, grade I, PVC compound conforming to ASTM resin specification D1784. All pipe must meet requirements as set forth in Federal Specification PS-22-70, with an appropriate standard dimension (S.D.R.). (Solvent weld pipe)

C. Pressure main line piping for sizes 1 ½ in. and smaller shall be PVC schedule 40 with solvent-weld joints.

D. Pipe shall be made from NSF approved type I, grade I, PVC compound conforming to ASTM resin specification D1785. All pipe must meet requirements as set forth in Federal Specification PS-21-70. (solvent-weld pipe).

E. PVC solvent-weld fittings shall be schedule 40, 1-2, II-1 NSF approved conforming to ASTM test procedure D2466.

F. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be of type and installation methods prescribed by the manufacturer.

G. All PVC pipe must bear the following markings:

1. Manufacturer's name.

2. Nominal pipe size.

3. Schedule or class.

4. Pressure rating in P.S.I.

5. NSF (National Sanitation Foundation) approval.

6. Date of extrusion.

H. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable I.P.S. schedule and NSF seal of approval.

2.03 PVC NON-PRESSURE LATERAL LINE PIPING

A. Non-pressure buried lateral line piping shall be PVC class 200 with solvent-weld joints.

B. Pipe shall be made from NSF approved, type I, grade II PVC compound conforming to ASTM resin specification D1784. All pipe must meet requirements set forth in Federal Specification PS-22-70 with an appropriate standard dimension ratio.

C. Except as noted in paragraph A and B of Section 2.03, all requirements for non-pressure lateral line pipe and fittings shall be the same as for solvent-weld pressure mainline pipe and fittings as set forth in section 2.02 of these specifications.

2.04 BRASS PIPE AND FITTINGS

A. Where indicated on the drawings, use red brass screwed pipe conforming to Federal Specification #WW-P-351.

B. Fittings shall be red brass conforming to Federal Specifications #WW-P-460.

2.05 GALVANIZED PIPE FITTINGS

A. Where indicated on the drawings, use galvanized steel pipe ASA schedule 40 mild steel screwed pipe.

B. Fittings shall be medium galvanized screwed beaded malleable iron. Galvanized couplings may be merchant coupling.

C. All galvanized pipe and fittings installed below grade shall be painted with two (2) coats of Koppers #50 Bitumastic.

2.06 QUICK COUPLING VALVES

A. Quick coupling valves shall have a brass one or two piece body designed for working pressure of 150 P.S.I. operable with quick coupler. Key size and type shall be as shown on plans.

B. Quick coupling valves shall be installed from 6 in. to 12 in. from nearest adjacent paved area.

2.07 GATE VALVES - 3" AND SMALLER

A. Shall be 125 lb. SWP bronze gate valve with screw-in bonnet, non-rising stem and solid wedge disc.

B. Shall have threaded ends and shall be equipped with a bronze handwheel.

C. Shall be similar to those manufactured by Nibco or approved equal.

D. All gate valves shall be installed per installation detail.

2.08 CONTROL WIRING

A. Connections between the automatic controllers and the electric control valves shall be made with direct burial copper wire AWG-UF 600 volt. Pilot wires shall be a different color wire for each automatic controller. Common wires shall be white with a different color stripe for each automatic controller. Install in accordance with valve manufacturer's specifications and wire chart. In no case shall wire size be less than #14.

B. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible.

C. Where more than one (1) wire is placed in a trench, the wiring shall be taped together at intervals of ten (10) feet.

D. An expansion curl shall be provided within three (3) feet of each wire connection. Expansion curl shall be of sufficient length at each splice connection at each electric control, so that in case of repair, the valve bonnet may be brought to the surface without disconnection of the control wires. Control wires shall be laid loosely in trench without stress or stretching of control wire conductors.

E. All splices shall be made with Scotch-Lok #3576 connector sealing packs, Rainbird Snap-Tite wire connector, or approved equal. Use one splice per connector sealing pack.

F. Field splices between the automatic controller and electrical control valves will not be allowed without prior approval of the Landscape Architect.

2.09 CHECK VALVES

A. Swing check valves 2 in. and smaller shall be 200 lb. W.O.G. bronze construction with replaceable composition, neoprene or rubber disc and shall meet or exceed Federal Specification WW-V-51D, Class A, Type IV. Install when required to prevent any low head drainage.

B. Anti-drain valves shall be of heavy duty virgin PVC construction with F.I.P thread inlet and outlet. Internal parts shall be stainless steel and neoprene. Anti-drain valve shall be field adjustable against drawout from 5 to 40 feet of head. Anti-drain valve shall be similar to the Valcon 'ADV' or approved equal. Install when required to prevent any low head drainage.

2.10 TRICKLE DRIP EMITTERS AND EMITTER TUBING

A. Emitter body shall be manufactured of 20% glass-filled polypropylene and have an inlet barb. Flow shall be regulated through a silicone flapped diaphragm with a flow path of 1/4 in. The emitter shall pressure compensate for rated flow ±10% over a pressure variant of 10 to 50 PSI. It shall be similar to those manufactured by Global Water Systems, Inc., 7341 Whittier Blvd, Whittier, California. (213) 945-2287. Refer to irrigation drawings for

emitter size and type.

B. Tubing for emitter systems shall be virgin polyethylene extruded from Union Carbine Bakelite resin #60-80 or #75-10. The ½ in. tubing shall have an I.D. of .580 inches and an O.D. of .690 inches. The 1/8 in. tubing shall have an I.D. of .125 inches and an O.D. of .195 inches. Tubing shall be similar to that manufactured by Global Water Systems, Inc.

C. Fittings for emitter tubing shall be molded from specially formulated ultra high heat resistant polypropylene plastic material. Fitting for emitter tubing shall be similar to Agricultural Products, Inc. 'compression line fittings'. Use AG Products #CA adapter and #CAA adhesive when connecting emitter tubing to ½ in. PVC slip socket fittings.

2.11 AUTOMATIC CONTROLLERS

A. Automatic controllers shall be of size and type shown on the plans.

B. Final location of automatic controllers shall be approved by the Landscape Architect.

C. Unless otherwise stated on the plans, the 120 volt electrical power to the automatic controller location shall be furnished by others. The final electrical hook-up shall be the responsibility of the irrigation Contractor.

2.12 ELECTRIC CONTROL VALVES

A. All electric control valves shall have a manual flow adjustment.

B. Provide and install one control valve box for each electric control valve.

2.13 BACKFLOW PREVENTION UNITS

A. Backflow prevention units shall be of size and type indicated on the irrigation drawings. Install backflow prevention units in accordance with irrigation construction details.

B. Wye strainers at backflow prevention units shall have a 125 lb flanged cast iron with 30 mesh monel screen and shall be similar to Bailey #100A or approved equal.

2.14 CONTROL VALVE BOXES

A. Use 10 in. x 10 1/4" round valve box with extension and bolt down cover for all gate valves, Carson Industries 910-12B or approved equal. Extension sleeve shall be PVC - 6" minimum size.

B. Use 9-1/2 in. x 16 in. x 11 in. rectangular box for all electrical control valves, Carson Industries 1419-12B with green bolt down cover or approved equal.

C. All electric control valve boxes shall have controller and valve station numbers embossed on top of cover.

2.15 IRRIGATION HEADS

A. All irrigation heads shall be of the same size, type, and deliver the same rate of precipitation with the diameter (or radius) of throw, pressure, and discharge as shown on the plans and/or specified in these special provisions.

B. Spray heads shall have a screw adjustment.

C. Riser units shall be fabricated in accordance with the details shown on the plans.

D. Riser nipples for all sprinkler heads shall be the same size as the riser opening in the sprinkler body.

E. All irrigation heads of the same type shall be of the same manufacturer.

3.00 EXECUTION

3.01 OBSERVATION

A. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions and receive Landscape Architect's approval prior to proceeding with work under this section.

B. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities which are caused by his operations or neglect. Check existing utilities drawings for existing utility locations.

C. Coordinate installation of irrigation materials, including pipe, so there shall be no interference with utilities or other construction or difficulty in planting trees, shrubs, vines, and ground cover.

D. The Contractor shall carefully check all grades to satisfy himself that he may safely proceed before starting work in the irrigation system.

3.02 PREPARATION

A. Physical Layout:
   1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of irrigation heads.

   2. All layout shall be approved by Landscape Architect prior to installation.

B. Water Supply:

1. Irrigation system shall be connected to water supply points of connection as indicated on the drawings.

2. Connections shall be made at approximate locations as shown on drawings. Contractor is responsible for minor changes caused by actual site conditions.

C. Electrical Supply:

1. Electrical connections for automatic controller shall be made to electrical points of connection as indicated on the drawings.

2. Connections shall be made at approximate locations as shown on drawings. Contractor is responsible for minor changes caused by actual site conditions.

3.03 INSTALLATION

A. Trenching:

1. Dig trenches straight and support pipe continuously on bottom of trench. Lay pipe to an even grade. Trenching excavation shall follow layout indicated on drawings and as noted.

2. Provide for a minimum cover of twenty four (24) inches for all pressure main line piping 4 in. and larger and for a minimum cover of eighteen (18) inches for all pressure main line piping 3 in. and smaller

3. Provide for a minimum cover of twelve (12) inches for all non-pressure lines.

4. Provide for a minimum cover of eighteen (18) inches for all control wiring.

B. Backfilling:

1. The trenches shall not be backfilled until all required tests are performed. Trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, or other approved materials, free from large clods of earth or stones. Backfill shall be mechanically compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill will conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.

2. A fine granular material backfill will be initially placed on all lines. No foreign matter larger than ½ in. in size will be permitted in the initial backfill.

3. Flooding of trenches will be permitted only with approval of Landscape Architect.

4. If settlement occurs and subsequent adjustments in pipe, valves, irrigation heads, lawn or planting, or other construction are necessary, the Contractor shall make all required adjustments without cost to the Owner.

C. Trenching And Backfill Under Paving:

1. Trenches located under areas where paving, turfblock, asphaltic concrete or concrete, will be installed shall be backfilled with sand - a layer 6 in. below the pipe

and 3 in. above the pipe - and compacted in layers to 95% compaction, using manual or mechanical tamping devices. Trenches for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in a firm unyielding condition. All trenches shall be left flush with the adjoining grade. The Contractor shall set in place, cap and pressure test all piping under paving prior to the paving work.

2. Generally, piping under existing walks is done by jacking, boring or hydraulic driving, but where any cutting or breaking of sidewalks and/or concrete is necessary, it shall be done and replaced by the Contractor as part of the contract cost. Permission to cut or break sidewalks and/or concrete shall be obtained from the Landscape Architect. No hydraulic driving will be permitted under concrete paving.

3. Provide for a minimum cover of eighteen (18) inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.

D. Assemblies:

1. Routing of irrigation lines as indicated on the drawings is diagrammatic. Install lines (and various assemblies) in such a manner as to conform with the details per plans.

2. Install no multiple assemblies on plastic lines. Provide each assembly with its own outlet.

3. Install all assemblies specified herein in accordance with respective detail. In absence of detail drawings or specifications pertaining to specific items required to complete work, perform such work in accordance with best standard practice with prior approval of Landscape Architect.

4. PVC pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.

5. On PVC to metal connections, the Contractor shall work the metal connections first. Teflon tape or approved equal, shall be used on all threaded PVC to PVC, and on all threaded PVC to metal joints. light wrench pressure is all that is required. Where threaded PVC connections are required, use threaded PVC adapters into which the pipe may be welded.

E. Line Clearance: All lines shall have a minimum clearance of 6 in. from each other and from lines of other trades. Parallel lines shall not be installed directly over one another.

F. Automatic Controller: Install in accordance with manufacturer's instructions. Remote control valves shall be connected to controller in numerical sequence as shown on the drawings.

G. High Voltage Wiring For Automatic Controller:

1. 120 volt power connection to the automatic controller shall be provided by the Contractor.

2. All electrical work shall conform to local codes, ordinances, and union authorities having jurisdiction.

H. Remote Control Valves: Install where shown on drawings and details. When grouped together, allow at least 12 in. between valves. Install each remote control valve in a separate valve box.

I. Flushing Of System

1. After all new irrigation pipe lines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of irrigation heads, the control valves shall be opened and a full head of water used to flush out the system.

2. Irrigation heads shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the Landscape Architect.

J. Irrigation Heads:

1. Install the irrigation heads as designated on the drawings. Irrigation heads to be installed in this work shall be equivalent in all respects to those itemized.

2. Spacing of heads shall not exceed the maximum indicated on the drawings. In no case shall the spacing exceed the maximum recommended by the manufacturer.

3.04 TEMPORARY REPAIRS

A. The Owner reserves the right to make temporary repairs as necessary to keep the irrigation system equipment in operating condition. The exercise of this right by the Owner shall not relieve the Contractor of his responsibilities under the terms of the warranty as herein specified.

3.05 EXISTING TREES

A. Where it is necessary to excavate adjacent to existing trees, the Contractor shall use all possible care to avoid injury to trees and tree roots. Excavation in areas where two (2) inch and larger roots occur shall be done by hand. All roots two (2) inches and larger in diameter, except directly in the path of pipe or conduit, shall be tunneled under and shall be heavily wrapped with burlap, to prevent scarring or excessive drying. Where a ditching machine is run close to trees having roots smaller than two (2) inches in diameter, the wall of the trench adjacent to the tree shall be hand trimmed, making clean cuts through. Roots one-half (½) inch and larger in diameter shall be painted with two coats of tree seal, or equal. Trenches adjacent to trees should be closed within twenty four (24) hours; and where this is not possible, the side of the trench adjacent to the tree shall be kept shaded with burlap or canvas.

3.06 FIELD QUALITY CONTROL

A. Adjustment of the System:

1. The Contractor shall flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible.

2. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, the Contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required.

3. Lowering raised irrigation heads by the Contractor shall be accomplished within ten (10) days after notification by Owner or Landscape Architect.

4. All irrigation heads shall be set perpendicular to finished grades unless otherwise designated on the plans.

B. Testing of Irrigation System:

1. The Contractor shall request the presence of the Landscape Architect in writing at least 48 hours in advance of testing.

2. Test all pressure lines under hydrostatic pressure of 150 lbs. per sq. inch, and prove watertight.
NOTE: Testing of pressure main lines shall occur prior to installation of electric control valves.

3. All piping under paved areas shall be tested under hydrostatic pressure of 150 lbs. per sq. inch, and proved watertight, prior to paving.

4. Sustain pressure in lines for not less than two (2) hours. If leaks develop, replace joints and repeat test until entire system is proven watertight.

5. All hydrostatic tests shall be made only in the presence of the Landscape Architect. No pipe shall be backfilled until it has been observed, tested and approved in writing.

6. Furnish necessary force pump and all other test equipment.

7. When the irrigation system is completed, perform a coverage test in the presence of the Landscape Architect, to determine if the water coverage for planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate, without bringing this to the attention of the Landscape Architect. This test shall be accomplished before any ground cover is planted.

8. Upon completion of each phase of work, entire system shall be tested and adjusted to meet site requirements.

3.07 MAINTENANCE

A. The entire irrigation system shall be under full automatic operation for a period of seven (7) days prior to any planting and for sixty (60) days after observation to begin maintenance period.

B. The Landscape Architect reserves the right to waive or shorten the operation period.

3.08 CLEAN-UP

A. Clean-up shall be made as each portion of work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down, and any damage sustained on the work of others shall be repaired to original conditions.

3.09 FINAL OBSERVATION PRIOR TO ACCEPTANCE

A. The Contractor shall operate each system in its entirety for the Landscape Architect at time of final observation. Any items deemed not acceptable by the observer shall be reworked to the complete satisfaction of the Landscape Architect.

B. The Contractor shall show evidence to the Landscape Architect that the Owner has received all accessories, charts, record drawings, and equipment as required before final observation can occur.

3.10 OBSERVATION SCHEDULE

A. Contractor shall be responsible for notifying the Landscape Architect in advance for the following observations, according to the time indicated:

1. Pre-job conference - 7 calendar days.

2. Pressure supply line installation and testing - 48 hours.

3. Lateral line and sprinkler installation - 48 hours.

4. Coverage test - 48 hours.

5. Observation to begin maintenance period - 7 calendar days.

6. Final observation coverage test - 7 days.

B. When observations have been conducted by other than the Landscape Architect, show evidence of when and by whom these observations were made.

C. No observations will commence without as-built drawings. In the event the Contractor calls for an observation without as-built drawings, without completing previously noted corrections, or without preparing the system for observation, he shall be responsible for reimbursing the Landscape Architect at the rate of two and one-half times the normal office

hourly rate per hour portal to portal (plus transportation costs) for the inconvenience. No further observations will be scheduled until this charge has been paid.

END OF SECTION

SECTION 02890 POST-MOUNTED SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, Special Conditions and Division 1.

B. Section Includes:
1. Traffic entry warning signs.
2. Parking space signs.
3. Circulation Path Signs.

1.02 REFERENCES

A. American Society for Testing and Materials.
1. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
2. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

B. California Code of Regulations.
1. CBC - Part 2, Title 24, CCR, 2001 California Building Code (CBC), (1997 Uniform Building Code Volumes 1-3 and 2001 California Amendments) – Chapter 11B Accessibility.

C. Americans with Disibilities Act.
1. ADA – Title III.

D. Federal Specifications.
1. FED-STD-595 - Colors used in Government Procurement.

1.03 SUBMITTALS

A. Submit under provisions of Section 01330.

B. Submit product data listing sign styles, lettering and locations and overall dimensions of each sign.

C. Submit three samples illustrating full size sample sign, of type, style and color specified.

1.04 REGULATORY REQUIREMENTS

A. Comply with CBC Chapter 11B and ADA for provisions of the physically disabled.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store and protect products until installation.

PART 2 - PRODUCTS

2.01 CONSTRUCTION

A. Post mounted and wall mounted signs shall be fabricated from 16 gage enameling iron with porcelain enamel finish.

B. Mount signs to posts with minimum two 3/16 inch diameter round head bolts with tamperproof nuts, galvanized.

C. Posts: ASTM A53; two-inch diameter galvanized steel pipe weighing a minimum of 3.65 lbs per foot schedule 40 or 2 by 2 inch galvanized steel tubing, weighing a minimum of 4.31 lbs per foot and complying with ASTM A500, grade B, 3/16 inch thick wall thickness.

2.02 TRAFFIC ENTRY WARNING SIGNS

A. Single post mount, not less than 17 by 22 inches with white reflectorized copy on blue background complying with No. 15090, FED-STD 595, one inch high letters shall read: "Unauthorized vehicles parked in designated accessible spaces not displaying distinguishing placards or license plates issued for persons with disabilities may be towed away at owner's expense. Towed vehicles may be reclaimed at the Chula Vista Police Department or by telephoning(619) 691-5151."
   1. All information shall be part of permanent fabrication of sign. See architectural detail for information.

B. Missing information is on Drawings.

C. Position sign in a conspicuous location immediately adjacent to each entrance to off-street parking facility or immediately adjacent to and visible from each stall or space, or as indicated on the Drawings.
   1. Verify and coordinate sign locations to prevent conflict with underground utilities.

D. Sign shall be mounted 80 inches from bottom of sign to the adjacent finish grade, ground or sidewalk or as shown on the Drawings.

2.03 PARKING STALL SIGNS

A. Single post mount, not less than 70 square inches with white reflectorized copy on blue background complying with No. 15090, FED-STD 595B. Sign shall display the international symbol of accessibility in white on blue background.

B. Position one sign at the end of each parking space designated for disabled usage.

C. One in every eight spaces, but not less than one, also shall display a "Van Accessible" sign below the symbol of accessibility. Comply with layout indicated on Drawings for number, type, spacing and location of parking stall signs.

D. Sign shall be mounted 80 inches from bottom of sign to finish grade of parking space or centered on wall at interior end of parking space at a minimum height of 36 inches above the parking space, finished grade, ground or sidewalk.

2.04 Circulation Path Signs:

A. Circulation path signs leading from public right of ways, public transportation, and/or parking lots that are not accessible or do not lead to accessible entrances to the building, shall be located at decision points directing people with disabilities to the accessible routes and/or entrances. Signs shall include the ISA. (ANSI 117.1. 703.7) Such signs shall be installed so those steps will not have to be retraced. (CBC 1117B.5.7).

B. Accessible Path of Travel Signs:

1. 0.080 inch aluminum rounded corners; white on dark blue background; non-glare, high contrast signs. ISA minimum 4-1/2 inches high, conforming to ANSI 117.1-1198 (703.7). Text to conform to ANSI 117.1 (703.4). H. Toji and Company Style 3.1, or equal.
2. Sign to be mounted on post or wall with the lower edge of the sign between 48 inches and 60 inches above the ground or surface.

C. Other Informational and Directional Signs: Signs to be non-glare and high contrast. Text to conform to ANSI 117.1 (703.4). H. Toji and Company Style 3.1, or equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Beginning of installation means installer accepts existing surfaces.

3.02 INSTALLATION

A. Set posts in concrete base per Drawings.

B. Signs set in asphaltic paving surfaces or concrete sidewalks shall be mounted in core drilled holes minimum 12 inch diameter, 18 inches deep with top of base flush to finish.

C. Signs mounted to walls shall be attached firmly with appropriate, non-corrosive, vandal-proof fasteners. Seal all holes in substrate water tight.

D. Clean and polish.

END OF SECTION 02890

SECTION 02900 - LANDSCAPE PLANTING

1.00 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, appliances and necessary incidentals for the complete installation of all landscape planting as shown on the drawings and as specified herein. Work includes, but is not limited to, the following:

1. Furnish and install import soil, backfill mix, acid loving plant backfill mix and raised planter mix in planting areas indicated on plans and in specifications.

2. Apply pre-emergent to planting areas as specified herein.

3. Fine grading

4. Soil preparation and fertilization.

5. Furnish trees, shrubs, vines and ground covers.

6. Install trees, shrubs and ground covers.

7. Stake and/or guy trees.

8. Attach vines as directed.

9. Plant new lawn (hydraulic seeding)

10. Mulching

11. Furnish and install (metal landscape edging)

12. Install jute matting on all slopes 2:1 and steeper.

13. Install decomposed granite.

14. Protect, maintain and warranty as specified.

15. All work of every description mentioned in the specification and/or amendments thereto, and all other satisfactory completion of the work including clean-up of the site.

1.02 RELATED WORK IN OTHER SECTIONS

A. Finish grading

B. Landscape irrigation

1.03 QUALITY ASSURANCE

A. Soils testing for planting areas shall be performed by District approved Laboratory.

B. The testing laboratory for soils analysis shall use the following criteria for soil testing:

1. USDA Agricultural Suitability test per Handbook-60.

2. University of California Soil Fertility test.

3. Interpretation, recommendations, and comments regarding these tests are required.

C. A soils analysis of existing on-site soils shall be required.

1. There shall be 5 areas throughout the site. At each sampling area there shall be 2 core samples taken. Suitability and fertility analyses with comments and recommendations shall be required for each sample.

D. The Contractor shall perform all the soil testing of the existing on-site soil after the completion of rough grading and submit the testing laboratory's interpretation, recommendations, and comments to the Landscape Architect within 14 days.

E. A soils analysis of import soil, raised planter mix and organic amendment shall be required prior to backfill.

1. One quart of import soil, without specified amendments, shall be submitted for particle size, suitability and fertility analyses. Two quarts of the custom lightweight soil mix shall be submitted for organic analyses. Two quarts each of sphagnum peat moss, organic amendment, and fine sand for backfill mix and on-grade plantings shall be submitted for organic and particle size analyses. Do not mix.

F. After the completion of planting in the soil preparation areas and on-grade backfill mix areas, soil testing shall be conducted for organic suitability. The Contractor shall submit to the testing laboratory the original amendment specification with all issued bulletins for soil amendments and installation procedures along with 5 random samples of soil preparation areas and 5 random samples of backfill mix areas for analysis. Fertility analyses, recommendations, and interpretation shall be required from the testing laboratory to assure all specified amendments have been provided.

G. Backfill for acid loving plants shall be sampled after mixing and delivery to the site but prior to backfilling. The Contractor shall submit to the testing laboratory the original acid loving plant backfill mix specifications with all issued bulletins and one quart of backfill mix for every 25 cubic yards of organic and fertility analyses. Fertility analyses, recommendations and interpretation shall be required from the testing laboratory to assure all specified amendments have been provided.

H. The Contractor shall perform all soil testing of the backfill mix, acid loving plant mix and raised planter mix and submit the soil testing laboratory's findings to the Landscape Architect within a minimum of 5 days prior to backfilling.

I. Samples of materials shall be submitted for observation. Delivery may begin upon approval of samples. Material samples shall include fertilizers and soil conditioners, plants and any other materials indicated herein.

J. The Contractor shall furnish a certificate of delivery slip with each delivery of material in containers or in bulk. Certificate shall state source, quantity, or weight, type and analysis and date of delivery. Deliver all certificates to the Landscape Architect.

K. No substitutions will be permitted without the approval of the Owner's authorized Representative. Rejected materials shall be removed from the site by the Contractor.

L. The Contractor shall warranty shrubs and hydroseeded ground covers for a period of six months and trees for one year from date of final acceptance.

1.04 SUBMITTALS

A. The Contractor shall furnish the articles, equipment, materials, or processes specified by name in the drawings and specifications. No substitution will be allowed without prior written approval by the Landscape Architect.

B. Complete material list shall be submitted prior to performing any work. Material list shall include the manufacturer, model number and description of all materials to be used.

C. Materials installed or furnished without prior approval of the Landscape Architect may be rejected and the Contractor required to remove such materials from the site at his own expense.

D. Approval of any item, alternate or substitute indicates only that the product or products apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted.

E. Manufacturer's warranties shall not relieve the Contractor of his liability under the warranty. Such warranties shall only supplement the warranty.

1.05 JOB CONDITIONS

A. Visit the site to determine existing conditions, including access to the site and the nature and extent of existing improvements upon adjacent public and private property, as well as materials and other factors to be encountered that may affect the work of this section.

B. Additional compensation resulting from the alleged ignorance of local conditions, and their effect upon the cost of the work will not subsequently be approved.

C. Protect the Owner's property from injury or loss. All damage to existing property (buildings, utilities, plantings, etc.) caused by the Contractor during his operation or as a result of malfunction of installed work during the warranty period shall be repaired at Contractor's expense.

D. Cause minimum interference with workmen, materials, or other equipment of other trades on the project.

E. Landscape work shall not begin until all construction adjacent to the planting areas has been completed and until the irrigation systems have been installed and approved by the Landscape Architect and the Owner's designated representative.

F. Contractor shall apply for and secure all required permits.

2.00 PRODUCTS

2.01 MANUFACTURER: It is the intent of this specification that all materials herein specified and shown on the drawings shall be of the highest quality available and meet the requirements specified.

2.02 SOIL MATERIALS

A. Import Soil: Furnish all import soil necessary to complete the required planting of on-grade planting areas and for backfill and raised planter mix as indicated:

1. Silt plus clay content of the import soil shall not exceed 15% by weight with a minimum 95% passing the 2.0 millimeter sieve.

2. The sodium absorption ratio (SAR) shall not exceed 6.

3. The electrical conductivity (EC) of the saturation extract of this soil shall not exceed 3.0 millimhos per centimeter at 25 degrees centigrade.

4. The boron content of this soil shall be no greater than one part per million as measured on the saturation extract.

5. Samples of the import soil shall be submitted to the soils testing laboratory for analysis, interpretation, and recommendations prior to blending or backfilling.

B. Organic Amendment

1. Humus material shall have an ash content of no less than 8% and no more than 50%.

2. The pH of the material shall be between 6 and 7.5.

3. The salt content shall be less than 10 millimhos/cm @ 25 degrees C. (ECe less than 10) on a saturated paste extract. If the ECe exceeds 10 millimhos/cm, the maximum rate of use shall not exceed 15% by volume.

4. Boron content of the saturated extract shall be less than 1.0 parts per million.

5. Silicon content (acid-insoluble ash) shall be less than 20%.

6. Calcium carbonate shall not be present if to be applied on alkaline soils.

7. Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, sludges, peat mosses, etc., low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.

8. Composted wood products are conditionally acceptable stable humus must be present. Wood-based products are not acceptable which are based on redwood or cedar.

9. Sludge-based materials are not acceptable if the soil already has a high level (toxic level) of zinc, copper, or other heavy metals based on soil analysis.

10. Carbon: nitrogen ratio is less than 25:1.

11. The compost shall be aerobic without malodorous presence of decomposition products.

12. The maximum particle size shall be 0.5", 80% or more shall pass a No. 4 screen.

    Maximum total permissible pollutant concentrations in amendment in parts per million on a dry weight basis:

Arsenic	20
Mercury	10
Cadmium	15
Molybdenum	60
Chromium	100
Nickel	100
Cobalt	50
Selenium	30
Copper	150
Silver	10
Lead	100
Vanadium	50

13. Samples of the organic amendment shall be submitted to the soils testing laboratory for analysis, interpretation, and recommendations prior to blending or backfilling, as outlined in 1.03 Quality Assurance in this Section. Pending approval from the soils lab, suppliers of acceptable products are:

    a. Earth Works - composted washed steer manure. 310/322-9702.
    b. Auinaga Fertilizer Co. Forest Floor Humus. 949/786-9558.
    c. Foster Farms - compost. 209/394-7901.

D. Sand: A single sand source shall be used. The sand must pass the following gradation and chemical specifications:

1. Particle size distribution (USDA sand classification) #16 sand.

Sieve No. (US Standard) Passing	Percent Dry Weight
10	100
16	65-100
20	0-20

35	0-5
40	0-2

2. Soluble Salts: Maximum 3.0 dS/m at 25 degrees C. as determined in saturation extract.

3. Sodium Absorption Ratio (SAR): Maximum 6.0 at 25 degrees C. as determined in saturation extract.

4. Boron: Maximum 1 ppm at 25 degrees C as determined in saturation extract.

5. Samples of the import sand shall be submitted to the soils testing laboratory for analysis, interpretation, and recommendations prior to blending or backfilling.

E. Peat:

1. Milled Canadian sphagnum peat, light brown and fibrous without excessive sticks. Peat moss shall have a ph of not less than 5, and have an organic content of not less than 90% (L.O.I.)

F. Vermiculite: Horticultural vermiculite shall be medium sized, clean, odorless, nontoxic and sterile with a pH of 7.0-8.5.

G. Triple super phosphate (0-45-0) granular commercial grade.

H. Potassium sulfate (0-0-50) granular commercial grade.

I. Urea-formaldehyde (38-0-0) commercial grade.

J. Calcium Carbonate: 95% lime as derived from oyster shells.

K. Gypsum: Agricultural grade containing minimum 98% calcium sulfate.

L. Commercial fertilizer: As specified by soils testing laboratory. Deliver in sacks, with a manufacturer's label attached to each sack, which lists weight and analysis.

M. Soil sulphur shall be agricultural grade, containing a minimum 99% sulphur.

N. Ferrous iron sulfate shall be first quality commercial grade; ground ferrous sulphate containing a minimum 18.5% iron expressed as metallic.

O. Root hormone shall be "Super Thrive."

P. Planting tablets shall be NPK 20-10-5, 21 gram and 5 gram fertilizer tablets.

Q. Gro-Power materials shall be first quality commercial grade as manufactured by Gro-Power, Inc., 15065 Telephone Avenue, Chino, CA 91710-9614. 800/473-1307 or 909/393-3744. FAX: 909/393-2773.

R. Soil drain/PAM: As manufactured by Complete Green (310/640-6815) applied in accordance with manufacturer's recommendations.

2.03 PRE-EMERGENT WEED CONTROL

A. Pre-emergent herbicide shall be as recommended by a licensed pest control advisor and as accepted by the Owner's agricultural testing laboratory.

1. Pre-emergent herbicide products include: Ronstar, Treflan, Eptam, Vegitex or equal.

2. Fungicide/Insecticides include Subdue 2-E and Bayleton.

2.04 LAWN MATERIALS

A. Hydraulic Seeding

1. Seed shall be fresh, clean, new crop seed, premixed by mechanical mixer to proportions specified. Minimum purity and germination as follows:

	Proportion	Purity	Germination
Dwarf fescue	95%	95%	95%

2. Hydraulic mulch shall be 'Turfiber.'

3. Soil stabilizer shall be Ecology Controls M-Binder. Spread at a rate of 80 lbs. per one acre.

4. Fertilizer shall be 17-13-5 urea formaldehyde first quality commercial grade.

5. For those areas that have been soil prepped, apply 320 lbs. of Gro-Power Hi-Nitrogen 14-4-9 per acre in slurry.

6. Seed shall be mixed by dealer and furnished with dealer's warrantied statement of composition and percent of purity, which shall be delivered to the Landscape Architect.

2.05 PLANT MATERIALS

A. Plant materials shall be furnished where applicable (except for Owner-supplied trees) by the Contractor in quantities, sizes, and/or spacing as indicated or noted for each location and shall be of species, types, etc., as symbolized and described in the plant list.

B. Plants shall be protected in transit and after delivery to the project site. Plants in broken containers will not be accepted, and plants with broken branches or injured trunks will be rejected.

C. Plants that are specified by container size shall be first class material equal to the size of similar material in local retail nurseries.

D. All plant materials shall be healthy, vigorous, with a good root system, and shall be free from pests or disease. All plant material shall have been observed and released by the County Agricultural Inspector prior to delivery to the job.

E. Palm trees: Palms shall have a square root ball with a minimum of 18" from trunk to edge of root ball at each side. The intent is to anchor tree with the square root ball. Retain six fronds minimum on head of palm and as accepted by Owner.

F. All ground cover plants shall be well rooted in flats or containers.

G. Plant material shall be observed and approved by Landscape Architect prior to their placement for planting. Materials not up to specifications will be rejected.

H. The Contractor shall warranty shrubs and hydroseeded ground covers for a period of six months and trees for one year from date of final acceptance.

2.06 MULCH

A. Mulch shall be Eco Mulch, 100% recycled above ground tree trimmings, screened and sized from 3" to 3/8". Supplied by Earthwise Products, 2515 Pioneer Avenue, Suite 6, Vista, CA. 760/599-4156.

Note: Mulch shall be certified by manufacturer to be free of weed seed, herbicides, fungus, and other deleterious material.

2.07 METAL LANDSCAPE EDGING

A. Metal headers shall be constructed of 3/16" x 5-1/2" black ribbed aluminum that is anodized with electrically absorbed dyes as manufactured by: Permaloc Aluminum Edging, 13505 Barry Street, Holland, MI 49424. 616/399-9600 or 800/356-9660.

B. Stakes: Same material and finish and manufacturer as edging.

2.08 TREE GUYING MATERIAL (ON-GRADE)

A. Tree Guys: Tree guys shall be white vinyl-coated galvanized wire with galvanized cable clamps and galvanized turnbuckle, eye-to-eye type with welded eyes; number of guys shall be per details. Where guy ties to tree, tie to be covered with hose as specified to protect the tree. Sizes for vinyl-coated wire are as follows:

1. For trees less than 3" caliper: 1/16 (7x7) white vinyl-coated galvanized wire with 1/16 galvanized cable clamps and 3/8" x 6" galvanized turnbuckle.

2. For trees 3" caliper to less than 6" caliper: 1/8 (7x7) white vinyl-coated galvanized wire with 1/8 galvanized cable clamps and 3/8" x 6" galvanized turnbuckle.

3. For trees 6" caliper to less than 10" caliper: 3/16 (7x7) white vinyl-coated galvanized Aircraft cable with 3/16 galvanized cable clamps and 3/8" x 6" galvanized turnbuckle.

4. For trees with 10" caliper or larger caliper: 5/16 (7x9) galvanized wire with 5/16 galvanized cable clamps and 1/2" x 6" galvanized turnbuckle.

B. Anchors (deadmen): Shall be aluminum anchors as manufactured by Duckbill (800/325-5360). All connections for the Duckbill aluminum earth system to be factory assembled. Follow manufacturer's recommendations for installation of anchors with hand drive rods and power equipment drive rods (where applicable). Sizes are as follows by tree caliper:

Less than 3" caliper:	Model No. 40-Db1
3" to less than 6" caliper:	Model No. 68-Db1
6" to less than 10" caliper	Model No. 88-Db1
10" caliper and larger caliper:	Model No. 138-Db1

C. Hose for covering wires shall be 3/4" reinforced black rubber garden hose and a minimum 12" length.

D. Flags shall consist of 1/2" diameter, white semi-rigid plastic tubing, 5' long.

2.09 TREE STAKING MATERIALS (LODGE-POLE PINE)

A. Stakes shall be Lodge Pole Pine, treated with copper napthanate wood preservative in accordance with Federal spec TT-W-572, Type I, composition B. Minimum nominal size, diameter times length as required in the staking detail, pointed at one and with no splits.

B. Ties shall be Wonder-Tree ties as manufactured by Alden Enterprises, 151 Ninth Avenue, Unit U, City of Industry, CA 91746. 818/336-3517.

2.10 VINE TIES

A. For wall surfaces: Clear plastic "Stik-N-Ty" garden wall tie as manufactured by Dexol.

2.11 EROSION CONTROL FABRIC - JUTE MATTING

A. Natural colored jute matting. Jute matting which has been impregnated with chemicals to retard decay shall not be acceptable.

2.12 DECOMPOSED GRANITE PAVING

A. Stone Fines

1. Stone fines material from Gail Materials, 1256 Magnolia Avenue, Corona, CA 92879-2027 (909) 279-1095, will be selected from one of the following:

   a. California Gold
   b. Temescal Gold
   c. Graphite Gray
   d. Desert Coral
   e. Desert Mauve
   f. Desert Red

2. Stone fines grading - ASTM C 136 methodology (Cal Trans 202)

Screen Size	Percent Passing by Weight
1/2"	100
3/8"	90 to 100
No. 4	50 to 90
No. 30	25 to 55
No. 100	10 to 20
No. 200	5 to 18

Sone fines shall have a minimum sand equivalent of 30 as determined by the ASTM D 2419 methodology (Cal Trans 217), and a minimum R-Valve of 70 as determined by ASTM D 2488 methodology (Cal Trans 301).

3. Aggregate Binder: The aggregate binder shall be a natural, non-toxic, non-staining, odorless, environmentally safe powder consisting of 95% Psyllium with a 70% mucilliod content. The powder shall be of a size that not more than 10% is retained on a U.S. Standard #40 mesh sieve. The powder binder shall be with color to match stone as manufactured by Stabilizer, Inc., 4832 East Indian Lane, Phoenix, AZ 85018. 800/336-2438 or 602/837-8038.

3.00 EXECUTION

3.01 SOIL PREPARATION

A. Soil for planting shall be free of rocks over 1/2" in diameter, and free of foreign debris, refuse, plants or roots, clods, weeds, sticks, solvents, petroleum products, concrete, base rock, or other deleterious or undesirable and unwanted materials. Soil shall be free of soil-borne diseases and capable of sustaining healthy plant life. Materials not meeting such requirements shall be removed, including all temporary road bases or pavement already in place.

B. All on-grade planting areas with a slope gradient of less than 2-1/2:1 shall be cross-ripped to a depth of 10" to 12" in two directions and receive per 1,000 square feet of area the following:

Ammonium nitrate (34-0-0)	3 lbs.
Potassium sulphate (0-0-50)	6 lbs.
Triple superphosphate (0-45-0)	5 lbs.
Agricultural gypsum	50 lbs.
Organic amendment	3 cu.yds.

Note: Areas to be planted that are densely compacted, 85% to 90%, shall be cross-ripped to 12" depth. Areas over 90% compacted shall be cross-ripped to 24" depth, and all unacceptable materials removed.

C. Broadcast uniformly and rototill into upper 4-6 inches of soil.

D. Samples of the native soil shall be submitted to the soils testing laboratory after rough grading and prior to soil preparation. On receipt of a soils analysis and recommendations, an addendum or bulletin to these specifications shall be issued if revision to the soil

treatment is necessary. Refer to 1.03 Quality Assurance in this section for soil testing procedure.

E. Upon completion of soil preparation, an additional soil testing shall be conducted as outlined in 1.03 Quality Assurance in this section.

3.02 ON-GRADE BACKFILL MIX

A. Backfill mix for plant pits shall be of the following material per ten yards:

Ammonium nitrate (34-0-0)	1/4 lb.
Potassium sulphate (0-0-50)	1/3 lb.
Triple superphosphate (0-45-0)	1/4 lb.
Agricultural gypsum	2 lbs.
Organic amendment	15% by volume

B. Samples of the native soil shall be submitted to the soils testing laboratory prior to blending of backfill mix. On receipt of a soils analysis and interpretation, and recommendations, an addendum or bulletin to these specifications shall be issued if revisions to the soil treatment are necessary. Refer to 1.03 Quality Assurance in this section for soil testing procedure.

C. Upon completion of backfill mix blending and prior to installation, an additional soil testing shall be conducted as outlined in 1.03 Quality Assurance in this section.

D. The above material should be uniformly blended prior to use. Incorporate as specified under "tree, shrub and vine planting" herein.

3.03 BACKFILL MIX FOR ACID LOVING PLANTS

A. Planters with acid loving plants shall be backfilled with a soil mix consisting of 1/3 sphagnum peat moss, 1/3 nitrogen stabilized fir sawdust, 1/3 fine sand, I lb. 12-12-12 commercial fertilizer per each cubic yard of mix, 2 lbs. iron sulfate per cubic yard of mix and 1-1/2 tablespoons of Gro-Power Flower 'N' Bloom 3-12-12 in bottom of each plant pit.

B. A soils analysis, interpretation, and recommendation of the acid loving plant backfill mix shall be required prior to backfilling as outlined in 1.03 Quality Assurance in this section.

3.04 PRE-PLANT WEED CONTROL

A. Clear and remove existing weeds by mowing or grubbing to at least 1/4" below the soil surface.

B. Pre-emergence herbicide shall be applied to all planting areas except lawn and hydroseeded areas. Apply in accordance with manufacturer's recommendation. After this application, apply 1-2" of water.

C. Contact herbicides shall be applied as per manufacturer's recommendation to areas to receive lawn or hydroseed. Apply in accordance with manufacturer's recommendation. After this application, apply water as if just seeded for period of one month to stimulate weed growth. Reapply contact herbicide and water for period of one week. Remove all remaining weeds manually.

3.05 GENERAL PLANTING

A. Finish grade shall be as specified in Section 02210.

B. The Landscape Architect shall approve all planting areas prior to the installation of any materials. Placement of plant materials shall be approved before holes are dug. Stake plant locations and secure approval from Landscape Architect before excavating pits making necessary adjustments as directed.

C. Inspect and accept all landscape irrigation work and finish grading prior to start of shrub planting as specified. Trees may be planted in advance of irrigation system installation, provided adequate provision is made for interim watering.

D. All on-grade plant pits shall be excavated to a minimum of two times the diameter and height of the container to permit handling. Excavate pits with vertical sides for all plants. Scarify sides of plant pit with spade, trowel or other tool so that the sides are pocked and uneven. When hardpan, muck, or unsuitable soil is encountered, break through to clean soil and backfill with prepared backfill as directed.

E. Plant pits for rooted cuttings or seedlings to be at least 6" x 6" x 6".

F. In a centralized area, mix all backfill soil to achieve a uniform blend of amendments. The intent is to achieve well-blended soil and not amend each planting hole at the plant pit. Clean up unused excavated soil and dispose of off-site. Protect mix from water until it has been placed in backfill around plants.

G. All plants shall be planted immediately after containers are cut and containers shall be regularly removed so as not to present a hazard to those persons using the areas.

H. Planting tablets are to be placed in all planting pits on slope areas 2-1/2" or steeper that are not soil prepped.

1. During backfilling, place NPK 10-10-5, 21 gram fertilizer tablets near, but not in direct contact with, the bottom half of the root balls at the following rates:

   One tablet per 1 gallon plant
   Two tablets per 5 gallon plant
   Three tablets per 15 gallon plant
   Five tablets per 24" and larger boxes
   Ten tablets per 36" box
   Twelve tablets per 42" and larger boxes

2. For ground cover plants, place one 10-10-5, 5 gram tablet near, but not in contact with, the bottom half of the root ball.

I. Remove each plant from its container, cut out all broken, frayed or circular root systems. Scarify root ball and place each plant in center of pit and backfill, unless specified otherwise, with prepared soil. Plants to be set in a vertical position in such a manner that when settled, it will bear the same relation to constructed finish grade as it bore to grade in

its container or soil surface at place of growth before being transplanted. Remove wire basket 18" below grade if B&B material is used.

J. Backfill with specified soil mix and tamp firm. No soil in a muddy condition shall be used for backfilling. Water jet plant when hole is two-thirds full to remove all air pockets. After watering, continue to backfill and tamp soil until the surface of the backfill is level with the surrounding grade. No filling shall be permitted around the trunk or stem of the plants.

K. After backfilling, construct an earthen basin around each plant. Each basin shall be of a depth sufficient to hold at least 4" of water. Basins shall be constructed of amended backfill materials. Remove basin in all turf areas after initial watering and prior to sodding. If erosion occurs, reconstruct water basin until final acceptance.

L. Water thoroughly immediately following planting. Backfill all voids which develop with additional prepared soil to bring to finish grade.

M. Upon completion of all planting operations and again as a requirement just prior to final observation, all soil between plants shall be lightly cultivated, weeded, and neatly raked.

3.06 PLANTING TREES

A. Prepare tree pits as specified above, with the addition of a 12" round by 10' deep augered hole in the bottom of the plant pit. Remove the excavated soil and fill hole with coarse sand as well as first 6" at bottom of plant pit.

B. Trees planted in raised planters shall be backfilled to the bottom of the root ball with import soil and thoroughly water-settled. (Do not flood planters.)

C. Specimen trees to be planted prior to construction of finished grades shall be located by surveyor for position and finish-grade relationship to top of root ball. Adjust or replant all plant materials that do not meet final grades at no cost to Owner.

D. Handle each tree in such a manner as not to cause injury or damage to material during digging or planting. Any tree damaged as a result of Contractor's operation shall be rejected and replaced at Contractor's expense.

NOTE: The "choke" strapping method of lifting is strictly forbidden (except of single trunk palms), any trees hoisted in this manner shall not be accepted.

E. Box Removal:

1. Remove bottom of plant boxes before planting. If it is not possible to remove box bottom because of size or soil type, remove every other bottom board, or other method accepted by Owner.

2. Remove sides of box without damage to root ball after positioning plant and partially backfilling.

F. Ball and burlap removal: Remove burlap away from the crown of the tree or palm. Cut away as much of burlap as possible without injury to root ball.

G. Stake or guy trees as detailed on the drawings.

H. Keep guy wires out of general pedestrian traffic areas whenever possible.

I. All transplanted trees shall be set 2" minimum above finish grades.

J. Apply root hormone to each tree as follows:

1. Construct tree basins at rim or outer edges of tree ball so that applied water will remain on the top of the ball.

K. Apply root hormone at the rate as recommended by the manufacturer.

1. Tree balls shall be set before application of root hormone, and shall be mulched in conformance with specifications immediately after completion of root hormone and its irrigation into the ball.

L. Fungicide: Contractor shall apply as per manufacturer's recommendation a root ball drench containing 4 ounces of "Subdue 2-E" per 100 gallons of water to all trees prior to installation of the mulch.

3.09 PLANTING SHRUBS AND VINES

A. Prepare shrub and vine pits as specified under "General Planting."

B. Planting procedures and practices shall be the same as those indicated under "Planting Trees."

C. Vine Tie Installation:

1. For wall surfaces: Secure plastic garden wall ties to wall and plant material as per manufacturer's recommendation. Minimum of 5 ties per 5 gallon plant container size. Minimum of 15 ties per 15 gallon plant container size. Contractor shall tie plants securely as required. Final tying shall be approved by Landscape Architect. Provide additional ties as may be required at no additional cost.

3.10 PLANTING ANNUALS AND PERENNIALS

A. Broadcast and thoroughly work into soil bed 2-1/2 lbs. per 100 s.f. of Gro-Power Flower 'N' Bloom 3-12-12.

3.11 LAWN PLANTING

A. Hydraulic Seeded Lawn:

1. Plant seed in areas indicated on plans.

2. Prepare lawn areas as specified in "Soil Preparation."

3. Fine grade seed areas to a smooth uniform grade. Roll lawn areas with 300 lb. roller until a uniformly compact and even surface is obtained in compliance with required finished grades and as directed by Landscape Architect. All finish grades shall meet approval of the Landscape Architect before seeding.

4. Method of seeding - hydraulic seeding:
   a. Moisten area prior to seeding.
   b. Apply hydraulic seeding material at a rate of 1500 lbs. per acre, mixed with commercial fertilizer 17-13-5 at 600 lbs. per acre. Mix with specified seed material to be mixed with water in 1500 gallon capacity agitator mixer and spray resulting slump under high pressure evenly and uniformly over area to be seeded.
   c. Quantities of seed to be mixed with hydromulch: Seed to be 12 lbs. per 1,000 square feet.

3.12 GROUND COVER PLANTING

A. Flat Cuttings:

1. Prepare ground cover areas as specified under "Soil Preparation" except for those slopes which are 2:1 or steeper.

2. Plant rooted cuttings, pots, or flats in areas and at spacing indicated on plans after mulching.

3. Smooth soil about plants and leave areas in neat and clean condition. Do not pile soil or mulch around crown of any plants.

4. For hand-planted ground cover areas which occur on slopes of 2:1 or steeper, Contractor shall install one fertilizer tablet per ground cover cutting.

3.13 MULCHING

A. All planting areas, that do not exceed a 10% slope, except lawns, shall receive a prepared mulch spread evenly over the surface to a depth of 1".

3.14 FERTILIZING AFTER PLANTING

A. All planting areas shall receive an application of Gro-Power Hi-Nitrogen 14-4-9 commercial fertilizer at the rate of 7-1/2 lbs. per 1,000 sq. ft. thirty days after planting.

B. Fertilizer applications shall be repeated at 30-day intervals until the end of maintenance period.

C. All lightweight soil planting areas that have acid loving plants shall be fertilized with the following mix:

Quantity/1000 gallons:

1. 3 lbs. ammonium nitrate
2. 4-1/2 lbs. potassium
3. 16 fl. oz. phosphoric acid

3.15 METAL EDGING LAYOUT AND INSTALLATION

A. Metal edging shall be laid true to line and grade. Protect adjacent improvements from damage. See drawings for layout of metal edging.

B. Metal headers shall be placed true to lines as indicated on drawings. Straight sections shall be laid utilizing a taut string line or transit. Curved sections shall be installed to present even, continuous curves.

C. Aluminum Line Stake: Stake shall be locked into preformed loops on the edging after the edging has been installed. Compact adjacent grades to edging prior to placement of line stakes to avoid settling. Install a minimum of five (5) 12" line stakes for each 16' section of edging.

3.16 TREE GUYING

A. Guys shall be anchored with either Duckbill aluminum anchors for on-grade conditions, or to stainless steel eye bolts for raised planter applications. Refer to planting details and manufacturer's installation instructions.

B. Guy trees immediately after planting. Guys should be placed so as to give equal support to the tree from any direction. To each guy install specified signal. Protect bark of tree by covering wire with hose.

C. Guy lines to be tightened to a firm but not overly tight tension. Should tree growth be of such a manner that the tree guys do not give the required equal support from all directions, install additional deadmen and guy wires.

3.17 TREE STAKING

A. Immediately after planting, stake all trees which are not to be guyed (refer to planting details). Drive the stakes at the edge of the root ball and 12" minimum into native earth. Stakes shall align with the direction of prevailing winds. Place stakes so as to avoid completely the root ball of the tree.

B. Fasten trees to stakes using tree ties as specified (refer to planting details) to support and protect the tree trunk. Secure ties to each stake as detailed.

3.18 JUTE MATTING INSTALLATION

A. Apply and incorporate fertilizer and amendments into the soil as specified prior to jute matting installation.

B. Roll matting in the direction of the flow of water in drainage channels and smooth and secure in place. Bury leading edge of fabric in trench 6" deep and staple with 6" long steel wire staples. Overlap 4" minimum at sides and 18" at ends. Staple 3' on center along side laps, 12" on center at ends. The material shall be applied without stretching and lie smoothly but loosely on the soil surface. In cases where one roll of matting ends and a second roll starts, the up-channel piece shall be brought over the buried end of the second roll so that there is an 18" overlap. Where two or more widths of matting are applied, side-by-side, the overlap shall be not less than 4"

C. Maintain jute matting until all work on the entire contract has been completed or accepted. Maintenance shall consist of the repair or replacement and resealing of loose or undermined matting, including reseeding and bedding.

D. Make check slots before the matting is rolled out. Dig a narrow trench across the channel perpendicular to the direction of the flow. Fold jute, the same length as the trench, and press together. Location of check slots shall be a maximum of 50' apart.

E. Overlaps which run parallel to the direction of the flow in channel bottoms shall be stapled at 24" intervals. Outside edges, centers and overlaps on banks shall be stapled across the channel at 6" intervals.

F. Spread loose topsoil over outside edges to allow for smooth entry of water.

G. Top dress jute area with a thin layer of topsoil. After the top dressing, the yarns shall still be visible.

H. Plant material through matting.

I. Any clods, etc., which hold the jute off the ground shall be stamped into the soil. Force jute matting down into any depressions and hold there with a staple.

J. The matting shall completely cover all slope areas 2:1 and steeper. Overlaps must be ample and well-stapled. The matting shall lie smoothly and loosely and be in continuous contact with the soil surface at all points.

3.19 DECOMPOSED GRANITE INSTALLATION

A. Stone fines paving system installer shall prepare the subgrade in areas designated to receive stone fines paving system for correct compaction, grade and pitch as a base for paving system installation.

B. Proof roll prepared subgrade surface to check for unstable areas and areas requiring additional compaction. Subgrade under paving systems shall be compacted to a minimum 90%.

1. Contractor shall have compaction test taken and reported at questionable areas as directed by Owner's representative.

C. Herbicide Treatment: Apply chemical weed control agent in strict compliance with manufacturer's recommended dosage and application instructions. Apply to compacted, dry subgrade.

D. Stone Fines Mixing:

1. Prepare surface course material by thoroughly mechanically, mixing the constituent stone fines and aggregate binder in the proportions specified. When mixing, the adding of stone fines and aggregate binder should end almost simultaneously as the capacity of the mixer is reached.

2. Mixing shall be immediately before placement. At time of mixing , the stone fines material may be slightly damp/moist (not wet) and the aggregate binder shall be dry.

3. No segregation of large or fine materials shall be allowed.

E. Stone Fines Installation

1. Place granular stone fine paving material proportioned mix in one layer raked smooth as required to obtain a minimum, after compaction, 2" total thickness.

2. Spread stone fines mix while material is moist to extent specified for stone fines mixing, uniformly covering the course below to a minimum total depth of two inches with allowance for compaction and to the depth required to provide crown and pitch to drain.

   a. If, in order to smooth out subgrade or to ensure proper drainage, it is necessary to build up surfacing material to a thickness greater than 4", place material in two lifts, approximately equal, wetting and compacting each lift as specified.

3. Watering: After spreading, water stone fines paving surface using a garden hose with coarse spray nozzle to achieve full depth moisture penetration and saturation of the spread mixed material and to activate the aggregate binder. Applied water pressure shall not be allowed to disturb the leveled surface and shall be allowed to evenly pond on the surface (manufacturer's suggested rate is at approximately 20 g.p.m. per 1,000 square feet of stone fines surface.) Let watered mix stand until surface water is no longer present (suggested 6 to 24 hours) and the mix is moist but not wet.

4. Compaction: Compact stone fines paving surface in a minimum of two operations after watering. Compact until surface elevations are within tolerances specified herein and to a uniform density within range of 90 to 92 percent at optimum moisture content and tamp near edges of adjoining material to avoid damage to adjoining curbs, lawns, edge materials and other work.

   a. First Compaction Operation: While the stone fines mix is still thoroughly moist, roll with lawn type roller (minimum 225 pounds and maximum 30 inch width), to achieve finish grade and initial compaction, hand tamp at edges as specified.

   b. Second Compaction Operation: Use a heavy (1 ton minimum) small rider equipment type, after having initially used the lawn roller, to obtain the final dense, smooth, uniform texture.

   c. Do not use whackers or vibratory rollers.

F. Loose gravel on the surface is considered evidence of improper bonding due to poor mixing or insufficient watering.

   1. Test the loose material for adequate Aggregate Binder by wetting, then tamping, and allowing it to dry. If the material still is unconsolidated the Aggregate Binder did not get mixed adequately throughout the crushed aggregate (stone fines) screenings. If the material is not solid, initial watering was insufficient.

   2. Cracking or sponginess is evidence of excessive Aggregate Binder in the mix.

G. Any significant irregularities shall be smoothed out prior to final acceptance of work. Smoothing shall be accomplished by rewetting/saturating rough areas thoroughly, and then rolling the surface again with a heavy roller (1000 - 1500 lb powered walk-behind or small rider type).

3.20 PRUNING

A. Pruning shall be limited to the minimum necessary to remove injured twigs and branches and to shape tree for design intent as directed by Owner to include, but not be limited to: lifting of branch structure, thinning of canopy, and elimination of cross-branching. Pruning may not be done prior to delivery of plants and only as directed by Owner by an experienced and Owner-accepted Arborist. Pruning paint shall not be used.

3.21 MAINTENANCE

A. Continuously maintain all areas included under this section during the progress of the work, the 60-day maintenance period, and until final acceptance of this work.

B. If plantings are not acceptable at the completion of this work for entire work, due to defective maintenance, maintenance shall be continued until all work meets specifications and can be approved.

C. Maintenance shall include continuous operations of watering, weeding, mowing, rolling, trimming, edging, cultivation, fertilizing, spraying insect and pest control, reseeding, replacement and/or any other operations necessary to assure good normal growth. Apply lawn moth control sprays or other materials, as often as my be required to protect lawns and turfs until final acceptance of this work.

D. All planted areas shall be kept free of debris and shall be cultivated and weeded at no more than 10-day intervals.

Note: Grass shall be cut to not less than 1-1/4" and during the period of maintenance, it will not be allowed to exceed 2" in height.

E. During installation period and during maintenance period, the Contractor shall be responsible for maintaining adequate protection of all areas. Any damaged plantings shall be repaired at Contractor's expense.

F. At termination of maintenance period, all plant materials shall be live, healthy, undamaged and free of infestations. Inferior planting shall be replaced and brought to a satisfactory condition before final acceptance of work will be made. All areas shall be neatly raked and free of weeds.

G. Replacements: Immediately replace any and all plant materials and grass that die or are damaged. Replacements shall be made to the same specifications as required for original plants.

H. Two observations shall be made that affect the maintenance period. The first after all planting has been completely installed in order to approve the beginning of the maintenance period of not less than 60 calendar days, and the second at the end of the 60-day maintenance period. If plantings are not acceptable at the end of the 60-day period due to defective maintenance, then maintenance shall be continued by the Contractor until all work meets with the specifications and can be approved. Written notice, requesting observations shall be submitted by the Contractor at least 7 calendar days before anticipated date of observation.

3.22 OBSERVATIONS

A. All observations herein specified shall be made by the Landscape Architect. The Contractor shall request observation at least 24 hours in advance of the time observation is required. Observations are required as follows:

1. When fine grading is completed.
1. When plant material has been delivered to the site.
2. When plant material has been spotted for planting but before planting pits are excavated.
3. After planting pits have been excavated but prior to backfill.
4. During decomposed granite installation.
5. The Contractor shall be required to have a complete observation and approval of all landscape construction items at the end of the landscape construction period in order to establish the time for beginning of the 60-day maintenance period. Notify Landscape Architect at least seven (7) days in advance of observation.
6. At the completion of the 60-day maintenance period, an observation shall be required by the Contractor to obtain final approval. Notify the Landscape Architect at least seven (7) days in advance of observation.

END OF SECTION

SECTION 03100 - CONCRETE FORMS AND ACCESSORIES

PART 1 – GENERAL

1.1 SUMMARY

A. Related Sections:

1. Section 03200 - Concrete Reinforcement.
2. Section 03300 - Cast-in-Place Concrete.

1.2 SYSTEM DESCRIPTION

A. Design Requirements:

1. Design, engineering, construction and removal of formwork is solely Contractor's responsibility.
2. Employ registered professional engineer, licensed to practice structural engineering in jurisdiction where Project is located, to engineer each component of formwork system.
3. Establish necessary concrete strength criteria for removal of formwork and reshoring of structure.
4. Design formwork for construction loads; minimum of 50 psf unless higher load required by placing equipment or local codes.
3. Design shoring and reshoring procedures and methods which will not create loadings exceeding design service load capacity of structural members. Limit deflections of members to those which would occur under design loads at 28 day design strength.

B. Structural Requirements: Maximum allowable deflection of form facing material between supports: 1/240 of span.

C. Interface with Other Systems: Coordinate reglet, dovetail slot, sleeve, insert, and anchor installation with requirements of other trades.

1.3 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: Submit product data for proprietary products.

C. Calculations:

1. Submit engineering calculations for strength requirements of structure for form removal, shoring and reshoring at various stages of construction.
2. Submit engineering calculations of proposed formwork, shoring, and reshoring materials for review.

D. Submit following Informational Submittals:

1. Qualification Data: Submit formwork designer's qualification data.
2. Manufacturer's instructions for proprietary products.
3. Submit engineering certification.

1.4 QUALITY ASSURANCE

A. Formwork Designer Qualifications: Registered professional engineer experienced in design of concrete formwork and licensed to practice structural engineering in jurisdiction where Project is located, with minimum of 5 years experience in design of concrete formwork.

B. Regulatory Requirements: Conform to governing codes regarding safety provisions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01600.

B. Store form materials and accessories off ground in ventilated and protected area to prevent damage and deterioration from moisture.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. General:

1. Plywood, metal, fiberglass, wood, hardboard, or other material providing continuous surfaces, non-reactive with form release agent or water.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Provide form material with sufficient thickness to support weight of concrete without deflection exceeding specified tolerances and without affecting appearance of finished surfaces.

B. Smooth Surface Panel-Type Forms:

1. Plywood: Comply with PS-1, APA B-B Plyform, Class I, 19/32 3/4 inch minimum thickness.
2. Fiberglass Reinforced Plastic: Smooth surfaces free from dents, sags, cracks, exposed fibers, or other irregularities.
3. Metal: Smooth surfaces free from dents, sags, rust, or other irregularities, 16 gage minimum thickness.
4. Wood: Tongue and groove or ship-lapped boards with square edges.
5. Hardboard: Treated hard-pressed fiberboard, 1/4 inch minimum thickness.

C. Cylindrical Columns and Members:

1. Metal or fiberglass reinforced plastic, surface treated with release agent.
2. Paper or fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior, treated with release agent.

3. Provide smooth form finish without evidence of spiral lines.
4. Acceptable Manufacturers:

   a. Jefferson Smurfit Corporation, Saint Louis, MO.
   b. Sonoco Products Company, Hartsville, SC.

D. Fillets for Chamfered Corners: Wood strips or rigid plastic type; triangular 3/4 inch size; maximum possible lengths. Chamfered corners shall not be used unless shown on architectural or structural drawings.

E. Rustication Strips, Drip Strips: Wood or plastic strips, profiles as detailed on Drawings.

2.2 FORMWORK ACCESSORIES

A. Snap-off Form Ties:

1. Steel Galvanized steel ties of fixed length; tight fitting to prevent leakage and designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.
2. Provide ties designed to break off inside concrete as follows:

   a. Exposed to Weather: 1-1/2 inches.
   b. Other Exposures: 1 inch.

3. Provide tie cones which will not leave holes larger than 1 inch diameter in concrete surfaces.

B. Threaded, Disconnecting-Type Form Ties: Sectional metal ties of adjustable length, consisting of permanent inner rods with threaded ends and removable, tapered outer rods.

C. Form Release Agent:

1. Colorless, non-staining, liquid chemical free of kerosene, oil, wax, and resin, of type which will not bond with or adversely affect concrete surfaces and which will be compatible with subsequent treatments of concrete surfaces.
2. Acceptable Products:

   a. Nox-Crete Form Coating, Nox-Crete Chemicals, Omaha, NE.
   b. Debond, L and M Construction Chemicals, Inc. Omaha, NE.
   c. Duogard Form Release Agent, W. R. Meadows, Inc., Elgin, IL.
   d. Cast-Off, Sonneborn Building Products, Shakopee, MN.

2.3 JOINT ACCESSORIES

A. Isolation Joint Fillers:

1. Bituminous Type: ASTM D1751, 1/2 inch minimum thickness, with 1/2 inch deep removable wood or plastic strip.
2. Non-bituminous Type: ASTM D1752, Type 1, 1/2 inch minimum thickness with 1/2 inch deep removable wood or plastic strip.

B. Preformed Expansion Joint Seals:

1. Elastomeric compound of polymerized chloroprene (neoprene), extruded open cell shape colored polymers.
2. Cross linked vinyl copolymer, extruded closed cell shape, colored.
3. Acceptable Product: Harris Specialty Chemicals, Inc., Jacksonville, FL.

C. Formed Joints for Slab-On-Grade:

1. Control Joint for Unsealed Joints:

   a. Plastic Strip with Removable Plastic Tee on Top. Minimum depth of strip equal to 1/4 the depth of the slab.
   b. Acceptable Product: Zip Cap-Control Joint, Greenstreak Plastic Products, Saint Louis, MO.

2. Circular Isolation Joints at Columns:

   a. Prefabricated, minimum 18 gage galvanized steel, formed in circular shape to full slab depth.
   b. Acceptable Product: Circular Isolation Joint Former, Greenstreak Plastic Products, Saint Louis, MO.

3. Construction Joints:

   a. Minimum 18 gage galvanized stainless steel, bent to form keyway with top a minimum 1/2 inch below slab surface with removable plastic joint cap.
   b. Acceptable Product: No. 95 Tongue & Groove Joint, Heckmann Building Products, Inc., Chicago, IL.

D. Adhered Waterstops:

1. Preformed Adhesive Type Waterstop:

   a. Blend of refined hydrocarbons, resins, plasticizing compounds and mineral fillers; extruded ribbons with protective paper on each face.
   b. Furnish primer as recommended by manufacturer.
   c. Acceptable Product: Synko Flex Preformed Plastic Adhesive Waterstop, Henry Sealants, Houston, TX.

2. Bentonite Type Waterstops:

   a. Bentonite clay matrix expanding type waterstop; extruded 1 by 3/4 inch ribbon with protective paper on each face.
   b. Acceptable Products:

      (1) Superstop Waterstop, Mameco International, Inc., Cleveland, OH.
      (2) Water Stop RX, American Colloid Company, Arlington Heights, IL.

3. Hydrophilic Type Waterstop:

   a. Preformed rubber, paste type and injectable type.
   b. Furnish accessories as recommended by manufacturer.

c. Acceptable Product: Adeka Ultraseal Water Stop, distributed by Mitsubishi International Corporation, Houston, TX.

E. Cast-In Waterstops:

1. Extruded polyvinyl chloride with profiles required for joint conditions.
2. Provide prefabricated tees, ells, and other special pieces for joints.
3. Acceptable Manufacturers:

a. Greenstreak Plastic Products, Saint Louis, MO.
b. Vinylex Corporation, Knoxville, TN.

2.4 CAST-IN-PLACE INSERTS

A. Adjustable Wedge Inserts:

1. Wedge Insert: Malleable iron, with integral anchor loop; plain finish hot-dip galvanized in accordance with ASTM A153.
2. Askew head bolt, nuts, and washers: Wedge headed stainless steel, plain finish hot-dip galvanized in accordance with ASTM A153 electro-galvanized in accordance with ASTM B633, service condition 3 (severe).
3. Acceptable Products:

a. No. 425/427 Wedge Inserts, Heckmann Building Products, Inc. Chicago, IL.
b. Type HW Wedge Inserts, Hohmann and Barnard, Inc., Hauppauge, NY.

B. Adjustable Box Inserts:

1. Malleable cast iron with integral anchor loop; plain finish hot-dip galvanized in accordance with ASTM A153.
2. Bolt, nuts and washers: Square headed steel, plain finish hot-dip galvanized in accordance with ASTM A153 electro-galvanized in accordance with ASTM B633, service condition 3 (severe). Acceptable Product: Adjustable Insert, Hohmann and Barnard, Inc., Hauppauge, NY.

C. Threaded Inserts With Anchor Loop:

1. Malleable cast iron with integral anchor loop; plain finish hot-dip galvanized in accordance with ASTM A153.
2. Acceptable Product: Type HFH Threaded Inserts, Hohmann and Barnard, Inc., Hauppauge, NY.

D. Threaded Inserts:

1. Malleable cast iron, integral lugs to prevent rotation; plain finish hot-dip galvanized in accordance with ASTM A153.
2. Acceptable Products:

a. Hi-Tensile Inserts, The Burke Group, Converse, TX.
b. 444 Threaded Inserts, Heckmann Building Products, Chicago, IL.
c. Threaded Inserts, Hohmann and Barnard, Inc., Hauppauge, NY.

E. Continuous Slot Inserts:

1. Heavy rolled steel, with end caps; plain finish hot-dip galvanized in accordance with ASTM A153.
2. Acceptable Product: CS-HD, Hohmann and Barnard, Inc., Hauppauge, NY.

2.5 CAST-IN ACCESSORIES

A. Weep Holes: PVC or ABS plastic pipe, one end covered with securely anchored galvanized 16 gage, wire mesh, with 1/4 inch openings.

B. Reglets:

1. Type: 26 gage galvanized steel 0.018 inch Type 302 or 304 stainless steel, sloped design, equipped with foam filler or taped face.
2. Acceptable Product: No. 230 by Heckmann Building Products, Inc., Chicago, IL.

2.6 CONCRETE FASTENING SYSTEMS

A. Expansion Bolt Anchor:

1. Size: As indicated on Drawings.
2. Finish: Zinc plated.
3. Acceptable Product: HSL Expansion Anchor, Hilti Corporation, Tulsa, OK.

B. Flush or Shield Type Expansion Anchor Sleeve:

1. Size: As indicated on Drawings.
2. Finish: Zinc plated.
3. Acceptable Products:

   a. HDI-Drop In Anchor, Hilti Corporation, Inc., Tulsa, OK.
   b. Red Head Multi-Set II, ITW Ramset/Red Head, Michigan City, IN.
   c. Steel Drop-in, The Rawl Plug Company, Inc., New Rochelle, NY.

C. Adhesive Stud Anchor:

1. Size: As indicated on Drawings.
2. Capsule system of vinylester resin and aggregate, complete with zinc plated anchor rod, washer, and nut.
3. Acceptable Products:

   a. HVA Adhesive Anchor System, Hilti Corporation, Tulsa, OK.
   b. Red Head Redi-Chem, ITW Ramset/Red Head, Michigan City, IN.
   c. Rawl Chem Stud, The Rawl Plug Company, Inc., New Rochelle, NY.

D. Doweling Anchor System:

1. Cartridge of two-component adhesive.
2. Acceptable Product: HIT-Doweling system, Hilti Corporation, Tulsa, OK.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01700.

3.2 PREPARATION

3.3 FORMWORK ERECTION

A. Install forms in accordance with ACI 301, except for more stringent requirements of this Section.

B. Where concrete is to be exposed in finished structure, form waffle slabs and joist floor construction with fiberglass reinforced plastic forms only. Form exposed cylindrical columns with metal or fiberglass reinforced plastic forms only.

C. General:

1. Construct formwork to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide back-up material at joints.
2. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
3. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.
4. Assemble panel forms with ties as follows:

   a. Concrete with Divergent Faces: Threaded, disconnecting-type ties.
   b. Members Exceeding 30 inch Thickness: Threaded, disconnecting-type ties.
   c. Below Grade Concrete to receive Waterproofing: Snap-off ties with waterstop washers.
   d. Other Concrete: Snap-off ties.

5. Provide removable panels at bottoms of column, pier, wall and other forms to facilitate cleaning and inspection and to allow for total removal of wood form materials.
6. Install chamfer strips at corners of beams, columns, walls and other members where
7. Do not displace or damage vapor retarders.
8. Set edge forms or bulkheads and intermediate screed strips to obtain elevations and contours for slabs.

D. Shoring:

1. Shore forms to support concrete and construction loads without excessive deflection.
2. Prevent settlement of support for first tier formwork resting on compressible material.

E. Adjusting:

1. Conform to requirements of ACI 347.
2. Check formwork before placing reinforcing and continuously during concrete placement to verify that Work will be within specified tolerances.
3. Correct excessive settlement or distortion of forms during concrete placement.
4. Tighten forms during concrete placement if required to eliminate cement paste leaks.

F. Formwork Cleaning:

1. Clean forms to remove foreign matter as erection proceeds.
2. Ensure that water and debris drain to exterior through clean-out ports.

3.4 JOINT FORMING ACCESSORIES

A. Joint Fillers:

1. Install and support to prevent displacement by concrete.
2. Use non-bituminous type in joints to receive joint sealants, install with removable strip on edge to be sealed.
3. Use bituminous type in joints not receiving joint sealant, full depth of joint, except hold 1/4 inch below concrete surface when joint is tooled.

B. Expansion Joint Seals: Install in accordance with manufacturer's printed instructions.

C. Construction Joints:

1. Locate and install construction joints as required to preserve strength and appearance of structure, and as acceptable to Architect.
2. Locate construction joints within middle third of span in framed horizontal members. Roughen joint to expose aggregate for bond to subsequent pour.
3. Offset joints in girders minimum of 2 times width of intersecting beams.
4. Provide keyways 1-1/2 inch deep for vertical construction joints in walls, and in joints between footings and walls.
5. Place beams, girders, haunches, brackets, column capitals, and drop panels monolithic with slab system, unless otherwise indicated.
6. Form joints perpendicular to main reinforcing.
7. Continue reinforcing across construction joints.

D. Construction Joints In Slab-On-Grade:

1. Form as indicated on Drawings.
2. Use bent steel keyed strip, bent steel keyway attached to wood form, or wood keyway attached to wood form.
3. Install dowels as indicated on Drawings for doweled joints.

E. Isolation Joints In Slab-On-Grade:

1. Install at locations where slabs intersects vertical surfaces, unless otherwise indicated.
2. Install joint fillers against vertical surfaces walls and columns.
3. Install site-formed diamond shaped or pre-formed circular shaped isolation joints around columns.

F. Formed Control Joints In Slab-On-Grade:

1. For slabs with unsealed joints and covered with floor finish, form control joints by inserting preformed plastic strip in fresh concrete. Remove tee on plastic strip prior to troweling.

3.5 INSERTS, EMBEDDED ITEMS, AND OPENINGS

A. Anchorage Items:

1. Install in accordance with manufacturer's written instructions to prevent displacement during concrete placement.
2. Attach dovetail anchor slots to forms spaced at intervals specified in Section 04200.
3. Install reglets as indicated.
4. Install inserts with integral anchor loops with reinforcing bars through loops.

B. Embedded Items:

1. Place in accordance with approved shop drawings for related work.
2. Use templates for bolts, anchors and other inserts not attached to formwork.

C. Waterstops:

1. Install in accordance with manufacturer's printed instructions at locations indicated.

2. Support and protect from displacement by concrete placement and subsequent construction.

D. Weep Holes: Install in concrete walls as indicated, with mesh placed on earth side.

E. Piping and Conduit Embedded in Concrete:

1. Do not coat piping or conduit.
2. Do not embed aluminum conduit.
3. Do not place items closer than 3 diameters OC.
4. Do not embed items with outside diameter more than 1/3 thickness of concrete element.
5. Place piping and conduit in middle third of slab thickness.

F. Conduit, Sleeves, and Pipes Passing Through Concrete Elements:

1. Do not cut, bend or displace reinforcement.
2. Do not place items between concrete surface and reinforcement.

G. Openings:

1. Provide formed openings where required for Work embedded in or passing through concrete.
2. Coordinate Work of other Sections in forming openings, slots, recesses, chases, and other special conditions.

3.6 FORM REMOVAL

A. Do not remove forms and shoring for beams or slabs until concrete has sufficient strength to support its own weight and construction, design or other loads which may be imposed upon it.

B. Remove formwork only after following length of time which represents cumulative number of hours or days during which temperature of air surrounding concrete is above 50 degrees F.

1. Walls: 12 hours.
2. Columns: 12 hours.
3. Sides of Beams and Girders: 12 hours.
4. Pan joist forms of type which can be removed without disturbing shoring:

   a. 30 inches wide or less: 3 days.
   b. Over 30 inches wide: 4 days.

5. Arch Centering:

   a. Where design live load less than dead load: 14 days.
   b. Where design live load greater than dead load: 7 days.

6. Joist, Beam, or Girder Soffits:

   a. Less than 10'-0" clear span between structural supports:

      (1) Where design live load less than dead load: 7 days.
      (2) Where design live load greater than dead load: 4 days.

   b. 10'-0" to 20'-0" clear span between structural supports:

      (1) Where design live load less than dead load: 14 days.
      (2) Where design live load greater than dead load: 7 days.

   c. Over 20'-0" clear span between structural supports:

      (1) Where design live load less than dead load: 21 days.
      (2) Where design live load greater than dead load: 14 days.

7. One-way Floor Slabs:

   a. Less than 10'-0" clear span between structural supports:

      (1) Where design live load less than dead load: 4 days.
      (2) Where design live load greater than dead load: 3 days.

   b. 10'-0" to 20'-0" clear span between structural supports:

      (1) Where design live load less than dead load: 7 days.
      (2) Where design live load greater than dead load: 4 days.

   c. Over 20'-0" clear span between structural supports:

(1) Where design live load less than dead load: 10 days.
(2) Where design live load greater than dead load: 7 days.

8. Two-way Slab Systems: Remove formwork and shoring after concrete has attained stripping strength indicated by formwork designer.

9. Post-tensioned Slab Systems: Remove formwork after application of full post-tensioning.

C. When formwork is removed prior to specified length of curing period, continue curing concrete surfaces by specified method and maintain thermal protection for balance of specified curing period.

D. Remove formwork progressively so unbalanced loads are not imposed on structure.

E. Do not damage concrete surfaces during form removal.

F. Completely remove wood form materials from concealed locations and from other locations where soil or water contact may occur.

G. Reshoring:

1. Reshore structural members according to procedure established by formwork designer.
2. Do not strip and reshore until concrete has properly hardened and will not be damaged during reshoring.
3. Reshore simultaneously with stripping.
4. Reshore to distribute construction loads safely to at least 3 floors below, or to ground. Locate to align with reshores below and shoring above.
5. Limit loads on reshored construction to developed capacity of members at time of reshoring.
6. Do not remove reshores under load-bearing concrete until concrete has attained 28 day compressive strength.
7. Retain reshores under cantilevered construction for at least 28 days after concrete is placed.
8. Limit loads on unshored portion of structure during construction to design live load indicated on Drawings.

H. Re-Use of Forms:

1. Forms may be cleaned, repaired, re-coated and re-used if they will provide acceptable exposed surfaces.
2. Store reusable forms in manner to prevent damage to contact surfaces.
3. For exposed concrete surfaces, do not re-use wood formwork more than 3 times.

3.7 CONCRETE FASTENING SYSTEMS

A. Install in accordance with manufacturer's written instructions.

B. Drill and clean holes.

C. Install bolts to manufacturer's specified torque with minimum specified embedment depths, unless deeper embedment is indicated on Drawings.

3.8 TOLERANCES

A. Conform to requirements of ACI 117 and 347.

B. Verify variations in floor level prior to removal of shoring.

3.9 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01450.

B. Responsibilities of Testing and Inspection Agency:

1. Verify dimensions of concrete members.
2. Verify openings and joints per Contract Drawings and shop drawings.
3. Inspect conditions of formwork and preparation of form surfaces.
4. Inspect shoring and reshoring for conformance with shop drawings.
5. Verify placement of embedded items including anchor bolts, inserts, pipe sleeves, conduits, pipes, etc.

END OF SECTION 03100

SECTION 03200 – REINFORCING

PART 1 – GENERAL

1.1 SUMMARY

A. Provide reinforcing steel bars, welded wire fabric, support chairs, bolsters, *bar* supports and spacers as indicated on the drawings as specified herein and needed for a complete and proper installation.

B. Related Requirements: The General Provisions of the Contract Documents affecting the work of this Section to include but not necessarily limited to the General Conditions, Supplementary Conditions and Sections of Division 1 of the Project Manual.

1.2 RELATED WORK

A. Site Concrete.

B. Formwork.

C. Cast-in-place, concrete.

D. Concrete Unit Masonry

1.3 QUALITY ASSURANCE

A. Perform reinforcing work in strict conformance with CRSI 93 unless specified otherwise or required otherwise by local code jurisdiction.

1.4 CODES AND STANDARDS

A. Title 24, Part 2, C.C.R., 2001 C.B.C., Chapter 19 and applicable Sections.

B. In addition to CR51 specifications, follow ACI 315 and 318, AWS screlding codes and qualifications, and ASTM A185, A3Q5, A615, and A706 and C.B.C. Std. 19.2.

C. Testing of bars in accordance with Title 24, Section I929A.2 and 1903A.5.

1.5 TESTING

A. Where samples are taken from bundles as delivered from the mill, with the bundles identified as to heat number, and provided the mill analyses accompany the report, then one tensile test and one bend test shall be made from a specimen from each 10 tons or fraction, of each size of reinforcing steel

B. Where positive identification of the heat number cannot be made or where random samples are to be taken, then one series of tests shall be made from each 2-1/2 tons or fraction, of each size of reinforcing steel.

C. Comply with Title 24, Chapter 17 & Section 1903A.5.

D. Comply with Section 01401 of Division 1.

PART 2 - PRODUCTS

2.1 REINFORCING BARS

A. Deformed billet steel bars, ASTM A615, plain finish, see drawings for grade. ASTM A706 for bars to be welded, and elsewhere as defined on drawings.

2.2 WELDED WIRE FABRIC

A. Provide plain type, ASTI4 A185, in coiled rolls, or flat sheets, plain finished, void of rust, dust, scale, paint, grease and other coatings, conforming to UBC Standard 19-1.

2.3 ACCESSORIES

A. Provide minimum 16 gage galvanized annealed tie wires, and chairs, bolsters, bar supports, and spacers sized and shaped for strength and support of reinforcing. Plastic accessories may be acceptable if approved by Architect prior to use

2.4 FABRICATION AND MANUFACTURE

A. Fabricate in accordance with details shown.

B. Accurately bend, cut and place bars as shown on drawings. Bend bars cold; heating of bars is not permissible. Do not bend or straighten bars in any manner that will injure materials. Comply with Title24, Section 1907A.2 and 3.

C. Welding: All welded reinforcing steel shall be A.S.T.M. A7O6. Perform welding, where shown or approved, by the direct electric arc process in accordance with AWS D1.4 using 90 series low hydrogen electrodes. Preheat 6 inches each side of joint. Protect joints from drafts during cooling process; accelerated cooling is prohibited. Do not tack weld bars. Clean metal surfaces to be welded of all loose scale and foreign materials. Clean welds each tithe electrode is changed and chip burned edges lef ore placing welds. When wire brushed, completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration into the base metal. Cut out welds or parts of welds found defective, with chisel, and replace with proper welding. Comply to Title 24, Section I903A.5.2.

1. Employ only experienced AWS certified welding operators.

2. Prequalification of welds are to be in accordance with code and carbon equivalent of reinforcing not exceeding 0.75.

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to commencing work of this section, inspect work of others and verify that such work has been properly completed and installed to allow for proper installation of all materials and methods required of this section. Inspection of welding shall be done, by a special inspector approved by D.S.A., services retained and paid for by the Owner.

3.2 INSTALLATION

A. Fabricate reinforcing in accordance with ACI 315. Locate reinforcing splices not shown on drawings, at mid span. Where shown or required, weld reinforcing bars in accordance with AWS D1.4

B. Place reinforcing supported and secured against displacement. Do not deviate from true alignment.

C. Ensure that reinforcing used is clean, free of scale, dirt, dust, rust and other matter.

D. Provide a minimum splice for bars noted as "cont.", typical wall reinforcing, no splices in concrete column reinforcing. Provide laps, masonry and concrete per structural drawings/details. Wire all laps and splices in welded wire mesh and provide side and end laps of at least 8 inches.

1. Spacing - minimum center-to—center distance between parallel reinforcing bars is to be in compliance with that shown on drawings, or in the absence of such information on drawings, the clear spacing is to be 1—1/2 bar diameter, but in no case less than 1—1/2 inch, nor 1- 1/3 times the maximum size of aggregate.
2. Where possible, stagger splices of adjacent bars.

E. Only splice reinforcing where shown or noted. Splices at other locations must be approved by the Architect or Structural Engineer. Provide continuous reinforcement between splice locations in vertical walls. No splices of vertical wall reinforcing may occur except at foundations, unless specifically approved by the Architect or Structural Engineer.

1. Securely tie reinforcing with 16 gage tie wire at all splices and intersections, and as may be directed.
2. Point ends of wire ties away from forms.

F. Stagger splices in adjacent horizontal wall reinforcing bars a minimum of 4 feet.

G. Provide dowels in footings and/or grade beams the seine size and number as vertical wall or column reinforcing. Provide a minimum dowel protection equal to standard lap splices unless noted otherwise.

1. Secure tie dowels in place before depositing concrete. Install No. 3 bars for securing dowels where no other reinforcement is provided.

H. Provide the minimum coverage of reinforcing by concrete; Below grade (unformed) 3 inches clear Below grade (formed) 2 inches clear walls 2 inch clear Columns, beams 2—1/2 inches clear

3.3 CORRECTION DURING CONCRETING

A. Maintain capable steel workers during placement of concrete for properly resetting reinforcement displaced by runways, workers, or other causes.

3.4 DEFECTIVE WORK

A. The following reinforcing work will be considered defective and may be ordered by Owner to be removed and replaced t no additional expense to Owner.

1. Bars with kinks or bends not shown on drawings
2. Bars in red due to bending or straightening.
3. Bars heated for bending.
4. Reinforcement not placed in accordance with drawings: or specifications.
5. Rusty or oily reinforcement.
6. Re-bent bars.Select one of three articles below depending on method used to provide secondary weather barrier.

3.5 INSPECTIONS

A. Prior to pouring concrete, notify the architect, structural engineer and D.S.A. that reinforcing is ready for inspection. Secure approvals by testing laboratory and inspector before concrete operations are commenced.

END OF SECTION 03200

SECTION 03300 – CAST-IN-PLACE-CONCRETE

PART 1 - GENERAL

1.1 WORK SPECIFIED IN THIS SECTION

A. Provide cast-in-place concrete (strengths as indicated on the drawings), finishes, and vapor barrier.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Formwork

B. Reinforcing

1.3 QUALITY ASSURANCE

A. Perform concrete work in accordance with ACI 301 and 318, and Title 24, Section 1905A and 1906A, California Building Code 2001 Edition, unless specified otherwise. Provide continuous inspection arid testing for concrete placement in accordance with Title 24, Part 1. Project Inspector to provide continuous inspection of reinforcing and concrete placement.

B. Testing Laboratory Services: In accordance with Section I905A.6 of Title 24.

C. Verify compatibility of products and materials listed herein with existing soils conditions as indicated in Geotechnical Report.

1.4 CODES AND STANDARDS

A. Refer to the following information for compliance of materials, products, and installation techniques: ASTM C33, C94, CI50, C260, C494, and ACI 117, 301, 304, and 305, Title 24, 1903A.

B. Handling and Placing: Concrete transported and placed as per Title 24, I905A. Concrete shall be thoroughly compacted and worked into forms around reinforcing steel using suitable equipment. Vibrating of formwork will not be permitted.

C. Where conditions make placing difficult or reinforcing is congested, batches containing the same proportions of sand and cement used in the concrete plus a smaller size aggregate shall be used.

1.5 TESTING

A. Provide free access to work. Provide laboratory design mix. No substitutions will be accepted. Cement and aggregates shall be tested.

B. Cement: Test Portland cement in accordance with Sections 1903A.2 and 1928A.1, Title 24, 2001 C.B.C.

C. Core Tests: Take and test cores in accordance with Section 1905A.6.4.4, Title 24, 2001 C.B.C.

D. Aggregate test per I903A.3, Title 24, 2001 C.B.C.

E. Batch Plant Inspection required for 4000 and 3000 psi concrete and bonded deputy weighinaster affidavit required for 2500 psi concrete per structural drawings, also in accordance with Section 1929A.4, Title 24, Part 2. Waiver of Batch Plant Inspection: If noted on the structural plans batch plant inspection may be waived per Title 24, 1929A.5. Where allowed, weighmaster is required.

F. Aggregate test per 1903A.3, Title 24.

G. Placing Record: Keep records of placing in accordance with Section 1928A.7.

H. Combined aggregate grading shall comply with Table I9A-J, Title 24.

PART 2 - PRODUCTS

2.1 CEMENT

A. Provide cement conforming to ASTM C150, Type V, conforming to 1903A.2, Title 24.

2.2 AGGREGATES

A. ASTM C33: 1-1/2 inch maximum: 1 inch maximum f or 5 inch or thinner slabs, conforming to Title 24, 1903A.3 and grading per Table 19A-J. 3/8" aggregate (pea gravel) at planter and ramp walls and at concrete column encasement where sandblasting is scheduled on drawings.

B. Concrete quality shall conform to Section 1905A, Title 24.

2.3 WATER

A. Provide clean: water free from injurious substances.

B. Maximum Water-Cementitious Materials Ratio: .45 maximum.

2.4 CURING MATERIALS

A. Curing Compound: In compliance with Title 24, provide Thompson's Waterseal, or other approved, in accordance (with ASTM C309, Type I with fugitive dye, guaranteed to be compatible with finishes to be applied to concrete.

B. Waterproof Paper: Provide type in conformance with ASTM Type I or II.

C. Burlap: Provide burlap meeting Federal Specifications CCC-C4 673.

2.5 VAPOR BARRIER

A. Provide 15 mil thick Stego Wrap Vapor Barrier (877/464—7834) or approved equal. Visqueen type polyethylene s not acceptable.

1. Install per manufacturer's guidelines. Provide all items/products accessory to installation, including Stego wrap Red Polyethylene Tape

2.6 ADMIXTURES (Use only with written approval of Structural Engineer)

A. Water reducing: Shall conform to UBC Std. No.19—9, Title 24, Section I903A.6. Reduce water 5 percent minimum, increase 28 day compressive strength, and decrease 14 day drying shrinkage. ASTM C494.

1. Provide one of the following, or other approved: Master Builders Pozzolith 300. Penn-Dixie Chemicals Chemstrong Type A.

B. Acceleration retarding: To conform to C.B.C. Std. No. 19—9 and ASTM C494.

C. Air entraining: 4 percent minimum, 6 percent maximum air content by volume, ASTM C260.

D. Admixtures shall be in accordance with Title 24, 1903A. 6.

E. Concrete Hardener: Hunt LMZ, select Conhard ZM or Shur-Hard M.S.F. distributed by Paul M. Wolff Co.

F. Non-slip Surface: Trowel finish aluminum exide grains

2.7 NON-SHRINK GROUT

A. Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, capable of developing non- shrink characteristics in both the horizontal and vertical direction with minimum compressive strength of 2,400 psi in 2 days and 4,000 psi in 28 days.

1. Provide Embecco Grout as manufactured by Master Builders, or other approved by Five Star, Burke, or Sika.

2.8 JOINT MATERIAIIS

A. Control Joints: Provide Quick Joint, Zip Strip, or Saw Cut.

B. Expansion Joints: Provide standard metal keyed dividers for cold joints, subject to review and approval.

PART 3 - EXECUTION

3.1 MIXES

A. Strengths: Shall comply with Title 24 2001 C.B.C, Section I905A.3. Provide concrete mixes which will yield the minimum 28 day compressive strengths required and shown on drawings

B. Slumps: Maximum concrete slumps shall not exceed 4'. Foundations may be 4" maximum slump.

C. Selection of concrete proportions: Concrete proportions to be selected using Method B, Title 24, 2001 C.B.C. 1905A.3.

3.2 CERTIFICATIONS

A. Provide legible copies of the delivery tickets of each load of concrete with the following information:

1. Name and location of plant.
2. Serial number of ticket.
3. Date and truck number.
4. Name of contractor.
5. Name of project
6. Type or class of concrete and how to be used.
7. Amount of concrete.
8. Time loaded, time of arriving and unloading at project site.
9. Water added at site and total water content.
10. Type, name and amount of admixtures.
11. Name and signature of person making slump tests.
12. Testing number of test cylinders.

3.3 PREPARATION FOR PLACEMENT

A. Remove foreign debris and matter which may have accumulated within forms and close ports and openings left in formwork per Section 1905A.7. Provide clean rough construction joints per Section 1906A.4, Title 24, 2001 C.B.C.

B. Thoroughly clean tools used in transportation, placing and conso1idating concrete immediately after each pour.

C. Ensure that required inspections have taken place prior to any pour.

3.4 CONVEYING

A. Handle concrete from mixer to location of placing as rapidly as practical, avoiding separation or loss of ingredients and re-handling. Use carts, wheelbarrows, concrete pumps, conveyors or buggies to deliver concrete to location of placement.

B. Do not permit a free fall of more than 4 feet when placing concrete.

C. Use elephant truck spouts for placing concrete in vertical elements. Space so that concrete does not exceed 4-foot flow horizontally.

3.5 PLACEMENT

A. In general, place concrete in accordance with ACI 301, Title 24, 2001 C.B.C. Section I905A.10 and in the presence of the inspecting personnel required.

B. Ensure that anchors, seats, plates, and other items to be cast into concrete are placed, held securely, and will not cause hardship in placing concrete.

1. Place control joints at 20 feet on centers in each direction, maximum, unless shown on drawings.

2. For walks, do not exceed 10 feet on centers, maximum, in each direction.

C. Maintain records of poured concrete. Record time, date, location, quantity, air temperatures, and test samples taken.

D. Ensure that reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

E. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.

F. Pour concrete continuously between predetermined construction, control and expansion joints. Pour in a checkerboard pattern, unless otherwise directed.

G. Excessive honeycomb and embedded debris are not acceptable.

H. Conform to ACI 305 Title 24, 2001 C.B.C. Section 1905A.13 when concreting in hot weather.

I. Inspect concrete surfaces immediately upon removal of forms. Patch imperfections.

J. Modify or replace concrete not conforming to required lines, details, shapes and elevations. Do not patch, fill, touch-up, repair, or replace exposed architectural concrete except upon *express* direction of Architect.

K. Beginning immediately after placement, protect concrete froth premature drying, excessively hot or cold temperatures and mechanical injury. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

L. Install vapor barrier in widest widths possible, under interior slabs on grade, lapping joints at least 12 inches and taping all joints. Cover with at least 2 inches of sand. (Refer to drawings).

M. Screed slabs and concrete bases level to a tolerance of 1/4 inch in 10 feet, and ACI 117.

N. Provide smooth rubbed finish on concrete surfaces to be left exposed such as concrete walls, columns, beams, and joists, except as otherwise indicated.

O. Surface preparation of construction joints shall be by sandblasting or washing 2 to 4 hours after placing concrete per Title 24, 2001 C.B.C. Section 1906A4.7.

P. Fully vibrate all concrete work.

3.6 FINISHING

A. Provide wood float finish for surfaces to receive waterproof membranes and tile systems do not permit a free fall of more than 4 feet when placing concrete.

B. Provide smooth steel trowel finish at all interior concrete floors and sills of any exterior spandrels.

C. At walk, ramps and stairs, provide a medium broom finish perpendicular to direction of traffic on all surfaces less than 6% and a heavy broom finish on al]J surfaces greater than 6%. Make texture heavy for vehicular traffic.

D. Where exposed aggregates are shown, provide exposure required by architect.

3.7 EQUIPMENT BASES

A. Provide concrete bases for all equipment indicated on drawings.

3.8 CURING

A. Formed concrete: In compliance with Title 24, Section 1905A.11, wet forms thoroughly, including tops and exposed portions of concrete, and keep in thoroughly moist condition until the forms are removed.

B. Unformed concrete: Water cure as follows:

1. After troweling and as soon as it can be done without marring surface, lay curing paper, lap seams 3 inches and seal with pressure sensitive tape. Keep concrete continuously moist for minimum of 14 days. Leave paper in place as temporary protection as long as possible.
2. Maintain and repair paper for the full curing period and replace evaporated water as required by lifting the edges and wetting the concrete surface to a properly moist condition.

3. Should paper become torn or otherwise damaged, allowing loss of moisture during curing period, immediately repair and keep surface moist by adding water as required to maintain effective, uninterrupted curing.

C. Use liquid membrane curing at all other locations: Immediately after removing forms and after finishing flat work, apply the specified liquid curing compound in accordance with manufacturer s printed recommendations.

3.9 DEFECTIVE CONCRETE

A. If compressive strength tests of cylinder specimens fail to show strengths assumed in design, take 4 inch diameter cores at representative locations throughout structure as designated by Owner. Take cores to comply with Section 1905A.6.4, Title 24, 2001 C.B.C. If results of these tests shown compressive strengths less than assumed in the design with no individual strength test less than 500 psi below that specified, the concrete will be deemed defective. Remove and replace defective concrete in a manner and to such limits as determined by Owner. Be financially responsible for repair and replacement of other in-place materials affected by such removal and replacement. Costs of taking core samples and performing tests required will be paid by Owner if tests prove satisfactory. If tests fail to show required strengths, concrete contractor will be held financially responsible.

B. If the strength of the molded test cylinder falls below the minimum ultimate compressive strength assumed in the design, adjust the proportions of the mix for the remaining portion of the structure to give concrete of the assumed minimum strength.

C. Concrete will also be deemed defective which is not formed properly as indicated, is not true to intended alignment, is not plumb or level where so intended, is not true to intended grades, has sawdust or other debris embedded within it, or does not fully conform to other provisions of these specifications. As directed, remove and replace concrete complying with these
specifications.

3.10 CONSTRUCTION JOINTS

A. Construction joints shall be prepared in accordance with Section I906A.4, Title 24, 2001 C.B.C.

END OF SECTION 03300

SECTION 04810 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Conditions and Division-I Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section covers the Concrete Unit Masonry as shown, indicated and detailed on the Drawings.

B. Related Sections: The following Sections contain information and requirements that relate to this Section.

a. Division 03, Section 03300, Cast-in-Place Concrete.
b. Division 09, Section 09220, Portland Cement Plaster.

1.3 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following installed compressive strengths (fm) at 28 days.

1. For Concrete Unit Masonry: As follows, based on net area:
   a. f 'm = 1,500 pounds square inch.

2. For Mortar: As follows, based on gross area:

   a. Comply with ASTM C270 and ASTM C1019, unless noted otherwise.

1.4 SUBMITTALS

A. Submit each item according to General Conditions and Division 1 Specification Sections.

B. Product data for each different masonry unit, trim, accessory, and other manufactured product specified.

C. Shop drawings for reinforcing detailing fabrication, banding, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.

1.5 QUALITY ASSURANCE

A. Unit Masonry Standard: Comply with ACI 530.1 / ASCE 6 "Specifications for Masonry Structures", except as otherwise Indicated.

1. Revise ACI 530.1 / ASCE 6 to exclude Sections 1.4 and 1.7; Part 2.1.2, 3.1.2. and 4.1.2; and Articles 1.5.1.2, 1.5.1.3, 2.1.1.1, 2.1.1.2, and 2.3.3.9 and to modify Article 2.1.1.4 by deleting requirement for Installing vent pipes and conduits built into masonry.

B. Single Source Responsibility for Masonry Units: Obtain each type of exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics. From one source and by a single manufacturer for each different product required.

C. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not install until they are in an air-dried condition.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store masonry accessories, including metal Items, to prevent corrosion and accumulation of dirt and oil.

E. Protect components from damage.

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During erection, cover tops of walls, projection, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 Inches down both sides and hold cover securely in place.

2. Where one wythe of muitlwythe masonry walls is completed In advance of other wythes, secure cover a minimum of 24 Inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply loads to new wall construction for at least 24 hours and concentrated loads for at least 5 days after building masonry walls.

C. Stain Prevention: Prevent grout, mortar, and sod ' from staining the face of masonry. immediately remove grout mortar, and soil that come In contact with masonry.

1. Protect base of walls from rain splashed mud and mortar splatter by coverings spread on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with pointed and Integral finishes, from mortar droppings or splashings.

D. Cold Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit masonry damaged by frost or freezing conditions. Comply with the following requirements:

1. Cold Weather Construction: When the ambient temperature is within the limits Indicated, use the following procedures:

   a. 40 to 32 F (4 to 0 C): Head mixing water or sand to produce mortar temperatures between 40 and 120 F (4 and 49 C).

   b. 32 to 25 F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 F. Heat grout materials to produce grout temperatures between 40 and 120 F. Maintain mortar and grout above freezing until used in masonry.

   c. 25 to 20 F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 F. Heat grout materials to produce grout temperatures between 40 and 120 F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 F before grouting. Use heat on both sides of walls under construction.

   d. 20 F and below: Heat mixing water and sand to produce mortar Temperatures between 40 and 120 F. Heat grout materials to produce grout temperatures between 40. And 120 F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 F (4 C). Provide enclosures and use heat on both sides of walls under construction to maintain temperatures above 32 F within the enclosures.

2. Cold Weather Proton: When the mean daily temperature is within the limits indicated, provide the following protection:

   a. 40 to 25 F: Cover masonry with a weather resistant membrane for 48 hours after construction.

   b. 25 to 20 F: Cover masonry with insulating blankets or provide enclosure and heat for 48 hours after construction to prevent freezing. Install wind breaks when wind velocity exceeds 15 miles an hour.

   C. 20 F and below: Provide enclosure and heat to maintain temperatures above 32 F within the enclosure for 48 hours after construction.

3. Cold Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 F and above and will remain so until masonry has dried out, but not less than 7 days after completion of cleaning.

E. Hot Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide

artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 F and above.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Portland Cement, Mortar Cement, and Lime:

a. Glen-Gary Corporation.

b. Lafarge Corporation.

c. Lehigh Portland Cement Go.

d. Riverton Corporation.

2. Joint Reinforcement, Ties, and Anchors:

a. AA Wire Products Co.

b. Dur-O-Wal, Inc.

c. Heckman Building Products, Inc.

d. Hohmann & Bamard, Irw.

e. Masonry Reinforcing Corp. of America.

f. National Wire Products Industries.

2.2 CONCRETE MASONRY UNITS

A. Concrete Masonry Units: ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net area Compressive strength indicated below:

a. 1,900 pounds square inch, per C90.

2. Weight Classification: Normal Weight

3. Aggregates: Do not use aggregates made from pumice, scoria, or tuff.

4. Provide Type 1, moisture controlled units.

5. Size: Manufactured to the actual dimensions listed below (within tolerances specified in the applicable referenced ASTM specification) for the corresponding nominal sizes indicated on Drawings:

a. 4 inch nominal: 3-5/8 inch actual.

b. 6 inch nominal: 5-5/8 inch actual.

c. 8 inch nominal: 7-5/8 inch actual.

d. 12 inch nominal: 11-5/8 inch actual.

6. Exposed Faces: Manufacturer's standard color and texture as selected by the Architect.

7. Grade N-1.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold weather construction. Provide natural color or white cement as required to produce mortar color - indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement Lime Mix: Packed blend of Portland cement complying with ASTM C 150, Type I or Type III, and hydrated rune complying with ASTM C 207.

1. For pigmented mortars, use colored Portland cement lime mix of formulation required to produce color Indicated, or if not Indicated, as selected from manufacture's standard formulations. Pigments shall not exceed 10 percent of portland cement by weight for mineral oxides nor 2 percent for carbon black.

D. Aggregate for Mortar: ASTM C144; except for joints less than 1 1/2 inch use aggregate graded with 100 percent passing the No. 16 sieve.

1. White Mortar Aggregates: Natural white sand or ground white stone.

E. Aggregate for Grout: ASTM C 404.

F. Mortar Pigments: Natural and synthetic Iron oxides and chromium oxides, compounded for use in mortar mixes. Only use pigments with a record of satisfactory performance in masonry mortars.

G Ready Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this Article; combined with set controlling admixtures to produce a ready mixed mortar complying with ASTM C 1142.

H. Cold Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C. and recommended by the manufacturer for use in masonry mortar of composition Indicated.

I. Water: Potable.

J. Products: Subject to compliance with requirements, provide one of the following:

1. Cold Weather Admixture:

   a. Accelguard 80 by Euclid Chemical Co.

   b. Morset by W. R. Grace & Co.

2.4 REINFORCING STEEL

A. Steel Reinforcing Bars: Material and grade as follows:

1. Billet steel complying with ASTM A 615 (ASTM A 615M).

   a. Grade 60 (Grade 400).

B. Deformed Reinforcing Wire: ASTM A 496, with ASTM A 153, Class B-2 zinc coating.

C. Welded Wire Fabric: ASTM A 185.

2.5 JOINT REINFORCEMENT

A. Provide joint reinforcement formed from the following:

1. Galvanized carbon steel wire, coating class as follows:

   a. ASTM A 641 (ASTM A 641 M), Class 1, for interior walls and ASTM A 153, Class B2, for exterior walls.

B. Description: Welded wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with requirements Indicated below:

C. For single wythe masonry, provide type as follows with single pair of side rods:

1. Truss design with continuous diagonal cross rods.

D. For mufti wythe masonry, provide type as follows:

1. Ladder design with cross rods spaced not more than 16 Inches o/c.

   a. Number of Side Rods for Multiwythe Concrete Masonry: One side rod for each face shell of hollow masonry units more than 4 Inches In width, plus 1 side rod for each wythe of masonry 4 inches or less In width.

   b. Provide Integral drips on cross rods at cavity walls.

2. Tab design with single pair of side rods and rectangular box-" cross ties spaced not more than 16 inches o.c., with side rods spaced for embedment within each face shell of back up wythe and ties extended to engage the outer wythe by at least 1-1 /2 Inches.

3. Adjustable (2 piece) tab design with single pair of side rods and rectangular box type cross ties spaced not more than 16 Inches o.c., with side rods spaced for

embedment within each face shell of back up wythe and with separate adjustable ties engaging the cross ties and extended to engage the outer wythe by at least 1 -*1* 1'2 Inches and spaced not more than 16 Inches o.c.

a. Use where horizontal joints of facing wythe do not align with those of back up and where indicated.
b. Use where facing wythe is of different material than back up

E. Manufacturers:

1. Hohmann & Bamard, Inc.

2. Heckmann.

3. Dur-O-Wal, Inc.

2.6 TIES AND ANCHORS, GENERAL

A. Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of this Article, unless otherwise indicated.

B. Wire: As follows:

1. Galvanized Carbon Steel Wire: ASTM A 82; with ASTM A 153. Class B-2 coating.

C. Steel Sheet: As follows:

1. Galvanized Steel Sheet: ASTM A 526, G 60 (ASTM A 526M. Z 180) (commercial quality), steel sheet zinc coated by hot dip process on continuous lines prior to fabrication, for sheet-metal ties and anchors In Interior walls and In exterior walls when completely embedded in mortar.

2. Galvanized Steel Sheet: ASTM A 366 (ASTM A 366M) (commercial quality) cold-rolled, carbon-steel sheet hot dip galvanized after fabrication to comply with ASTM A 153, Class B-2 or B-3, as applicable, for sheet-metal ties and anchors in exterior walls not completely embedded in mortar and grout.

D. Galvanized Steel Sheet Thickness: For steel sheet hot dip galvanized by continuous process prior to fabrication:

1. .0635 Inch.

E. Thickness of Steel Sheet Galvanized after Fabrication: Uncoated thickness of steel sheet for hot dip galvanizing after fabrication:
1. .0598 Inch.

F. Steel Plates and Bars: ASTM A 36 (ASTM A 36M), hot dip galvanized to comply with ASTM A 153, Class B-1, B-2, or B-3, as applicable to size and form Indicated.

2.7 BENT WIRE TIES

A. Individual units prefabricated from bent wire to com. ply with requirements Indicated below:

1. Tie Shape for Hollow Masonry Units Laid with Cells Vertical: Rectangular with ends and not less than 4 Inches wide.

2. Type for Masonry Where Coursing Between Wythes Does Not Align: Adjustable ties composed of 2 parts. One with pintles, the other with eyes. Maximum misalignment of 1 inch.

3. Type for Masonry Where Wythes Are of Different Materials: Adjustable ties composed of 2 parts; one with panties, the other with eyes; maximum misalignment of 1 inch.

2.8 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast iron or malleable iron inserts of type and size indicated.

B. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6) with ASTM A 563 (ASTM A 563M) hex nuts and, where Indicated, flat washers; hot dip galvanized to comply With ASTM A 153, Class C; of diameter and length Indicated and In the following configurations:

1. Headed bolts.

2. Nonheaded bolts, straight.

C. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load Imposed Within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified Independent testing agency.

I. Type: Expansion anchors.

2. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe / Zn 5 (5 microns) for Class SO I service condition. (mild).

3. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to 4 times the loads imposed by masonry.

2.9 EMBEDDED FLASHING MATERIALS

A. Sheet Metal Flashing: Fabricate complying with requirements specified in Division 07, Section 07600, Sheet Metal Flashing and Trim and below:

B. Solder and Sealants for Sheet Metal Flashings: As specified in Division 07, Section 07600, Sheet Metal Flashing and Trim.

C. Products: Subject to compliance with requirements, provide one of the following:

1. Metal Flashing:
   a. Cheney Flashing (Dovetail) by Cheney Flashing Company, Inc.

   b. Cheney Flashing (Sawtooth) by Cheney Flashing Company, Inc.

c. Keystone 3 Way Interiocking Thruwall Flashing by Keystone Flashing Co.

2. Copper Fabric Laminate Flashing:

a. Copper Fabric by AFCO Products, Inc.

b. Type FCC-Fabric Covered Copper by Phoenix Building Products.

c. Copper Fabric Flashing by Sandell Manufacturing Co., Inc.

d. York Copper Fabric Flashing by York Manufacturing, Inc.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Promolded filler strips complying with ASTM D 1056, Type 2, Class A, Grade 1; compressible up to 85 percent; of width and thickness Indicated; formulated from the following material:

1. Neoprene.

2. Urethane.

3. Polyvinyl chloride.

B. Preformed Control Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall size and configuration as indicated.

1. Styrene Butadiene Rubber Compound: ASTM D 2000, Designation M2AA-805.

2. Polyvinyl Chloride: ASTM D 2287, General Purpose Grade, Type PVC-65406.

C. Bond Breaker Strips: Asphalt saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep Holes: Provide the following:

1. Round Plastic Tubing: Medium density polyethylene, of indicated outside diameter by 4 inches long.

E. Cavity Drainage Material: I inch thick, reticulated, nonabsorbent mesh, made from polyethylene strands and shaped to maintain drainage at weep holes without being clogged by mortar droppings.

1. Product: Subject to compliance with requirements, provide 'Mortar Net' by AA Wire Products Co.

2.11 INSULATION

A. Extruded Polystyrene Board Insulation: Rigid, cellular, polystyrene thermal insulation with dosed cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578, Type IV In manufacturers standard lengths and widths; and In thickness indicated.

1. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.12 MASONRY CLEANERS

A. Proprietary Cleaner: Manufacture's standard strength, general purpose cleaner designed for removing mortar / grout stains, efflorescence, and other now construction stains from now masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for Intended use by manufacturer of masonry units being cleaned.

1. Products: Subject to compliance with requirements, provide one of the following:

a. 202 Now Masonry Detergent by Diedrich Technologies, Inc.

b. Sure Klean No. 600 Detergent by ProSoCo, Inc.

2.13 MORTAR AND GROUT MIXES

A. Do not use admixtures, Including pigments, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

2. Add cold weather admixture (if used) at ft same rate for all mortar, regardless of weather conditions, In order to ensure that mortar color is consistent.

B. Mortar for unit Masonry. Comply with ASTM C 270, P 8 for job mixed mortar; and ASTM C 1142 for ready mixed mortar, of types Indicated below:

1. Limit cementitious materials in mortar to Portland cement and lime.

2. For masonry below grade, in contact with earth, and where indicated, use type indicated below:

a. Type: S.

3. For reinforced masonry and for exterior, above grade, load bearing and nonload bearing walls and parapet walls, use type indicated below:

a. Type: S.

C. Grout for Unit Masonry: Comply with ASTM C 476. Use grout of consistency indicated or, If not otherwise Indicated, of consistency (fine or coarse) at time of placement that will completely fill spaces Intended to receive grout.

1. Use fine grout in grout spaces less than 2 inches in horizontal dimension, unless otherwise indicated.

2. Use coarse grout in grout space 2 inches or more in least horizontal dimension, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single wythe walls to the actual thickness of the masonry units, using units of thickness Indicated.

B. Build chases and recesses to accommodate Items specified in this and other Sections of the Specifications.

C. Leave openings for equipment to be installed before completion of masonry. After installing complete masonry to match construction immediately to adjacent to the opening.

D. Do not wet concrete masonry units, do not place wet units.

E. Cut masonry units with motor driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full size units before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

F. Mix units for each type of exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

3.3 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical Ones and surfaces of columns, walls, and rises, do not exceed 1/4 inch In 10 feet nor 1/2 Inch in 20 feet nor 3/4 inch in 40 feet or more. For external comers, expansion joints, control Joints, and other conspicuous lines, do not exceed 1/2 Inch in 20 feet nor 3/4 inch in 40 feet or more. For vertical alignment of head joints, do not exceed plus or minus 1/8 Inch in 10 feet nor 1/4 inch maximum.

B. Variation from Level: Do not exceed 1/2 inch In 20 feet, nor 3/4 inch in 40 feet or more. For top surf ace of bearing walls, do not exceed 1/8 inch in 10 feet, nor 1/16 Inch within width of a single unit.

C. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls, and partitions, do not exceed 1/2 inch in 20 feet nor 3/4 inch in 40 feet or more.

D. Variation in Gross Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/16 Inch nor plus 1/8 inch.

E. Variation In Mortar Joint Thickness: Do not vary from bed joint thickness Indicated by more than plus or minus 1/8 Inch, with a maximum thickness limited to 3/8 inch. Do not vary bed joint thickness from bed joint thickness of adjacent course by more than 1/8 inch. Do not vary from head joint thickness Indicated by more than plus or minus 1/8 inch. Do not vary head Joint thickness from adjacent head joint thickness by more than 1/8 inch. Do not vary from collar joint thickness Indicated by more than minus 1/16 inch or plus 1/8 inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls In advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement type joints, and returns. and offsets. Avoid the use of **less** than half size units at comers, jambs, and where possible at other locations.

B. Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

C. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Lay concealed masonry with all units in a wythe in running bond. Bond and Interlock each course of each wythe at. Do not use units with less than nominal 4 Inch horizontal face dimensions at comers or iambs.

E. Stopping and Resuming Work: In each course. rack back 1 unit length for one half running bond or I unit length for one third running bond. Do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry unit and mortar prior to laying fresh masonry.

F. Built in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built in items.

G. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

H. Where built in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

I. Fill cores in hollow concrete masonry units with grout 24 Inches under beating plates, beams, lintels, posts, and similar Items, unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.

2. Bed webs in mortar in starting course on footings and In all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.

3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

4. Maintain joint widths Indicated, except for minor variations required to maintain bond alignment.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise Indicated.

3.6 HORIZONTAL JOINT REINFORCEMENT

A. Provide continuous horizontal Joint reinforcement as Indicated. Install entire length of longitudinal side rods in mortar on exterior side of walls. Lap reinforcing a minimum of 6 inches.

1. Space reinforcement not more than 16 Inches o.c.

2. Space reinforcement not more than 8 Inches o.c. in foundation and/or retaining walls.

3. Provide reinforcement in mortar joint 1 block course above and below wall openings and extending 12 inches beyond opening.

a. Reinforcement above Is in addition to continuous reinforcement.

B. Cut or Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at comers and wall Intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints In unit masonry where Indicated. Building related items as the masonry progress. Do not form a continuous span through movement joints unless provisions are made to prevent in plane restraint of well or partition movement.

B. Form control joints in concrete masonry as follows:

1. Install preformed control joint gaskets designed to fit standard sash block.

2. Install interlocking units designed for control joints. Install bond breaker strips at joint. Keep head joints free and clear of mortar or rake joint.

3. Install temporary foam plastic filler in head joints and remove when unit masonry is complete.

C. Build in horizontal pressure relieving joints where indicated. Construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod.

3.8 FLASHING, WEEP HOLES, AND VENTS

A. Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where Indicated.

B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Place through wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer before covering with mortar.

3.9 FIELD QUALITY CONTROL

A. The District will employ and pay a qualified Independent testing agency to perform the following testing and inspection for field quality control. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. Mortar properties will be tested per property specification of ASTM C 270.

C. Mortar will be sampled and tested for comprehensive strength per ASTM C 780.

D. Grout will be sampled and tested for compressive strength per ASTM C I 01 9.

E. Prism Test Method: For each type of wait construction Indicated, masonry prisms will be tested per ASTM E 447, Method B, and as follows:

1. Prepare 1 set of prisms for testing at 7 days and I set for testing at 28 days.

F. Evaluation of Quality Control Tests: In the absence of other indications of non compliance with requirements, masonry will be considered satisfactory If results from construction quality control tests comply with minimum requirements Indicated.

G. Full-time, continuous inspection of laying of masonry units and grout placement.

3.10 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or R units do not match adjoining units. Install now units to match adjoining units; Install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up Joints, Including corers, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.

C. In Progress Cleaning: Clean unit masonry as work program by dry brushing to remove mortar fins and smears prior to tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel. Leave one half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

4. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

5. Clean concrete masonry by cleaning method indicated in NCMA TEK B-2 applicable to type of stain present on exposed surfaces.

6. Clean cast stone as recommended by manufacturer.

E. Protection: Provide final protection and maintain conditions that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

3.11 MASONRY WASTE DISPOSAL

A. Recycling: Undamaged, excess masonry materials are Contractor's property and shall be removed from the Project site for his use.

B. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste and legally dispose of off District's property.

END OF SECTION 04810

SECTION 05120 – STRUCTURAL STEEL.

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Requirements: The General of the Contract Documents

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Miscellaneous metals.

B. Non-shrink grout.

1.3 CODES AND STANDARDS

A. Refer to the following for information regarding materials and installation methods necessary:

1. American Society for Testing and Materials — Specifications A36, A53—B, A153, A570, A307, A370 and A500, ASOI (also listed on SS00), A446, A611 and A572, A992
2. American Institute of Steel Construction, Steel Construction Manual, 9th Edition. RIS - Redwood Inspection Service.
3. American Welding Society — AWS D1.1 — D1.5.
4. Steel Structures Painting Council.
5. Title 24, Part 2, C.C.R., 2001 C.B.C.
6. F.E.M.A. 350, Recommended Seismic Design Criteria for New Steel Moment Frame Buildings
7. F.E.M.A. 353 Recommended Specifications and Quality Assurance Guidelines for Steel Momenty Frame Construction for Seismic Application.

1.4 SUBMITTALS

A. Shop drawings and product data shall be submitted in compliance with the pertinent provisions of the General Conditions and Section 01330.

B. Submit shop and erection drawings prior to fabrication. Prepare erection drawings by State registered structural engineer. Show welded connections, lengths of welds, profiles, sizes, spacing and locations of all members, attachments, anchorages, framed openings size and type of fasteners, cambers and land loads. Contractor is responsible for dimensions on shop drawings.

1. Splices and deviations: Splices will be permitted only where and as shown on drawings. Deviations from design drawings are to be handled by change order and require approval of the structural engineer and the Division of the State Architect.

C. Erection and bracing plan to procedure: Refer to Section 1710, Title 8, CCR Employ a state licensed civil engineer to prepare erection and bracing plan and erection procedure for structural steel including columns, beams, and girders, who will be responsible for compliance. Follow plan and procedure exactly. Keep a copy at project site. The Owner will pay for costs involved.

D. Submit following Informational Submittals:

1. Test Data: Submit test data demonstrating the suitability of direct tension indicator washers as described in AISC S329.
2. Mill Test Reports: Submit certified mill test reports of chemical analysis and physical test for each heat number of structural steel.
3. Certifications specified in Quality Assurance article.
4. Qualification Data: Fabricator's, erector's and welder's qualification data.
5. Erection Survey: Submit copy of contractor's field quality control erection survey.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications:

1. Minimum 5 years documented experience in fabrication of structural steel.
2. Certified in accordance with AISC Quality Certification Program for Category I

B. Erector Qualifications: Minimum 5 years documented experience in erection of structural steel for similar structures.

C. Welder Qualifications: AWS certified within past 12 months for each type of weld required.

D. Certifications:

1. Submit certificates verifying AWS qualifications for each welder employed on Project.
2. Submit fabricator's certification that structural steel, bolts, nuts and washers, anchor bolts, threaded rods, filler metal and flux for welding, shop paint, and non-shrink grout meet or exceed specified requirements.
3. Submit Contractor's certification that steel is installed in accordance with Contract Documents, based on inspection and testing specified as part of field quality control.
4. Submit current certificate of AISC Quality Certification Program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01600.

B. Store to facilitate inspection.

1.7 PROJECT CONDITIONS

A. Existing Conditions: Field verify conditions. Architect will not review or take responsibility for dimensions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel Shapes: ASTM A992 Grade 50.

B. Structural Steel Plates and Bars: ASTM A36 and ASTM , 572 Grade 50 and ASTM A588; locations indicated on Drawings.

C. Square and Rectangular Structural Tubing:

1. ASTM A500, Grade B.

D. Pipe and Round Structural Tubing:

1. Pipe: ASTM A53 Grade B.

E. Bolts, Nuts and Washers:

1. Anchor bolts:

a. Bolts: ASTM A307, Grade A ; ASTM A354, Grade BC ASTM A354, Grade BD ;ASTM A449, Type 1 and ASTM 447 as indicated on the plans.
b. Threaded Rods: ASTM A36 ,ASTM A572/A572M, Grade 50
c. Nuts: ASTM A563, Grade D, heavy hex.
d. Washers: ASTM A36 plates.

2. Standard Threaded Fasteners:

a. Bolts: ASTM A307, Grade A.
b. Nuts: A563, Grade A.
c. Washers hardened; beveled where required.

3. High Strength Fasteners:

a. ASTM A325, Type 1:

(1) Diameter: Up to 1-1/2 inches.
(2) Nuts: ASTM A563, Class C plain, Class DH galvanized, heavy hex; or ASTM A194, Grade, Grade 2H galvanized
(3) Washers: Hardened.

b. ASTM A490, Type 2

(1) Diameter: 1/2 inch to 1 inch 1-1/2 inches.

(2) Nuts: ASTM A563, Class DH DH3 plain, heavy hex; or ASTM A194, Grade 2H plain, heavy hex.
(3) Washers: Hardened.

4. Washers:

a. Plain Washers: ANSI B18.22.1, Type A Hardened Washers: ASTM F436.
b. Lock Washers: ANSI B18.21.1.
c. Tension Indicating Washers: ASTM F959.

F. Welding Materials: AWS D1.1; type required for materials being welded.

G. Shop Paint:

1. Standard shop paint: SSPC Paint 11, Paint 13, or Paint 25.

H. Field Touch-Up Paint:

1. Primed Surfaces: Same paint as applied in shop.
2. Galvanized Surfaces: SSPC Paint 20, Type II, organic zinc rich.

I. Non-Shrink Grout:

1. ASTM C1107, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives.
2. Minimum Strength at 28 Days: 5000 psi.
3. Acceptable Products:

a. Masterflow 713, Master Builders, Cleveland, OH.
b. Euco N.S., Euclid Chemical Company, Cleveland, OH.
c. Crystex, L&M Construction Chemicals, Inc., Omaha, NE.
d. SikaGrout 212, Sika Corporation, Lyndhurst, NJ.
e. Sonogrout 10K, Sonneborn Building Products, Shakopee, MN.

2.2 FABRICATION

A. Shop Fabrication and Assembly:

1. Fabricate structural steel members in accordance with AISC S326
2. Perform corrective work on material not meeting ASTM A6/A6M tolerances for camber, profile, flatness, or sweep subject to limitations given in appropriate ASTM material specification.
3. Fabricate architecturally exposed structural steel (AESS) members in accordance with AISC S302:

a. Use materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, and roughness.
b. Remove blemishes by grinding, or welding and grinding, prior to cleaning, treating and application of shop paint.

B. Connections:

1. Bolt or weld shop connections.
2. Bolt or weld field connections, except where welded connections are indicated.
3. Use high-strength threaded fasteners for bolted connections, except that standard threaded fasteners may be used in temporary erection connections when final connection is welded after adjustment and for temporary bracing.
4. Install high-strength bolted construction in accordance with AISC S329 utilizing fully pre-tensioned bolts, unless noted otherwise.
5. Punch, ream or drill bolt holes.
6. Weld in accordance with AWS D1.1.

C. Holes for Other Work:

1. Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as approved by Architect.
2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning.

D. Base Plates and Column Plates: Milled or pressed, loose or attached.

E. Bearing Plates: Provide under beams resting on piers and walls; loose or attached.

F. Anchor Bolts: Provide templates for anchor bolt groups.

2.3 FINISH

A. Clean steel of oil and grease by SSPC SP1 Solvent Cleaning; remove dirt and foreign material by brushing.

B. Interior Steel Members:

1. Preparation: Clean by SSPC SP6 - Commercial Blast Cleaning.
2. Primer: Apply shop paint for exposed members to thickness recommended by finish coat manufacturer to minimum 2 mil dry thickness.
3. Do not paint within 2 inches of field welds and on contact surfaces of slip-critical connections.
4. Clean and paint surfaces inaccessible after shop assembly prior to assembly.

C. Exterior steel members exposed to atmosphere and concealed members located outside exterior weatherproofing envelope:

1. Preparation: Clean by SSPC SP6 - Commercial Blast Cleaning.
2. Primer: Apply shop paint for exposed members to thickness recommended by finish coat manufacturer to minimum 2 mil dry thickness.
3. Do not paint within 2 inches of field welds and on contact surfaces of slip-critical connections.
4. Clean and paint surfaces inaccessible after shop assembly prior to assembly.

D. Galvanized Finish:

1. Hot-dipped galvanized coating according to ASTM A123.
2. Provide for exterior suspended steel lintels and at other locations noted on Drawings.

E. Protect machine finished surfaces with rust-inhibiting coating, which is removable prior to erection, or which has characteristics which make removal unnecessary.

2.4 SHOP QUALITY CONTROL

A. Shop testing and inspection will be performed by an Independent Testing Laboratory employed by Owner approved by Architect under provisions of Section 01450, except as otherwise specified.

B. Inspector Qualifications: AWS Certified Welding Inspector.

C. Weld Inspection:

1. Perform visual inspection of welds in accordance with AWS D1.1.
2. Verify qualifications of welders.
3. Verify welding procedure qualification and equipment.
4. Verify weld materials and storage facilities.
5. Inspect joint fit-up prior to welding.
6. Measure 25% of fillet welds.

D. Non-Destructive Testing of Welds:

1. Ultrasonic Testing (UT):

   a. Conform to ASTM E164.
   b. Test 100 percent of full penetration welds.

E. Inspect bolted connections in accordance with AISC S329.

F. Inspect shop fabricated assemblies, verify dimensional tolerances.

G. Mark inspected connections.

H. Retest rejected connections after repair.

I. Verify surface preparation and shop paint application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01700.

3.2 PREPARATION

A. Temporary Shoring and Bracing:

1. Provide temporary shoring and bracing members and connections during construction to carry loads to structure including wind, seismic, dead loads, equipment loads and erection loads.
2. Provide temporary shoring for members indicated as shored construction.
3. Provide temporary guy lines to achieve proper alignment of structure as erection proceeds.
4. Remove temporary members and connections when permanent members shear walls are in place and final connections are made.

3.3 ERECTION

A. Erect structural steel members in accordance with AISC S326.

B. Setting Base Plates and Bearing Plates:

1. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces.
2. Clean bottom surface of base and bearing plates.
3. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
4. Tighten anchor bolts after supported members are positioned and plumbed. Do not use impact torque wrenches.
5. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to grouting.
6. Place non-shrink grout solidly between bearing surfaces and plates or steel member so that no voids remain. Comply with grout manufacturer's instructions.

C. Field Assembly:

1. Set structural frames accurately to lines and elevations indicated.
2. Align and adjust various members forming part of complete frame or structure before permanently fastening.
3. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly.
4. Adjust as necessary to compensate for discrepancies in elevations and alignment.
5. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
6. Splice members only where indicated on approved shop drawings.
7. Complete field connections before load is applied.
8. On exposed welded construction, remove erection bolts, run-off plates, tack welds and backing bars. Fill holes with plug welds and grind smooth at surfaces which remain exposed to view.
9. Field weld components indicated on approved shop drawings.
10. Do not field cut or alter structural members or connections without approval of Architect.

11. Install high strength bolted construction in accordance with AISC S329 utilizing fully pre-tensioned bolts unless noted otherwise.
12. Tightening of bolts in slip-critical connections shall be done by turn-of-nut tightening, installation of alternate design bolts or direct tension indicator tightening. Calibrated wrench tightening may also be used for connections noted to be fully pre-tensioned but not slip-critical.
13. Coordinate installation of slip-critical connections with the Independent Testing Laboratory to facilitate inspection.

D. Erection Tolerances:

1. Comply with AISC S326.
2. All specified tolerances are to be achieved at an ambient temperature of 70 degrees F.

E. Touch-Up Painting:

1. After erection, touch-up abrasions on shop-primed or galvanized surfaces except surfaces which are indicated as unpainted.
2. After inspection and approval, paint welds, bolts and nuts, and surfaces adjacent to welds, on painted steel members. Insert specific model code organization in paragraph below or revise if report must be from another source.

3.4 TESTS AND INSPECTIONS

A. If structural steel can be identified by heat or melt numbers and is accompanied by mill analysis and test reports, testing shall be in accordance with Sec. 2231A.4, Title 24 2001 C.B.C. Identified stock shall be tested also.

3.5 FIELD QUALITY CONTROL

A. Field testing and inspection will be performed by an Independent Testing Laboratory employed by Owner approved by Architect under provisions of Section 01450, except as otherwise specified.

B. Inspector Qualifications: AWS Certified Welding Inspector.

C. Weld Inspection:

1. Perform visual inspection of welds in accordance with AWS D1.1.
2. Verify qualifications of welders.
3. Verify welding procedure qualification and equipment.
4. Verify weld materials and storage facilities.
5. Inspect joint fit-up prior to welding.
6. Measure 25 percent of fillet welds.
7. Inspect welded stud shear connectors in accordance with AWS D1.1.

D. Non-Destructive Testing of Welds:

1. Ultrasonic Testing (UT):

a. Conform to ASTM E164.
b. Divide connections into groups containing not less than 40 connections. Test 25% of connections in each group. If any weld is rejected, test all connections in group.

2. Magnetic Particle Testing (MT):

a. Conform to ASTM E709.
b. Test 10 percent of length of fillet welds and 100 percent complete penetration weld.

E. Bolt Inspection:

1. Slip-Critical Connections: Inspect 10 percent of the bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC S329. Inspect all bolts in the connection when one or more are rejected.
2. Fully Pre-Tensioned Connections: Inspect 10 percent of the bolts, but not less than 2 bolts, selected at random in 25 percent of the connections in accordance with AISC S329. Inspect all bolts in the connection when one or more are rejected.
3. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
4. Snug Tight Connections: Inspect 100 percent of connections verifying that plies of connected elements have been brought into snug contact.

F. Mark inspected connections.

G. Inspect beams for camber requirements.

H. Inspect field erected assemblies, verify locations of structural steel for plumbness, level and alignment.

I. Repair and retest rejected connections.

J. Contractor's Field Quality Control Responsibilities:

1. Survey steel frame as erection proceeds to determine plumbness, level and alignment.
2. Adjust steel frame as necessary during erection to maintain erection tolerances.
3. Survey elevations of each level of steel frame as work progresses.
4. Notify Architect of deviations from required elevations and tolerances.

END OF SECTION 05120

SECTION 05310 - STEEL DECK

PART 1 - GENERAL

1.1 SUMMARY

A. Related Sections:

1. Section 05120 - Structural Steel.

1.2 SYSTEM REQUIREMENTS

A. Design Requirements:

1. Compute section properties in accordance with AISI Specification for the Design of Cold-Formed Steel Structural Members.
2. Span Design: 3 span typical. Gage indicated on Drawings represents minimum thickness required in completed structure. Provide gage conforming to SDI requirements for stress and deflection during construction, based on actual span lengths, number of continuous spans, loading, and presence or absence of shoring.

B. Interface With Adjacent Systems:

1. Coordinate installation with requirements of UL classified assembly indicated on Drawings.
2. Coordinate with requirements of suspended ceiling below.
3. Coordinate installation with requirements of roof membrane manufacturer.
4. Coordinate with requirements of electrical system.
5. Coordinate with requirements of stud shear connectors.

1.3 SUBMITTALS

A. General: Submit following items in accordance with Section 01330.

B. Product Data:

1. Submit product data for each type of decking and accessory.
2. Provide deck profile characteristics and dimensions, structural properties, and finishes.
3. Submit manufacturer's literature documenting fastener capacity.
4. Submit maximum unshored clear span and superimposed live load capacities for each type of decking and slab thickness.

C. Shop Drawings: Indicate following items:

1. Type of deck.
2. Layout of deck and accessories.

3. Support locations.
4. Edge and end of deck locations.
5. Openings.
6. Connections of deck and accessories.
7. Methods of welding.
8. Supplementary framing locations.
9. Bearing details.
10. Layout of stud shear connectors.

D. Submit following Informational Submittals:

1. Test Reports:

a. Submit 3 certified mill test reports of chemical analysis and physical test for steel deck materials.
b. Submit certified noise reduction coefficient test results by independent testing laboratory.
c. Submit certified test reports demonstrating that steel rolling compounds, lubricants, and primers are compatible with sprayed fireproofing and will not impair performance under fire exposure for applications indicated.

2. Certifications specified in Quality Assurance article.
3. Qualification Data: Erector's qualification data.
4. Manufacturer's Instructions: Indicate specific installation sequence and special instructions.

E. Certificates:

1. Submit certificates verifying AWS qualifications within previous 12 months for each welder employed for Work.
2. Submit fabricator's certification that steel deck furnished for this Project meets or exceeds specified requirements.
3. Manufacturer's Installation Instructions: Indicate specific installation sequence and special instructions.

1.4 QUALITY ASSURANCE

A. Welder Qualifications: AWS certified within past 12 months for each type of weld required.

B. Erector Qualifications: Minimum 5 years documented experience in erection of steel deck.

C. Underwriters Label: Provide metal floor and roof deck units listed in Underwriters Laboratories "Fire Resistance Directory," with each deck unit bearing UL label and marking for specific system detailed.

D. Certifications:

1. Submit certificates verifying AWS qualifications for each welder employed on Project.
2. Submit fabricator's certification that products furnished for Project meet or exceed specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with provisions of Section 01600.

B. Store off ground with one end elevated higher than other end.

C. Protect with waterproof covering, ventilated to prevent condensation.

1.6 PROJECT CONDITIONS

A. Field verify measurements. Architect will not review or take responsibility for dimensions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers: Manufacturer members of Steel Deck Institute are acceptable.

2.2 MATERIALS

A. Deck:

1. Painted Deck: ASTM A611, Grade C .
2. Galvanized Deck: ASTM A653, Grade 50.
3. Uncoated Deck: ASTM A611, Grade C.

B. Accessories:

1. Flexible Flute Closure: Closed cell foam rubber, 1 inch thick, profile to fit tight to deck.
2. Metal Closure Strips:

   a. Material: Same as deck , 20 gage minimum thickness.
   b. Fabricate metal closure strips for openings between decking and other construction.
   c. Form to provide tight-fitting closures at open ends of cells or flutes and sides of decking.

3. Column closures, end closures, side closures: Same material as deck; 20 gage minimum thickness.
4. Pour Stops: Same material as deck, gage as required for overhang, 20 gage minimum thickness, limit deflection to 1/8 inch.
5. Composite Finish Strips, Filler Strips: Same material as deck Weld Washers: Mild steel, uncoated, 16 gage minimum, with 3/8 inch diameter hole.
6. Reinforcing Channels: ASTM A653, Grade 33, 20 gage minimum.
7. Butt Plate (Cover Plate): ASTM A653, Grade 33, 20 gage minimum, 6 inch minimum width.

8. Ridge, Eave, and Valley Plates: ASTM A653, Grade 33, minimum 4 inch wide.
9. Cant Strip: ASTM A653, Grade 33.
10. Sump Pans: ASTM A653, Grade 33; flat plate recessed sloped pan; size as required by roof drain assembly, 14 gage minimum.

C. Headed Stud-Type Shear Connectors: ASTM A108, Grades 1010 through 1020, and AWS D1.1, forged steel, headed, uncoated.

D. Welding Materials: AWS D1.1.

E. Primer Paint: Deck manufacturer's standard.

F. Touch-Up Primer for Galvanized Surfaces: Zinc rich type, Tneme-Zinc, Tnemec Company, Inc., Kansas City, MO.

G. Touch-Up Primer for Painted Surfaces: Same as prime coat.

H. Fasteners: Galvanized hardened steel, self tapping, size 12 minimum.

I. Powder Activated or Pneumatically Driven Fasteners: Steel with minimum 5/16 inch diameter head size.

2.3 DECK TYPES

A. Composite Deck:

1. Material: Steel conforming to ASTM A653, Grade 33, with minimum yield strength of 33 ksi.
2. Profile: Fluted with diagonal rib deformations for bond with concrete slab.
3. Side Joints: Lapped.
4. Formed Sheet Width: 36 inches.
5. Finish: Galvanized Phosphatized.

B. Non-Composite Form Deck:

1. Material: Steel conforming to ASTM A611 ASTM A653, Grade 33, with minimum yield strength of 33 ksi.
2. Profile: Fluted units of wide rib
3. Side Joints: Lapped.
4. Formed Sheet Width: 36 inches.
5. Finish: Galvanized
6. Vent Area: Fabricate with slots or perforations to provide minimum 1-1/2 percent open area.

C. Cellular Composite Units - Electrical Floors:

1. Material: Steel conforming to ASTM A653, Grade 33, with minimum yield strength of 33 ksi.
2. Profile:
   a. Fluted with diagonal rib deformations for bond with concrete slab.
   b. Flat metal plate attached to bottom of fluted units.
3. Factory punched holes for preset inserts.

4. Side Joints: Lapped.
5. Formed Sheet Width: 36 inches.
6. Finish: Galvanized

2.4 FINISHES

A. Deck:

1. Galvanized: ASTM A653, coating designation as indicated G90.
2. Galvanized and Painted: Chromate primer and acrylic topcoat on phosphate cleaned galvanized steel.

B. Accessories: Same finish as deck.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01700.

3.2 INSTALLATION

A. Erect metal decking in accordance with SDI Design Manual and manufacturer's instructions

B. Install deck in accordance with span, load, and shoring conditions on which design is based.

C. Erect decking on steel supports with 2 inch minimum bearing. Butt ends of deck where shear studs occur. Do not lap ends of deck over supports which have composite studs welded to top flanges. Align and level.

D. Erect decking on masonry and concrete support surfaces with 4 inch minimum bearing. Align and level.

E. Attachment:

1. Fasten deck to steel support members at ends of units and at all intermediate supports. Fasten at edge ribs and at interior ribs to provide maximum average spacing of 12 inches on center, with maximum spacing of adjacent attachments of 18 inches, unless noted otherwise.
2. Fasten floor deck units to steel support members, which span parallel to deck span, at maximum 36 inches on center, unless noted otherwise. Cut deck flutes as required to fasten deck to steel.
3. Fasten roof deck units to steel members which span parallel to deck span at maximum 12 inches OC, unless otherwise noted.

4. Use 5/8 inch minimum diameter puddle welds. Use welding washers for deck of 18 gage and thinner. Weld in accordance with AWS D1.1 and AWS D1.3.
5. Fasten side laps of adjacent non-composite form deck units having spans greater than 5'-0" at mid-span or at 36 inch intervals, whichever is smaller, by or welding, unless noted otherwise.
6. Fasten side laps of adjacent composite units at 36 inch intervals by screws or welding.
7. Fasten side laps of cantilevered deck at end and maximum 12 inch intervals to support, unless otherwise noted.

F. Additional Requirement for Corrugated Form Deck:

1. Placement: Edges up.
2. End Laps: 2 inch minimum; centered over support. Do not extend bottom sheet beyond edge of support.
3. Side Laps: Nested 1/2 corrugation minimum.
4. Attach deck units to supports at maximum 15 inch intervals, unless noted otherwise.

G. Openings:

1. Cut all openings with metal saws, drills, or punch-out devices.
2. Flame cutting not permitted.
3. Reinforce deck with supplemental framing at all openings exceeding 10 inches in any dimension.
4. Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

H. Accessories:

1. General:

   a. Attach metal accessories to deck or supporting steel by welding in manner to develop full capacity of accessory.
   b. Lap accessories onto supporting material 2 inches minimum.
   c. Set closures flush with adjacent construction, eliminating ledges and pockets.
   d. Compress flexible closures in place, providing tight fit.
   e. Set visible closures in true, even lines.

2. Provide flexible closures as follows:

   a. To close tops of non-fire rated, interior and exterior partitions in rooms without ceilings. Install on visible sides of partition.
   b. To close tops of exterior partitions where deck extends beyond face of wall.
   c. At both sides at tops of acoustically rated partitions. Fill space between closures with sound absorbing material.

3. Provide metal flute closures to close both sides of tops of fire rated partitions. Fill space between closures with filler material and seal all openings, cracks, and gaps as specified in Section 07840.

4. Provide column closures to close gaps at columns.

5. Provide end closures to close open ends of cells.

6. Provide side closures to close spaces parallel to deck flutes when gaps less than rib spacing occur.

7. Provide pour stops at ends and sides of deck to act as forms for concrete.

8. Provide composite finish and filler strips at edges of deck parallel to span when gaps less than rib spacing occur.

9. Provide hanger tabs to support suspended ceilings, spaced 24 inches on center each way.

10. Butt plate (Cover Plate): Provide where deck changes direction.

11. Reinforcing Channel: Provide parallel to deck span to support edge of deck adjacent to roof openings.

12. Ridge, Eave and Valley Plates: Provide at ridge, valley, and eave of roof when roof slope exceeds 1/2 inch per foot.

I. After inspection, clean and coat welds, burned areas, and damaged surface coating, with touch-up primer.

3.3 FIELD QUALITY CONTROL

A. Perform field quality control in accordance with Section 01450.

B. Field inspection will be performed under the provisions of Section 01450, except as otherwise specified.

C. Independent Testing Laboratory is responsible for:

1. Visual Inspection:

a. Inspect stud welding, deck and accessory welds, and side lap connections.
b. Perform inspections while work is progressing and after work is complete.
c. Verify gage, finish, size and type of metal decking, and accessories.
d. Inspect roof deck top surface for flatness after installation. Ensure top flanges of each sheet have concavity or convexity of less than 1/8 inch. Place straight edge across any 3 contact surfaces to ensure levelness of 1/8 inch from any surface.
e. Verify extent of touch-up primer.

2. Tests: Test 20 percent of headed studs for fastening strength in accordance with AWS D1.1.

D. Erect steel deck under observation of testing and inspection agency representative.

END OF SECTION 05310

SECTION 05400 – COLD FORMED STEEL

PART 1 - GENERAL

1.1 WORK SPECIFIED INTHIS SECTION

A. Provide structural framing members complete with bracing, weld washers, nuts, shims, anchor bolts.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Structural steel.

B. Welding (See Structural Steel Section).

C. Finish painting.

D. Substrates to which fabrications are to be embedded.

1.3 CODES AND STANDARDS

A. American Iron: and Steel Institute Specification for the Design of Cold-Formed Steel Structural Members, August 19, 1986, with December 1989 Addendum.

B. E Title 24, Part 2, C.C.R., 2001 C.B.C., Section 2204A.

C. American Society for Testing and Materials-A446/A446M-85 (Grades A,B,C,D,&F)

D. American Welding Society-AWS D1.1-2000, and D1.3-98.

E. Steel Structures Painting Code.

1.4 SUBMITTALS

A. General: Submit following items in accordance with Section 01330.

B. Submit shop and erection drawings prior to fabrication. Show member sizes with sections and section properties, welded connections, lengths and sizes of welds, spacing and locations of all members, attachments, anchorages, framed openings, size and type of fasteners. Contractor is responsible for dimensions on shop drawings.

1.5 TESTS AND INSPECTIONS

A. Each lift or bundle of fabricated elements shall have the grade and the ASTI'4 specification number or other specification designation shall be indicated by painting, decal, tagging or other

suitable means. Also the resulting minimum yield point shall be indicated in addition to the specification designation. Reference Title 24, Part 2, 2001 C.B.C, Section 2202A.2.Title 24.

B. The fabricator, in processing steel through his works, shall maintain identity of the material and shall maintain suitable procedures and records attesting that the specified grade has been furnished in conformity with the applicable Uniform Building Code Standard. The ASTM or other specification designation shall be included near the erection mark on each shipping assembly or important construction component over any shop coat of paint prior to shipment from the fabricator's plant. The fabricator's identification mark system shall be established and on record prior to fabrication. Reference Title 24, 2001 C.B.C., Section 2202A.2.

C. Steel which is not readily identifiable as to grade from marking and test records shall be tested to determine conformity to such standard. The fabricator shall when requested, furnish an affidavit of compliance with such standard. Reference Title 24, 2001 C.B.C., Section 2203A.3.

D. Welding of cold-formed steel members shall conform to the requirements of Title 24, 2001 C.B.C. Section 2209.A.

E. After fabrication and inspection, costs associated with re-inspection of defective or replaced materials will be back charged to the contractor.

F. Provide all labor, equipment and facilities necessary for moving and handling of material to be inspected.

G. All field and shop welding shall be under the supervision of a special inspector approved by the Office of State Architect all welding operations, including inspection for quality, penetration, and conformity of drawings, and a report verifying that welding is adequate and was done in conformity of all project requirements.

1.6 PROJECT CONDITIONS

A. Verify measurements, lines, grades, locations and details at project site. Conform to existing actual field conditions. If field conditions do not reasonably comply with those conditions shown on the plan contact the architect.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Cold-formed Steel members: Type for general construction, weldable steel, conforming to the requirements of ASTM A446/A446M-85 (Grades A, B, C, D and F). Galvanized where exposed to weather.

2.2 WELDING ELECTRODES

A. Conform to ASTM A233 and E70 series as required.

2.3 GALVANIZING

A. Provide hot-dip galvanizing in accordance with ASTM A446/A44:6M—85 (Grades A, B, C, D and F).

B. Field galvanizing: Provide ZRC, or other approved.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

A. Prior to commencing work of this section, inspect the work of others and verify that such work has been properly completed and installed to allow for proper installation of all material and methods requited of this section.

B. Drilling, Punching and Reaming, and/or Hole burning to make or enlarge previous holes is not allowed. Prepare required holes in structural steel members for attachment or passage of work of other trades. Where allowed, steel may be punched 1/16 inch larger than the nominal diameter of the bolt where thickness of the steel is equal to or less than the diameter of the bolt plus 1/8 inch. Precisely locate finished holes to ensure passage of all bolts: through steel assemblies without drifting. Poor matching of holes is cause for rejection of work.

C. Welding: See Structural Steel Section under Welding.

D. Erection:

1. Erect cold-formed steel using proper equipment; be laid out so that cutting will not be necessary. Erect the work plumb, square and true to line. Provide temporary bracing where necessary to provide for loads and stresses to which the structure may be subjected, including those due to erection equipment and its operation, and leave in place as long as necessary to safeguard all parts of the work.
2. Temporary connections-securely bolt work to maintain the steel in proper position while bolting and welding is being performed. Align, plumb and level all work prior to welding and final bolting.
3. Sequence-carry out the erection of steel in the proper sequence with the work of others. Frame, bed and anchor to concrete and related work in accordance with detailed drawings and setting diagrams
4. Perform erection with suitable equipment, of adequate capacity and design with due regard for personnel and public safety and as not to deflect or stress members beyond reasonable limits. Maintain erection and temporary bracing plan at project site in accordance with Title 8, CAC.
5. Damaged members-during erection, replace members which are bent, twisted or damaged as directed. When directed, remove members which are not damaged to an

extent impairing their appearance, strength or serviceability and replace with new members at no additional cost to the Owner

6. Anchor Bolts-provide with setting drawings and instructions. Verify position of bolts prior to delivery of steel; report errors of deviation for adjustment.

E. Erection Bracing: Provide erection bracing immediately upon erection of members and leave in place until all members are braced by balance of building.

F. Protection of Floors and Temporary Flooring: Exercise caution to protect floor surfaces and adjacent work from damages. Do not overload floors. Do not place steel members directly on concrete floors; use pads or timbers, or other material for cushioning.

END OF SECTION 05310

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.02 SUMMARY

A. This Section includes but is not limited to the following:

1. Steel framing and supports for operable partitions.
2. Steel framing and supports for overhead doors.
3. Steel framing and supports for countertops.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Loose bearing and leveling plates.
7. Steel weld plates and angles for casting into concrete not specified in other Sections.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
2. Division 4 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
3. Division 5 Section "Structural Steel."
4. Division 5 Section "Pipe and Tube Railings."

1.03 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.04 SUBMITTALS

A. General: Submit following items in accordance with Section 01330.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

2. Provide templates for anchors and bolts specified for installation under other Sections.

C. Welding certificates.

1.05 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code–Steel."

2. AWS D1.3, "Structural Welding Code–Sheet Steel."

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

2. Provide allowance for trimming and fitting at site.

1.07 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.

2.02 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.03 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500, cold-formed steel tubing.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.

1. Size of Channels: As indicated.

2. Material: Galvanized steel complying with ASTM A 653/A 653M, commercial steel, Type B, with G90 (Z275) coating.

2.04 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F593 (ASTM F738M) for bolts and ASTM F594 (ASTM F836M) for nuts, Alloy Group 1 (A1).

D. Anchor Bolts: ASTM F1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A489.

F. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

G. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

J. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A153/A153M.

L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633, Class Fe/Zn 5.

2. Material for Anchors in Exterior Locations: Alloy Group 1 (A1) stainless-steel bolts complying with ASTM F593 (ASTM F738M) and nuts complying with ASTM F594 (ASTM F836M).

2.05 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 9 painting Sections.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Products:

   a. ICI Devoe Coatings; Catha-Coat 313.

   b. Tnemec Company, Inc.; Tneme-Zinc 90-97.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

F. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C1107, specifically recommended by manufacturer for heavy-duty loading applications.

G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

H. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.06 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.07 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.

2. Furnish inserts if units are installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

2.08 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.09 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.12 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A123/A123M, for galvanizing steel and iron products.

2. ASTM A153/A153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

B. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.03 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION

SECTION 05511 - METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Ornamental steel-framed stairs.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Division 5 Section "Metal Fabrications" for metal treads and nosings not installed in metal stairs.
3. Division 5 Section "Pipe and Tube Railings" for pipe and tube railings.
4. Division 5 Section "Pipe and Tube Railings" for pipe and tube railings not attached to metal stairs or to walls adjacent to metal stairs.
5. Division 5 Section "Glass And Steel Handrails" for railings.
6. Division 9 Section "Porcelain Tile" for tile treads and landings for ornamental steel-framed stairs.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360.

B. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to the CBC and ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads.

1.4 SUBMITTALS

A. Product Data: For metal stairs and the following:

1. Prefilled metal-pan stair treads.
2. Abrasive nosings.
3. Paint products.
4. Grout.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Provide templates for anchors and bolts specified for installation under other Sections.
2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Welding certificates.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Ornamental Stairs: Architectural class.

C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.6 COORDINATION

A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500 (cold formed).

C. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.

2.3 NONFERROUS METALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

B. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.4 ABRASIVE NOSINGS

A. Extruded Units: Extruded-aluminumunits with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.

1. Available Manufacturers:

a. ACL Industries, Inc.
b. American Safety Tread Co., Inc.
c. Amstep Products.
d. Armstrong Products, Inc.
e. Balco Inc.
f. Granite State Casting Co.
g. Wooster Products Inc.

2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
3. Provide solid-abrasive-type units without ribs.
4. Nosings: Square-back units, 2 inches wide, without lip.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply bituminous paint to concealed bottoms, sides, and edges of cast-metal units set into concrete.

D. Apply clear lacquer to concealed bottoms, sides, and edges of extruded units set into concrete.

2.5 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A, with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

D. Machine Screws: ASME B18.6.3.

E. Lag Bolts: ASME B18.2.1.

F. Plain Washers: Round, ASME B18.22.1.

G. Lock Washers: Helical, spring type, ASME B18.21.1.

H. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 9 painting Sections.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

E. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

F. Welded Wire Fabric: ASTM A 185, 6 by 6 inches--W1.4 by W1.4, unless otherwise indicated.

2.7 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding, unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously, unless otherwise indicated.
5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.8 STEEL-FRAMED STAIRS

A. Stair Framing:

1. Fabricate stringers of steel per plans.

   a. Provide closures for exposed ends of channel and/or tube stringers.
2. Weld stringers to headers; weld framing members to stringers and headers.

B. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch.

1. Steel Sheet: Uncoated cold-rolled steel sheet, unless otherwise indicated.
2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
3. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
4. Shape metal pans to include nosing integral with riser.
5. Attach abrasive nosings to risers.
6. At Contractor's option, provide stair assemblies with metal-pan subtreads filled with reinforced concrete during fabrication.
7. Provide epoxy-resin-filled treads, reinforced with glass fibers, with slip-resistant, abrasive surface.
8. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.9 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:

1. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

E. Provide Stair Tread Striping for the visually impaired:

1. Upper Approach and lower approach shall be marked by a strip of clearly contrasting color.
   a. 2 inches wide and parallel to the nose of the tread.
   b. Locate not more than 1 inch from nose of tread.
   c. Marking shall be of a slip resistance greater than or equal to the treads.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Place and finish concrete fill for treads and platforms to comply with Division 3 Section "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

H. Install precast concrete treads with adhesive supplied by manufacturer.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

END OF SECTION 05511

SECTION 05521 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Steel pipe and tube railings.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry".

1.3 PERFORMANCE REQUIREMENTS

A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel:
   a. Load and Resistance Factor Design per CBC 2206A.
   b. Allowable Stress Design per CBC 2208A.

B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails:

   a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
   b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Top Rails of Guards:

   a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction

   b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

3. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Uniform load of 25 lbf/sq. ft. (1.2 kN/sq. m) applied horizontally.
c. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

A. General: Submit following items in accordance with Section 01330.

B. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Grout, anchoring cement, and paint products.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes on stainless steel.

E. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

a. Show method of finishing members at intersections.

F. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

G. Welding certificates.

H. Qualification Data: For professional engineer.

I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code–Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.2 STEEL AND IRON

A. STEEL MATERIALS
1. Steel Bars and Bar Sized Shapes: ASTM A306 Grade 65 or ASTM A36.
2. Steel Pipe: ASTM A53 Grade A, Schedule 40 seamless or welded.
3. Cast Iron: ASTM A48, Class 30 or higher, soft gray iron.
4. Malleable Iron Casting: ASTM A47, Grade 32510.
5. Steel Tubing, Hot-formed, Welded or Seamless: ASTM A501.
6. Welding Rods: ASTM A233 Series E60 or E70, conforming to AWS D1.1

B. STEEL PIPE HANDRAILS AND GURADRAILS
1. Steel Pipe Handrails and guardrails, General: Fabricate railings in accordance with NAAMM Pipe Railing Manual and as required for specified design requirements. Provide stock pipe and tubing and manufactured components sized and arranged as indicated on Drawings and specified herein.
2. Round Railings: Standard weight steel piping or tubing, unless otherwise noted.
3. Internal Stiffners: Cast iron, malleable iron, pipe or tube. Fit snugly.
4. Dimensions, Spacing and Configuration: As shown on Drawings and as specified herein.

   a. Handrails: For stairs and ramps, size as indicated on the Drawings, minimum 1-1/4 inches net outside diameter to maximum 1-1/2 inches net outside diameter, configured for 1-1/2 inches clear from side walls.
   b. Top rails: Run continuously over posts, level and not less than minimum height indicates on the Drawings and required by California Building Code (CBC).
   c. Vertical Members: Lay out as shown, evenly spacing verticals in each run. Where two runs are adjacent to each other, align verticals on each side. Set posts as required for design requirements a maximum of 60-inches on center. Fabricate verticals for plumb and true installation.
   d. Bottom Railing: Parallel to top rail and with floor surface or stair stringer, as applicable.
   e. Alignment: Centerline of members within each railing run shall be in same vertical plane.

5. Cutting and Fitting:

   a. Power cut throughout; gas cutting not permitted at joint.
   b. Cope to fit intersecting members. Bevel ends to receive full fillet weld.
   c. Provide corners neatly mitered, coped, welded and ground smooth.
   d. Provide connections with fittings or, at Contractor's option, neatly coped, welded and ground.

6. Fabricaton:

   a. Fabricate railings in largest practicable sections to minimize field joints.
   b. Fabricate rails in true, straight alignment.
   c. Provide for field-welded joints. Fabricate to hairline tolerances before welding.
   d. Grind projections, terminations and edges smooth.
   e. Provide closures on exposed ends.
   f. Do not use exposed fastening plates except as specifically detailed. Use concealed plug to direct welding as applicable.
   g. All welded joints shall be ground smooth, no sharp or abrasive corners, edges, or surface permitted. Wall surfaces adjacent to handrails shall be smooth.

7. Welding: Provide backup or stiffeners at joints to hold in perfect alignment during welding. Weld all around joint. Grind welds smooth and dressed.

C. SLEEVES AND POST HOLES

1. Sleeves for Removable Railing Sections: Steel pipe sleeve, oversized to provide minimum of 1/8-inch difference inside diameter of sleeve and outside diameter of removable post or bollard.

2.3 MISCELLANEOUS MATERIALS

A. GROUTING COMPOUNDS

1. Acceptable Manufacturers: Equivalent products of the manufacturers listed below will be acceptable in accordance with the "or equal" provision specified in Section 01600-Product requirements. Equivalent products of the manufacturer listed below will be acceptable in accordance with the "or equal" provision specified in Section 01600-Product Requirements. Equivalent products of other manufacturers will be considered in accordance with the substitution provision specified in Section 01600-Product Requirements.

   a. Euclid Chemical Co., Clevland, OH (216/531-9222 or 800/321-7628).
   b. L&M Construction Chemicals, Inc., Omaha, NE (402/453-6600 or 800/362-3331).
   c. Sika Corporation, Lyndhurst, NJ (201/933-8800; local representative, Santa Fe Springs, CA, 310/941-0231).

2. Shrinkage-Resistant Setting Grout: For setting railing posts and a similar components in sleeves or blockouts in concrete; pre-mixed, natural aggregate, minimum 5000 psi 28-day compressive strength, Master Builders Technology, Inc., Set Grout.

B. ACCESSORY MATERIALS

1. Primer Coating: For shop application at time steel products are fabricated.

   a. Specified Manufacturer: Tnemec Company, Inc., Kansas City, MO (local representative, TPC Consultants, Inc., Manhattan Beach, CA, 310/643-5191).
   b. Acceptable Manufacturers: Equivalent products of the manufacturers listed below will be acceptable in accordance with the "or equal" provision specified in Section 01600-product Requirements. Equivalent products of other manufacturers will be considered in accordance with the substitution provision specified in Section 01600-Product Requirements.

      1) Ameron Protective Coatings, Brea, CA (714/529-1951 or 800/344-0025).
      2) Carboline Company, St. Louis, MO (800/848-4645).
      3) International Protective Coatings Corp., Hatfield, PA (215/362-9020 or 800/334-8796; distributed by Dunn-Edwards Corp., Los Angeles, CA, 213/771-3330 or 800/372-6470).

   c. Primer coating for plain steel: Tnemec Series 90-97 Tneme-Zinc, two-component catalyzed epoxy coating.

d. Primer coating for galvanized steel: tnemec Series 66 Epoxoline, two-component catalyzed epoxy coating.

2. Expansion Anchors: Wedge-type anchors. Provide manufacturer, product type and size as identified on Structural Drawings. If products are not indicated on Drawings, then provide anchors as directed by the Architect (Structural Engineer) and approved by Division of the State Architect (DSA). Equivalent products of other manufacturers will be acceptable in accordance wit the "or equal" provision specified in Section 01600-Product Requirements, if approved DSA. Comply with California Building Code (CBC) Section 1923A.3 and Division of the State Architect (DSA)-Interpretation of Regulations Document IR 19-1. Powder-actuated driven fasteners will not be acceptable.

2.4 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections, unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

K. Form changes in direction as follows:

1. As detailed.
2. By bending.
3. By flush bends.
4. By radius bends of radius indicated.

L. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

M. Close exposed ends of railing members with prefabricated end fittings.

N. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

Q. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with steel plate forming bottom closure.

R. For removable railing posts, fabricate slip-fit sockets from steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

S. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.6 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. 180-Grit Polished Finish: Oil-ground, uniform, directionally textured finish.

D. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.

E. Polished and Buffed Finish: Oil-ground, 180-grit finish followed by buffing.

F. Directional Satin Finish: No. 4.

G. Dull Satin Finish: No. 6.

H. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

D. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

F. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed railings:

1. Exterior Railings (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interior Railings (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
3. Interior Railings Indicated to Receive Zinc-Rich Primer (SSPC Zone 1A): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

G. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Do not apply primer to galvanized surfaces.
2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches (150 mm) of post.

3.4 ANCHORING POSTS

A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

D. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch (3-mm) buildup, sloped away from post.

E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
2. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
3. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ANCHORING RAILING ENDS

A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

3.6 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. Use type of bracket with predrilled hole for exposed bolt anchorage.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.

3.7 ADJUSTING AND CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.8 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05521

SECTION 05720 - GLASS AND STEEL HANDRAILS

PART 1 GENERAL

1.01 SUMMARY

A. WORK INCLUDED
1. Furnish and install stainless steel railings and components.

B. WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS
1. Furnish anchors and fabrications to be cast in concrete to Section 03300 - Cast-in-Place Concrete.

C. RELATED WORK
1. Section 03300 - Cast-in-Place Concrete:
2. Section 05510 - Metal Stairs
3. Section 08800 - Glazing: Glass; Plastic Glazing; Glazing Accessories
4. Section 09912 - Painting: Paint Finish

1.02 REFERENCES

A. Aluminum Association (AA)
1. ABH-21 Aluminum Brazing Handbook
2. ASD-1 Aluminum Standards and Data
3. DAF-45 Designation System for Aluminum Finishes
4. SAA-46 Standards for Anodized Architectural Aluminum

B. American Architectural Manufacturers Association (AAMA)
1. AAMA 605.1 Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
2. AAMA 606.1 Voluntary Guide Specifications and Inspection Methods of Integral Color Anodic Finishes for Architectural Aluminum.
3. AAMA 607.1 Voluntary Guide Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
4. AAMA 608.1 Voluntary Guide Specifications and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

C. American Concrete Institute (ACI)
1. ACI 347-78 Recommended Practice for Concrete Formwork

D. American Iron and Steel Institute (AISI)
1. Steel Products Manual; Stainless and Heat-Resisting Steel.

E. American National Standards Institute (ANSI)
1. A21.1 Safety Requirements for Floor and Wall Openings, Railings and Toe Boards.
2. A58.1 Minimum Design Loads in Buildings and Other Structures.
3. A117.1 Accessible and Usable Buildings and Facilities.
4. Z97.1 Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings.

F. American Society for Testing and Materials (ASTM)
1. A 29 Specification for Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished, General Requirements for.
2. A 47 Specification for Ferritic Malleable Iron Castings.
3. A 269 Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
4. A 276 Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
5. A 312 Specification for Seamless and Welded Austenitic Stainless Steel Pipe.
6. A 500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
7. A 512 Specification for Cold-Drawn Buttweld Carbon Steel Mechanical Tubing.
8. A 743 Specification for Corrosion-Resistant Iron Chromium, Iron Chromium- Nickel, and Nickel Base Alloy Castings for General Application.
9. B 26 Specification for Aluminum-Alloy Sand Castings.
10. B 43 Specification for Standard Sizes of Seamless Red Brass Pipe.
11. B 221 Specification for Aluminum-Alloy Bars, Rods, Wires, Shapes and Tubes.
12. B 429 Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
13. B 455 Specification for Copper-Zinc-Lead Alloy (Leaded Brass) Extruded Shapes.
14. B 483 Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.
15. B 584 Specification for Copper Alloy Sand Castings for General Applications.
16. C 509 Specification for Cellular Elastometric Pre-Formed Gasket and Sealing Material.
17. C 595 Specification for Blended Hydraulic Cements.
18. C 1048 Standard Specification for Heat Treated Glass Kind HS, Kind FT-Coated and Uncoated.
19. D 635 Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
20. D 1730 Recommended Practices for Preparation of Aluminum and Aluminum Alloy Surfaces for Painting.
21. D 1784 Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
22. 22. E 84 Test Method for Surface Burning Characteristics of Building Materials.
23. 23. E 894 Standard Test Methods for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
24. E 935 Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
25. E 985 Specification for Permanent Metal Railing Systems and Rails for Buildings.

G. National Association of Architectural Metal Manufacturers (NAAMM)
1. Metal Finishes Manual
2. Pipe Railing Manual
3. Stair Manual

H. National Fire Protection Association (NFPA)
1. 101 Life Safety Code

I. National Ornamental and Miscellaneous Metals Association (NOMMA)
1. Metal Rail Manual

1.03 SYSTEM DESCRIPTION

A. Structural Requirements
   1. Handrail and Guardrail assemblies and attachments shall withstand a minimum concentrated load of 200 pounds applied horizontally or vertically down at any point on the top rail.

1.04 SUBMITTALS

A. Product Data
   1. Submit manufacturers engineering data and installation instructions under provisions of Section 01330.

B. Shop Drawings
   1. Submit shop drawings and product data under provisions of Section 01330.
   2. Indicate component details, materials, finishes, connection and joining methods, and the relationship to adjoining work.

1.05 QUALITY ASSURANCE

A. QUALIFICATIONS
   1. Furnish references listing projects of similar size and scope.

B. REGULATORY REQUIREMENTS
   1. Components and installation are to be in compliance with state and local code authorities.
   2. Components and installation are to follow current ADA and CABO/ANSI guidelines.

C. CERTIFICATIONS
   1. Furnish certification that all components and fittings are furnished by the same manufacturer or approved by the primary component manufacturer.
   2. Furnish certification that components were installed in accordance to manufacturers engineering data to meets the specified design loads.

D. PRE-INSTALLATION MEETING
   1. Prior to the beginning of work, conduct a pre-job conference at the job site.
   2. Provide seven calendar days advance written notice ensuring the attendance by competent authorized representatives of the fabricator, building owners representative, architect, and subcontractors whose work interfaces with the work of this Section.
   3. Review the specifications to determine any potential problems, changes, scheduling, unique job site conditions, installation requirements and procedures and any other information pertinent to the installation.
   4. Record the results of the conference and furnish copies to all participants.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.

B. Storage on site:
   1. Store material in a location and in a manner to avoid damage. Stack in a way to prevent bending.

2. Store material in a clean, dry location away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin, or polyethylene sheeting in a manner that will permit circulation of air inside the covering.

C. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of material.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. Basis-of-design: Railing and components shall be as manufactured JULIUS BLUM & CO., INC., of Carlstadt, New Jersey (800) 526-6293 for its JB® GLASS RAIL System.

2.02 MATERIALS AND FINISHES

A. Stainless Steel: Type 302/304 (18-8)
   1. Tubing: ASTM A 269
   2. Bars, Shapes, and Mouldings: ASTM A 276
   3. Finish: Ornamental Grade, AISI No. 4.

2.03 RAILING SYSTEM

A. Basis-of-design: JB®GLASS RAIL SYSTEM

B. Railing system shall be [surface] [flush] [facia] mounted.

C. Rails
   1. Fabricate rails from stainless steel.

D. Posts
   1. Fabricate posts from stainless steel tubing.

E. Glass Structural Balustrade shall be Laminated Glass: ASTM C 1172, Condition A (uncoated), Type I (transparent flat glass), Quality-Q3 with clear, polyvinyl butyral interlayer not less than 0.060 inch (1.52 mm) thick.

F. Shoe Moulding
   1. Fabricate shoe moulding from extruded aluminum alloy 6061-T6.

G. Fittings
   1. Fittings shall be of wrought material of stainless steel. Miter elbows shall be of welded construction with no weld marks visible when the fitting is installed.

H. Connector Sleeves
   1. Internal connector sleeves shall be of extruded aluminum.

I. Glazing Accessories
   1. Setting block shall be of polyvinyl chloride.
   2. Protective insert shall be of polyvinyl chloride.

2.04 FASTENERS

A. Mechanical Fasteners:
   1. All mechanical fasteners used in the assembly shall be manufactured from stainless steel.

2.05 HANDRAIL BRACKETS

A. Stainless steel

2.06 FABRICATION

A. Form rail-to-end post connections and all changes in rail direction by radius elbows.
B. Cut material square and remove burrs from all exposed edges, with no chamfer.
C. Make exposed joints butt tight and flush.
D. Close exposed ends of handrail with appropriate end cap.
E. Verify dimensions on site prior to shop fabrication.

PART 3 EXECUTION

3.01 PREPARATION

A. Supply items to be cast in concrete.
B. Inspect anchor installation. Correct any defects.

3.02 DISSIMILAR METALS

A. Paint bronze, nickel - silver, and aluminum components that come into contact with dissimilar metals with a heavy coat of a proper primer.

3.03 INSTALLATION

A. Install in accordance with plans and manufacturers instructions.
B. Erect work square and level, horizontal or parallel to rake of steps or ramp, and free from distortion or defects detrimental to appearance or performance.

3.04 CLEANING

A. As installation is completed, wash thoroughly using clean water and soap; rinse with clean water.
B. Do not use acid solution, steel wool, or other harsh abrasives.
C. If stain remains after washing, remove finish and restore in accordance with NAAMM Metal Finishes Manual.
D. Finish must not be removed from anodized aluminum. Reanodizing can only be done by removing railing and returning it to the anodizer.

3.05 REPAIR OF DEFECTIVE WORK

A. Remove stained or otherwise defective work and replace with material that meets specification requirements.

END OF SECTION 05720

SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Rough Carpentry Work.

C. Related Sections:

1. Section 01420: Testing and Inspection.
2. Section 06402: Finish Carpentry.
3. Section 09260: Gypsum Board Assemblies.

1.02 SYSTEM DESCRIPTION

A. Regulatory Requirements:

1. Work of this Section shall comply with CBC Chapter 23A.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. Redwood structural and framing lumber shall be graded in accordance with Standard Specifications for Grades of California Redwood Lumber of the Redwood Inspection Service.
2. Douglas fir, larch or hemlock structural and framing lumber shall be graded in accordance with the Standard Grading Rules of the West Coast Lumber Inspection Bureau (WCLIB) or the Western Lumber Grading Rules of the Western Wood Products Association (WWPA).
3. Plywood shall conform to requirements of Product Standard PS 1-95, and shall be grade marked by a recognized grading agency (APA and PTL).

B. Lumber shall bear official grade mark of the association under whose rules it was graded or official grade mark of another recognized grading agency.

C. Structural and framing members 2 inches in thickness and larger shall be air-dried to moisture content not to exceed 19 percent before installation.

D. Each piece of preservative treated lumber shall be identified by the Quality Mark of an approved inspection agency in accordance with CBC Chapter 23A; refer to Section 01420: Testing and Inspection.

E. Lumber showing visible signs of mold growth:

1. Any lumber showing visible signs of mold growth shall be removed from the project site or cleaned as outlined below.

2. The contractor is responsible for all costs associated with cleaning, post-cleaning testing, and reporting for lumber with mold.

a. Lumber that shows visible signs of mold growth prior to, or after installation, shall be cleaned pursuant to USEPA's guidance publication "Mold Remediation in Schools and Commercial Buildings dated March 2001 (EPA 402-K-01.001).

b. A minimum of 10% of the total locations cleaned must be sampled (tape lift method) post cleaning to ensure cleaning effort was successful. Cleaning will be considered acceptable when tape lift sample results evaluated by direct microscopic examination determine that the general abundance of mold is non-detect or rare (normal trapping to 1+).

c. A report prepared by a Certified Industrial Hygienist (CIH) that details the sampling and cleaning results shall be prepared and submitted to the OAR for review and approval of the LAUSD Office of Environmental Health and Safety.

d. Cleaned lumber shall not be installed or enclosed by finish materials until approval of test results. Cleaned lumber must meet moisture content requirements as required elsewhere in this specification prior to installation or application of finishes.

1.04 STORAGE, HANDLING AND PROTECTION

A. The materials supplied as part of the Work of this section shall be protected from exposure to inclement weather before being covered by other Work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lumber: Structural and framing lumber shall be of following species and grades:

	INSTALLATION	SPECIES	GRADE
1.	Subfloor,	Douglas fir and larch	Construction Board, WCLIB; WWPA
2.	Posts, (5" x 5" and larger, width not more than 2" greater than thickness). bers, WWPA.	Douglas fir and larch	No. 1 Structural Posts and Timbers, WCLIB. No. 1 Post and Tim-
3.	Miscellaneous nailing strips and blocks embedded in concrete or masonry.	Douglas fir and Larch treated	Same as subparagraphs 6 and 7.

B. Plywood: Plywood furnished for structural purposes, when exposed outdoors, shall be exterior type plywood. Other plywood furnished for structural purposes shall be exterior type, or Exposure 1.

C. OSB Board or Panels:

1. Oriented strand board or panels shall not be furnished as part of the Work of this section.

D. Fire Retardant Protection: Wood and plywood specified as fire retardant protected wood shall be treated by approved methods and materials and shall be dried following treatment to a maximum moisture content as follows:

1. Solid sawn lumber 2 inches in thickness or less: 19 percent.

2. Plywood: 15 percent.

E. Adhesive: Tec, Inc. Sturdi-Bond TA-175, or Top Industrial Inc., Rainbuster 345, elastomeric adhesive conforming to ASTM D 3498 and APA-AFG-01.

PART 3 - EXECUTION

3.01 FASTENINGS

A. Nails and Spikes:

1. Furnish only common wire nails or spikes whenever indicated, specified or required.

2. Whenever necessary to prevent splitting, holes shall be pre-drilled for nails and spikes.

3. Nails in plywood shall not be overdriven.

B. Lag Screws:

1. When installing lag screws in a wood member, pre-drill hole as required by the CBC.

2. Lag screws, which bear on wood, shall be fitted with standard steel plate washers under head. Lag screws shall be screwed and not driven into place.

C. Bolts:

1. Lumber and timber to be fastened together with bolts shall be clamped together with holes for bolts bored true to line.

2. Bolts shall be fitted with steel plates or standard cut washers under heads and nuts. Bolts shall be tightened when installed and again before completion of the Work of this section.

D. Wood Screws: When installing wood screws, pre-drill holes as required by the CBC.

E. Powder Driven Fasteners:

1. Loads shall not exceed 75 pounds unless indicated on the Drawings or when reviewed by the Architect.

2. The operator, tool, and fastener shall perform the following as observed by the IOR.

a. Observe installation of first 10 fasteners.

b. Test the first 10 fasteners by performing a pullout test. Load shall be at least twice the design load, or 150 pounds, whichever is greater.

c. Random testing:

1) Load less than 75 lb. - approximately 1 in 10 pins.

2) Load 75 lb. or greater - 1/2 of the pins.

3. Failure of any test will result in testing of all installed pins.

4. Nail heads shall not break the outer skin of sheathing.

5. Non-compliant pins shall be replaced.

3.02 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry".

1.2 SUMMARY

A. This Section includes the following:

1. Wainscots.
2. Plastic-laminate cabinets.
3. Plastic-laminate countertops.
4. Solid-surfacing-material countertops.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For panel products high-pressure decorative laminate adhesive for bonding plastic laminate solid-surfacing material fire-retardant-treated materials cabinet hardware and accessories handrail brackets and finishing materials and processes.

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in architectural woodwork.

4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
5. Apply WIC-certified compliance label to first page of Shop Drawings.
6. Coordinate with other trades, prior to fabrication.

C. Samples for Initial Selection:

1. Plastic laminates.
2. PVC edge material.
3. Solid-surfacing materials.

D. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
2. Solid-surfacing materials, 6 inches square.
3. Corner pieces as follows:

   a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
   b. Miter joints for standing trim.

4. Exposed cabinet hardware and accessories, one unit for each type and finish.

E. Woodwork Quality Standard Compliance Certificates: WIC-certified compliance certificates.

F. Qualification Data: For Installer and fabricator.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WIC's Certified Compliance Program.

B. Installer Qualifications: Licensee of WIC's Certified Compliance Program.

C. Quality Standard: Unless otherwise indicated, comply with WIC's "Manual of Millwork" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide WIC-certified compliance labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.
2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.

D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or,

where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 8 Section "Door Hardware (Scheduled by Naming Products)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 WOODWORK FABRICATORS

A. Available Fabricators: Subject to compliance with requirements, fabricators offering interior architectural woodwork that may be incorporated into the Work include, but are not limited to, the following:

B. Fabricators: Subject to compliance with requirements, provide interior architectural woodwork by one of the following:

2.2 MATERIALS

A. General: Provide materials that comply with requirements of WIC's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:

1. Plywood Base for Plastic laminate: Close-grained hardwood plywood, ANSI/AHA 135.4, all hardwood piles, non-telegraphing faces, formaldehyde-free.

   a. Provide exterior grade product with waterproof glue (marine grade plywood) at countertop locations with plumbing fixtures.

2. Wood Fiber Board: Medium density fiberboard (MDF), ANSI 208.1, Grades 2-M-2 and 2-M-3, composed of wood chips matrix bound with formaldehyde-free, high-moisture resistant, polyurea resin binders, passing ASTM D1037-Six Cycle Accelerated Aging Test.

   a. Specified Manufacturer: Medite Corporation, Medford, OR (800/676-3339).
   b. Acceptable Manufacturers: None identified. Equivalent products or other manufacturers will be considered in accordance with the "or equal" provision specified in Section 01600-Product Requirements.
   c. Casework panels and countertop substrate without plumbing fixtures: Medite II, medium density fiberboard, nominal 48 pcf for 3/4 –inch and less thickness, and nominal 46 pcf for 13/16-inch and greater thickness.
   d. Countertop substrate with plumbing fixtures: Do not use wood fiber. Provide exterior grade product with waterproof glue (marine grade plywood) at countertop locations with plumbing fixtures.

3. Particleboard: Not permitted.

4. Hardboard: ANSI/AHA 135.4, interfelted lignocellulosic fibers consolidated under heat and pressure, tempered treated, smooth on one side. Provide thickness indicated or, if not indicated, 1/8-inch thick when used as a laminate and ¼-inch thick (minimum) when used as drawer bottom, cabinet back or dust panel.

C. High-Pressure Decorative Laminate: NEMA LD 3 and ANSI 1 A161.2 grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:

   a. Formica: Formica Corporation, Cincinnati, OH (513/786-3400 or 800/367-6422; local representative, Brea, CA, 714/993-0393).
   b. Laminart: Laminart, Elk Grove Village, IL (708/860-4300 or 800/323-7624).
   c. Nevamar: Nevamar Corp., Odenton, MD (410/551-5000).
   d. Pionite: Pioneer Plastics Corp., Auburn, ME (207-784-9111 or 800/777-9113).
   e. Wilson Art: WilsonArt International, Temple, TX (817/778-2711 or 800/433-3222; local distributor, Santa Fe Springs, CA 213/771-8141, 310/921-7426 or 714/523-1200).

3. Plastic Laminate Finish, Typical: NEMA LD 3 and ANSI A161.2.

   a. Horizontal applications at countertops, not post-formed: NEMA Type GP50 (0.050-inch nominal thickness).
   b. Horizontal applications at countertops, post-formed: NEMA Type PF42 (0.039-inch nominal thickness) horizontal post-forming grade.
   c. Horizontal applications, other than countertops, and mill option for vertical applications: NEMA Type PF42 (0.039-inch nominal thickness).
   d. Vertical applications: NEMA Type GP28 (0.028-inch nominal thickness) or NEMA Type PF42 (0.039-inch nominal thickness.

4. Cabinet Liner: High-pressure cabinet liner laminate (HPL), 0.020-inch thick. Provide white color, unless otherwise directed.

5. Plastic Laminate Backing: NEMA LD-3, BK 20, high-pressure paper base laminate without a decorative finish; Style ND, Type IV, 0.020-inch thick, smooth surface finish, for baking at countertops and other concealed locations.

6. Panel Edging:
   a. For doors and drawers, 3 mm thick PVC T-molding. Provide color as indicated on the Drawings or, if not indicated, as selected by Architect.
   b. For cabinet body: high-pressure plastic laminate to match exposed face of panel.

D. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Avonite, Inc.
   b. E. I. du Pont de Nemours and Company.

c. Formica Corporation.
d. Nevamar Company, LLC; Decorative Products Div.
e. Samsung; Cheil Industries Inc.
f. Wilsonart International; Div. of Premark International, Inc.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.

1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:

1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
2. Interior Type A: Low-hygroscopic formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.
4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
5. Kiln-dry materials before and after treatment to levels required for untreated materials.

C. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

1. Product: Subject to compliance with requirements, provide "Medite FR" by SierraPine Ltd.; Medite Div.

2.4 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section.

B. HARDWARE

1. Specified manufacturers: Where manufacturer is not specified, provide hardware according to current WIC Approved Hardware Listing and as selected by Contractor as suitable for Project conditions, subject to review and acceptance by Architect.

   a. Accuride: Accuride International, Inc., Santa Fe Springs, CA (562/903-0200; local representative, Ladera Ranch, CA 949/481-9086).
   b. Blum: Julius Blum, Inc., Stanley, NC (704/827-1345; local supplier, E. B Bradley Co., Los Angeles, CA, 213/585-9201).
   c. EPCO: EPCO, Inc., West Palm beach, FL (561/585-5545).
   d. ERGO: ERGO Systems, Inc., East Hartford, CT (860/282-9767).
   e. Hafale: hafale America Co., Archdale, NC (336/889-2322 or 800/334-1873).
   f. Ives: H.B. Ives, Wallingford, CT (203/294-4837).
   g. K&V: Knape & Vogt Manufacturing Co., Grand Rapids, MI (616/459-3311 or 800/253-1561).
   h. Mockett: Doug Mockett & Company, Inc., Manhattan Beach, CA (310/318-2491).
   i. Olympus: Olympus Lock (206/525-5338 or 800/525-0954).
   j. Stanley: The Stanley Works, new Britian, CT

2. Finish Hardware for Casework: Provide hardware as indicated on Architectural Drawings and as follows. If not indicated, provide hardware conforming to WIC Manual of Millwork, WIC Approved Hardware Listing.

   a. Shelf Standards: Hettich International, catalog no. 1005-767, Sekura 1 or approved equivalent, 0.5 mm hole diameter with seismic (earthquake) pin, 50 lbs per clip working load rating.
   b. Door hinges: Grade 1, warp-around butt hinges, according to WIC Manual of Millwork, WIC-Approved Hardware Listing, to provide minimum 170 degrees opening. Concealed ("European") style hinges will not be acceptable.
   c. Drawer slides:

      1) Typical drawers, full extension, 90-100 lb. Capacity: Accuride 3832.
      2) Heavy drawers, overtravel design, 150 lb. Capacity: Accuride 4034 Series.
      3) Shallow drawers, full extension low profile, 65 lb. Capacity: Accuride 2632.
      4) File drawers, 1-inch overtravel, 200 lb. Capacity, three-section, 0.63-inch slide space: Accuride 4437.
   d. Retracting door hardware: Accuride 1332 Anti-Rak Flipper Door Slides with Anti-Rak cable, vertical retracting slide with hinge carrier strip and extra hinge; one hinge per foot of door height.
   e. Door and drawer pulls: Provide U-shaped wire rod type, satin chrome plated steel, 4-inch centers, Stanley 348515 - 5" Satin Chromium Plated(26D) Cabinet Pull, or approved equivalent at all accessible casework.
   f. Drawer stops: Provide stops to prevent drawer fronts from hitting face of cabinet body.
   g. Keyboard supports: Synchronicity by ERGO, Little Twist series, retracting keyboard support surface with attached twist-out mouse platform.
   h. Sliding door slides: KV2412.
   i. Sliding door pulls: Grant 428.
   j. File folder supports: As suitable for Pendaflex file folders, chrome plated.
   k. Cabinet drawer/locks: National, to match existing cabinet locks, re-keyable and capable of being masterkeyed.

      1) Provide locks at all drawers, single doors and on active leaf of paired doors.

2) Provide 2 keys for each lock.
3) Coordinate locks and latches specified below. At pairs of doors, active leaf shall have lock and inactive leaf shall have elbow catch.
4) All locks to be R-1 keyway (5 or 6 pin) to District standard master key. Master keyed by site, keyed alike by room in US26D as manufactured by either:
5) Olympus Lock Co 500DR (door), 600DW (drawer), 400SD (sliding door), or Corbin Cabinet Lock 0737 (door), 0738 (drawer), 02292 (sliding door).

l. All cabinet locks must have passed ANSI and BHMA Grade 1 testing of pin tumbler design. Any and all cam locks used to be pin tumbler to same District key system. All keying considerations to be approved by District Locksmith..

m. Elbow catches: Ives IV2AM, aluminum. Coordinate locks and latches specified below. At pairs of doors, active leaf shall have lock and inactive leaf shall have elbow catch.

n. Magnetic catches: provide magnetic catches at all doors with locks and all doors without elbow catches, Amerock (National) No. 61-570, Stanley No. 41 or approved equivalent.

o. Closet poles: 1-1/16 inch diameter chrome plated steel, 14-gage minimum, with chrome plated pole sockets.

p. Grommets: Mockett MM Series, cap and liner, solid brass, matte black finish, size as indicated on Drawings or, if not indicated, provide nominal 3-inch grommet cap size.

3. Casework hardware Finish: ANSI/BHMA A156.18.

a. Exposed hardware: Chrome plated or stainless steel, brushed finish, as follows:
1) Chrome, stain brushed finish, plated on steel: BHMA 652 (US26D).
2) Chrome, satin brushed finish, plated on brass or bronze: BHMA 626 (US26D).
3) Stainless steel, brushed: BHMA 630 (US32D).

b. Concealed hardware: Polished ort satin chrome or brushed stainless steel.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

a. Screws: For use at wood or metal stud walls, minimum #14x3", Phillips truss head, type 17 hard, zinc plated, self-tapping, full head screws. Select material, type, size and finish required for each use. Comply with applicable requirements of FS FF-S-111. For attachment to metal farming supports, provide screws as indicated in Drawings.

b. Countertop segment anchors: Tite Joint Fasteners.
c. Exposed Anchors and Fasteners: Same material, color and finish as the metal to which applied, except use only stainless steel at aluminum materials and use cadmium plated at interior pre-painted steel products.

D. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

E. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Contact Adhesive: 250 g/L.

a. Contact Adhesives: Formadehyde-free, Type II Water-Resistant typically and Type I Fully Waterproof at damp locations and countertops.
b. Wall Adhesive: Solvent release, cartridge type, compatible with wall substrate, capable of achieving durable bond.
c. Countertop Segment Adhesive: Rigid (urea, resorcinol) adhesive, complying with requirements for WIC Type II Water-Resistant adhesive.
d. Adhesive for Bonding Edges: Hot-melted adhesive or adhesive specified above for faces.

2.6 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide custom-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).
3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).

E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

G. Seal edges of openings in countertops with a coat of varnish.

2.7 PLASTIC-LAMINATE CABINETS

A. Grade: Custom

B. High-pressure decorative laminate grade HGP, provide HGS grade plastic laminate in all science room cabinets.

C. WIC Construction Style: Style A, Frameless.

D. WIC Construction Type: Type I, multiple self-supporting units rigidly joined together.

E. Plastics Laminate-Covered Casework fabrication: Shop fabricate casework and countertops for delivery to site in units easily handled and to permit passage through building openings. See Drawings for special casework fabrication details and notes. Provide high-pressure platic laminate covered casework complying with WIC manual of Millwork, Section 15-Plastic-Covered Casework, as follows.

1. Construction Details: Comply with referenced WIC standard, with details and notes indicated on the Drawings, and the following:

   a. Cabinet cases: ¾-inch thick medium-density fiberboard core, with high-pressure plastic laminate at exposed faces and edges and high-pressure cabinet liner at semi-exposed faces.
   b. Doors: ¾-inch thick medium-density fiberboard core, with high-pressure plastic laminate at exposed faces and either high-pressure decorative plastic laminate or high-pressure cabinet liner at semi-exposed faces. Provide PVC edge banding at all edges. Edge banding shall be eased, to eliminate sharp edges.
   c. Drawer fronts: ¾-inch medium-density fiberboard with high-pressure plastic laminate at exposed faces either high-pressure decorative plastic laminate or high-pressure cabinet liner at semi-exposed face. Provide PVC edge banding at all edges. Edge banding shall be eased, to eliminate sharp edges.
   d. Drawer sides, backs and sub-fronts: ½-inch thick hardwood with clear lacquer finish.
   e. Drawer bottoms: ¼-inch thick hardwood or plywood, except provide 3/8-inch thick bottoms at drawers 30-inches and wider. File drawer bottoms shall be ¾-inch thick

hardwood plywood, routed to receive file followers. Top surface of drawer bottoms shall be covered with 0.020-inch high-pressure cabinet liner.

f. Shelves: medium-density fiberboard or plywood, as suitable for shelf size, faced on all surfaces with high-pressure cabinet liner. Comply with WIC Technical Bulletin 435 for core material options for 50 psf shelf loading. Support shelves on metal shelf rests in vertical rows of cleanly bored holes in cabinet sides, not exceeding 2-inches on center.

   1) Locate rows between 1-1/2 and 2-inches from front and back faces of cabinet body.
   2) Row size, spacing and location shall be identical throughout Project.

g. Dust panels: ¼-inch thick plywood or hardboard, above compartments and drawers except where located directly under tops, to vertically secure spaces at locked cabinets.

h. Lumber components: As follows except if otherwise indicated on the Drawings.

   1) Backing cleats: ¾-inch by nominal 4-inches.
   2) Web rails: ¾-inch by nominal 4-inches.
   3) Base and sleepers: ¾-inch by net 4-inches

i. Closures: Minimum 1-inch and maximum 3-inches wide, scribed to wall. Close all gaps at face, bottom and top of cabinets. Provide closure at all cabinet sides abutting walls, to ensure clearance for door to swing open fully.

F. Laminate Cladding: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Make corners and joints hairline. Slightly bevel edges.

G. Field Cutting Fitting Provisions: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting. Provide trim for scibing and site cutting.

H. Base or Full-Height Cabinets Fabrication:

1. Mounting strips: Minimum ½-inch by 2-1/2 inch at top and bottom of case. Provide intermediate mounting strip at middle of casework 60-inches and taller, including bookcases.
2. Back: ¼-inch thick tempered hardboard, dadoed into top rail, sides and bottom of cabinet.
3. Base cabinet depth: 24-inches, excluding door and drawer front thicknesses, unless otherwise indicated on the Drawings.
4. Base cabinet height: 34-inches to top of countertop work surface, unless otherwise indicated on the Drawings.
5. Full-height cabinet depth: As indicated on the Drawings, excluding door and drawer front thicknesses.
6. Full height cabinet height: As indicated on the Drawings.
7. Cabinet width: Align wall cabinet end panels with base cabinet end panels and not countertop edge.
8. Toe kicks: Separate from or integral with base unit casework, 4-inches high by 2-inches deep at front and 4-inches high by ¾-inch deep at exposed ends.
9. Drawer construction: Dovetailed joints at drawer box, with drawer bottom ploughed into drawer sides, backs and subfronts. Provide 3/8-inch thick bottoms at drawers 30-inches and wider.

a. Hot-melt glue drawer bottom in place.
b. Glue all drawer box joints.
c. File drawers shall be fabricated to receive standard, letter-size Pendaflex hanging file folders; provide steel rails for hanging files.

10. Drawer pulls: Install door pulls horizontally, centered vertically and horizontally on drawer faces. Do not install pulls on false drawer fronts or sink base panels. Do not install pulls on drawers located directly above knee spaces, such as pencil drawers, or on keyboard trays.
11. Door pulls: Install door pulls vertically, with top mounting hole centered 1-1/2 inches from both top and strike (non-hinge) edge of door. Install pulls at 34-inches to center line above floor for full height cabinets.
12. Shelves:

    a. Base cabinets: Unless otherwise indicated, one adjustable shelf.
    b. Full-height cabinets: Unless otherwise indicated, four adjustable shelf.
13. Door catches at doors without locks: Install typically on al doors except as specified below for double doors without locks. Install spring-loaded latch body to inside face of door, with the catch installed on the bottom face of cabinet bottom panel. Center cached 1-1/2 inches from strike (non-hinge) edge of door.
14. Door catches at double doors with locks: Installed on door leaf without lock. Install spring-loaded latch body to inside face of door, with the catch installed on the bottom face of cabinet bottom panel. Center cached 1-1/2 inches from strike (non-hinge) edge of door.

I. Wall Cabinet Fabrication:
1. Mounting strips: Minimum ½-inch by 2-1/2 inch, at top and bottom of case. Provide intermediate mounting strip at middle of casework 60-inches and taller.
2. Back: ¼-inch thick tempered hardboard, dadoed into top rail, sides and bottom of cabinet.
3. Wall cabinet depth: 15-inches, excluding door and drawer front thicknesses, unless otherwise indicated on the Drawings.
4. Shelves: unless otherwise indicated, all wall cabinets shall two adjustable shelves.
5. Wall cabinet height: 36-inches, unless otherwise indicated on the Drawings. Provide closure to ceiling or soffit, typically.
6. Door pulls: Install pulls vertically, with top mounting hole centered 1-1/2 inches from both bottom and strike (non-hinge) edge of door.

2.8 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Custom.

B. High-Pressure Decorative Laminate Grade: HGP. Provide HGS grade.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from manufacturer's full range in the following categories:

    a. Solid colors, matte finish.
    b. Patterns, matte finish.

D. Plastic Laminate Countertop Core Materials
   a. Countertops without sinks: Medium density fiberboard (MDF) or close-grained hardwood plywood, ¾-inch minimum thickness, except 1-inch thickness for mobile units.
   b. Countertops with sinks: Water-resistant medium density fiberboard (MDF) or marine grade plywood, ¾-inch thick

E. Plastic Laminate Countertops Fabrications, General: WIC Premium Grade at locations with sinks and WIC Custom Grade at all other locations. See Drawings for details and notes.
   a. Locate counter butt joints minimum 2-feet from sink cut-outs.
   b. Countertops shall extend ½-inch beyond faces of doors and drawer fronts along the front face of base cabinets and ½-inch beyond the exposed ends of base cabinets (those ends not abutting walls).
   c. Unless otherwise indicated, all back and side splashes shall be 4-inches high.
   d. Provide support from below countertop, either by base cabinets or welded steel angle supports as indicted on the Drawings, spaced so that unsupported length does not exceed 36-inches. Comply with requirements specified in Section 05505-Miscellaneous Metal Fabrications.
   e. At each knee space and other locations to have communications or electrical receptacles installed below countertop, provide on 1-1/2 inch ID plastic grommet, black or color to match countertop/work surface, installed directly over the outlet, centered 1-1/2 inches from the back wall (if no back splash) or 1-3/4 inches from face of back splash.

F. Plastic Laminate Countertop Edges:

   a. Front, edge, countertops without sinks: Waterfall edge
   b. Front edge, countertops with sinks: No Drip edge (post-formed).
   c. Backsplash, countertops without sinks: ¼-inch radiused butt joint, side or back mount at mill option.
   d. Backsplash, countertops with sinks: Integral coved (post-formed).
   e. Backsplash top edge: Square.
   f. Side splash top edges: Square.
   g. Exposed corners: Bevel corners 45-degrees where end of cabinet is exposed and corner subject to impact.

G. Plastic Laminate Surfacing: High-pressure plastic laminate surfacing with minimum 0.020-inch backing sheet, in compliant with referenced WIC standard.

H. Fire Characteristics of Plastic Laminate-Clad Casework and Countertops

1. Fire Characteristics of Plastic Laminate-Clad Casework: Comply with California Building Code (CBC), Table 8-B, Class III, Flame Spread 200 or less and Smoke Density not exceeding 450, when tested in accordance with ASTM E84 by a testing agency acceptable to authorities having jurisdiction.

2.9 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Grade: Premium.

B. Solid-Surfacing-Material Thickness: 3/4 inch.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:

1. selected by Architect from manufacturer's full range.

D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied edges of materials and configuration indicated.
2. Fabricate tops with shop-applied backsplashes.

E. Install integral sink bowls in countertops in shop.

F. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

2.10 SHOP FINISHING

A. Grade: Provide finishes of same grades as items to be finished.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

C. General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this Section. Refer to Division 9 painting Sections for finishing architectural woodwork not indicated to be shop finished.

D. Shop Priming: Shop apply the prime coat including backpriming, if any, for items specified to be field finished. Refer to Division 9 painting Sections for material and application requirements.

E. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

F. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen with sheen measured on 60-degree gloss meter per ASTM D 523:

G. Opaque Finish: Comply with requirements indicated below for grade, finish system, color, effect, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523.

1. Grade: Economy.
2. WIC Finish System 7a.: Synthetic enamel.
3. Color: As selected by Architect from manufacturer's full range.
4. Sheen: Gloss, 80-100 gloss units.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches (1500 mm) long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
2. Install wall railings on indicated metal brackets securely fastened to wall framing.
3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

H. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips.

I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c.
4. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

J. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

K. Refer to Division 9 Sections for final finishing of installed architectural woodwork.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06402

SECTION 07141 - INTERIOR POLYMER WATER PROTECTION SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible epoxy membrane for interior spaces; suite for use on walls, ceilings and concrete floor surfaces.

1.3 REFERENCES

A. ASTM D 412 - Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.

B. ASTM D 570-81 - Test Method for Water Absorption of Plastics

C. ASTM D 2240-91 - Test Method for Rubber Property - Durometer Hardness

D. ASTM D 2794 - Test Method for Resistance of Organic Coatings to Rapid Deformation - Impact

E. ASTM D 4060-90 - Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser

F. ASTM E 84-91- Test Method for Surface Burning Characteristics of Building Materials

G. ASTM E 96-92 - Test Method for Water Vapor Transmission of Materials

H. ASTM D 4258-83 - Standard Practice for Surface Cleaning Concrete for Coating

I. ASTM D 4259-83 - Standard Practice for Abrading Concrete

J. ASTM D 4260-83 - Standard Practice for Acid Etching Concrete

K. ASTM D 4262-83 - Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces

1.4 SUBMITTALS

A. Comply with Section 01330 - Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including physical properties and colors available.

C. Maintenance Instructions: Submit manufacturer's maintenance instructions, including maintenance procedures and materials, procedures for stain removal and surface repair, and recommended schedule for cleaning.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Applicator: Use applicator experienced in application of specified materials for a minimum of 5 years on projects of similar size and complexity. Provide list of completed projects including project name and location, name of architect, name of material manufacturer, and approximate quantity of materials applied.
2. Applicator's Personnel: Employ persons trained for application of specified materials.

B. Pre-application Meeting: Convene a pre-application meeting 2 weeks before start of application of floor coating. Require attendance of parties directly affecting work of this section, including Contractor, Architect, applicator, and manufacturer's representative. Review surface preparation, priming, application, curing, protection, and coordination with other work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name, manufacturer, batch or lot number, and date of manufacture.

B. Storage:
1. Store materials in accordance with manufacturer's instructions.
2. Keep containers sealed until ready for use.

C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.7 PROJECT CONDITIONS

A. Maintain minimum concrete surface temperature of 55 degrees F (12 degrees C) for a minimum of 48 hours before, during and after installation, or until cured.

B. Concrete must be free of hydrostatic, capillary or moisture vapor pressure. Substrates in contact with ground must have a properly installed, effective vapor barrier to help prevent potential problems resulting from hydrostatic, capillary or moisture vapor pressure. Concrete must contain less than 3% moisture when tested per ASTM D 1864.

C. Concrete to receive Interior Polymer Water Protection System shall be patched and repaired to minimize random cracking, curling, slab deflections.

D. Do not apply sealers or membrane curing agents to concrete. Moisture curing of concrete is recommended.

E. Concretes containing lightweight aggregates are not recommended substrates.

F. Provide ventilation, lighting and clean, drinkable water supply.

G. Advise other trades of fixtures and fittings not to be installed until floor is cured, such as: radiators, painting, decorating, floor-supported equipment or cabinetwork, caulking, plumbing, fixtures, etc.

H. Floors shall be kept free of traffic and no trades shall be permitted in rooms during the application and curing of the coating.

I. Protect adjacent surfaces from damage resulting from work of this trade. If necessary, mask and/or cover adjacent surfaces, fixtures, equipment, etc. by suitable means.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design: Valspar Flooring, 1191 South Wheeling Road, Wheeling, Illinois 60090. Toll Free: (800) 637-7793. Fax: (847) 541-2752. E-mail: flooringmarketing@valspar.com.

2.2 MATERIALS

A. Basis-of-Design: Interior Polymer Water Protection System: Merflex B.

1. Description: Flexible epoxy membrane waterproofing membrane with slip resistant, highly durable epoxy topcoat surface for containment applications that must withstand pedestrian and light wheeled traffic.
2. Comprehensive Yield Strength, ASTM C 579: 8000 psi (55 Mpa)
3. Heat Resistance: 180 degrees F (for continuous exposure)
4. Tensile Strength, ASTM C 412: 1000 psi (7 Mpa).
5. Tensile Elongation, ASTM C 412: 125% max @ 75 degrees F (25% @ 14 degrees F).
6. Water Absorption, ASTM D 570: 0.3%
7. Impact Resistance, ASTM D 2794: 160 inch-pounds (900 cm/Kg).
8. System Thickness: 1/8 to 3/16 inch.
9. Wall base: Provide/extend product up wall 4-inches.
10. Color: Gray.

PART 3 EXECUTION

3.01 Inspection

A. Before starting work, ensure that environmental and site conditions are suitable for application and curing.

B. Inspect surfaces for acceptability of levelness, moisture content, pitch to drains and other critical factors.

C. Report in writing to Construction Manager and Architect, with copy to manufacturer, of deficiencies that could impair work. Surfaces must be approved prior to application of flooring.

3.02 Surface Preparation

A. Prepare surfaces in accordance with manufacturer's instructions.

B. Patch and repair existing cracked concrete surfaces.

C. Remove concrete laitance by steel shot blasting, grit blasting, or other method approved by manufacturer.

D. Pre-fill surface irregularities, holes and cracks in accordance with manufacturer's recommendations.

3.03 Mixing

A. Comply with manufacturer's instructions for mixing procedures.

B. Pre-mix each component before every batch to ensure uniformity.

C. Carefully measure and mix the components together.

3.04 Installation

A. Follow manufacturer's written instructions.

B. Apply stretch coat of Valflex (Basis-of-Design) to minimum width of 3 inches wide and 20 mils dry thickness over cracks in substrate.

C. Embed Pennflex (Basis-of-Design) tape or similar reinforcing fabric in Valflex (Basis-of-Design) over cracks in substrate.

D. Install flexible membrane in multiple coats to a dry film thickness of 20 to 40 mils.

E. Install cove and/or base in accordance with manufacturer's instructions.

F. Prime entire surface with recommended primer.

G. Apply flooring in accordance with manufacturer's instruction to dry film thickness of 1/32 inch increments.

H. Apply grout coats and topcoats at manufacturer's recommended coverage to provide uniform, dense surface.

I. Allow proper cure time for each installation step.

J. Allow the finished epoxy flooring to cure for a minimum of 7 days from completion before putting into service.

K. Provide temporary protection until flooring is fully cured.

END OF SECTION 07141

SECTION 07190 - WATER REPELLENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:

1. Cast-in-place concrete.

1.03 PERFORMANCE REQUIREMENTS

A. General Performance: Water repellents shall meet performance requirements indicated without failure due to defective manufacture, fabrication, or installation.

1. Water Repellents: Comply with performance requirements specified, as determined by preconstruction testing on substrate assemblies representing those indicated for this Project.

B. Water Absorption: Minimum 90 percent reduction of water absorption after 24 hours in comparison of treated and untreated specimens.

1. Cast-in Place Concrete: ASTM C 642.

C. Water-Vapor Transmission: Comply with one or both of the following:

1. Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, according to ASTM E 96/E 96M.

2. Minimum 80 percent water-vapor transmission in comparison of treated and untreated specimens, according to ASTM D 1653.

D. Durability: Maximum 5 percent loss of water-repellent properties after 2500 hours of weathering according to ASTM G 154 in comparison to water-repellent-treated specimens before weathering.

E. Chloride-Ion Intrusion in Concrete: NCHRP Report 244, Series II tests.

1. Reduction of Water Absorption: 80 percent.

2. Reduction in Chloride Content: 80 percent.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

B. MPI Standards: Comply with MPI standards indicated and provide water repellents listed in its "MPI Approved Products List."

C. Preconstruction Testing: Installed water repellents shall comply with performance requirements indicated, as evidenced by reports based on Project-specific preconstruction testing of existing substrate assemblies by a qualified testing agency.

1. Test Area: Test a minimum 4 ft. by 4 ft. area on each type of masonry. Use the manufacturer's application instructions. Let test area protective treatment cure before inspection.

2. In addition to verifying performance requirements, use test applications to verify manufacturer's written instructions for application procedure and optimum rates of product application to substrate assemblies.

3. Notify Architect seven days in advance of the dates and times when assemblies will be tested.

4. Keep test panels available for comparison throughout the protective treatment project.

D. Preinstallation Conference: Conduct conference at Project site.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include manufacturer's printed statement of VOC content.

2. Include manufacturer's standard finishes.

3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

4. Printout of current "MPI Approved Products List" for each product category specified in Part 2 that specifies water repellents approved by MPI, with the proposed product highlighted.

B. Samples: For each type of water repellent and substrate indicated, 12 by 12 inches in size, with specified water-repellent treatment applied to half of each Sample.

C. Qualification Data: For qualified Applicator.

D. Product Certificates: For each type of water repellent, from manufacturer.

E. Preconstruction Testing Reports: For water-repellent-treated substrates.

F. Field quality-control reports.

G. Warranty: Special warranty specified in this Section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling: Store containers upright in a cool, dry, well ventilated place, out of the sun. Store away from all other chemicals and potential sources of contamination. Keep lights, fire, sparks, and heat away from containers. Do not drop containers or slide across sharp objects. Keep containers tightly closed when not in use. Store and handle materials in accordance with manufacturer's written instructions.

1.07 PROJECT CONDITIONS

A. Temperature Limitations:

1. Do not apply at surface and air temperatures below 40°F or above 95°F, unless otherwise indicated by manufacturer's written instructions.

2. Do not apply when surface and air temperatures are not expected to remain above 40°F for a minimum of 8 hours after application, unless otherwise indicated by manufacturer's written instructions.

B. Do not apply under windy conditions such that water repellent may be blown to surfaces not intended.

C. Do not apply to frozen substrate. Allow adequate time for substrate to thaw, if freezing conditions exist before application.

D. Do not apply earlier than 24 hours after rain or if rain is predicted for a period of 8 hours after application, unless otherwise indicated by manufacturer's written instructions.

E. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PENETRATING WATER REPELLENTS

A. Siloxane, Penetrating Water Repellent: Clear.

1. Products: Basis-of-Design: Manufacturer: PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046. Phone: (800) 255-4255; Fax: (785) 830-9797. E-mail: CustomerCare@prosoco.com

B. Product Description: Basis-of-Design: Sure Klean® Weather Seal Siloxane WB concentrate: A self-emulsifying water repellent concentrate designed for dilution with fresh water at the jobsite. This solvent-free blend of silanes and oligomeric alkoxysiloxanes mixes with water to produce a penetrating water repellent.

C. Technical Data

1. Form: Liquid
2. Color: Clear
3. Specific Gravity: 1.000
4. Active Substance: Microemulsion concentrate of silanes and oligomeric alkyl alkoxysiloxanes
5. Solids: 100% concentrate
6. VOC: 318 grams/liters

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
2. Inspect for previously applied treatments that may inhibit penetration or performance of water repellents.
3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
4. Verify that required repairs are complete, cured, and dry before applying water repellent.
5. Verify by examination that masonry and concrete surfaces are acceptable to receive the specified water repellents. Notify the Architect if surfaces are not acceptable to receive the specified products.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions and as follows:

1. Cast-in-Place Concrete: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents according to ASTM E 1857.

B. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.

C. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

D. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.03 APPLICATION

A. Apply water repellents to substrates in accordance with manufacturer's written instructions, environmental regulations, and application procedures determined from test panel results approved by the Architect.

B. Apply to clean, dry, cured, and properly prepared surfaces approved by the Architect.

C. Consult manufacturer's written instructions for information on application equipment to be used and precautions to be taken with the specified products.

D. Dilute "Sure Klean® Weather Seal Siloxane WB" with clean, potable water at the site in accordance with manufacturer's written instructions.

E. Do not apply to below-grade surfaces.

F. Do not apply to asphalt or other non-masonry materials.

G. Do not apply to painted surfaces.

H. Do not apply to compensate for structural or material defects in substrates.

I. Avoid overspray, wind drift, and splash of water repellents.

J. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

3.04 FIELD QUALITY CONTROL

A. Inspection: Inspect the water repellent work with the Contractor, Architect, applicator, and Mfg.'s representative, and compare with test panel results approved by the Architect. Determine if the substrates are suitably protected by the water repellents.

B. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:

1. Owner will engage the services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect. .

C. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.

1. Notify Architect seven days in advance of the dates and times when surfaces will be tested.
2. Reapply water repellent until coverage test indicates complete coverage.

3.05 PROTECTION

A. Protect surrounding areas, landscaping, building occupants, pedestrians, vehicles, and nonmasonry surfaces during the work from contact with water repellents, masonry or concrete cleaners if used, residues, rinse water, fumes, wastes, and effluents in accordance with manufacturer's written instructions.

B. Apply water repellents before installation of windows or protect as necessary.

C. Divert and protect pedestrian and auto traffic.

3.06 CLEANING

A. Clean site of all unused water repellents, residues, rinse water, wastes, and effluents in accordance with environmental regulations.

B. Remove and dispose of all materials used to protect surrounding areas and nonmasonry surfaces, following completion of the work of this section.

C. Repair, restore, or replace to the satisfaction of the Architect, all materials, landscaping, and non-masonry surfaces damaged by exposure to water repellents.

D. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.

E. Comply with manufacturer's written cleaning instructions.

END OF SECTION 07190

SECTION 07210 - BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Cavity-wall insulation.
2. Concealed building insulation.
3. Vapor retarders.
4. Sound attenuation insulation.

1.3 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 PERFORMANCE REQUIREMENTS

A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface Burning Characteristics: Flame spread rating shall not exceed 25 and smoke density shall not exceed 50.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:

1. Available Manufacturers:

a. Dow Chemical Company.
b. Owens Corning.

2. Type IV, 1.60 lb/cu. ft., unless otherwise indicated.

B. Extruded-Polystyrene Drainage Panels: ASTM C 578, of type and density indicated below and fabricated with one side having a matrix of drainage and edge channels.

1. Available Manufacturers:

a. Dow Chemical Company.
b. Owens Corning.

2. Type IV, 1.60 lb/cu. ft..

2.3 GLASS-FIBER BLANKET INSULATION

A. Available Manufacturers:

1. CertainTeed Corporation.
2. Johns Manville.
3. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

C. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-polyethylene vapor-retarder membrane on 1 face.

1. Provide faced insulation at exposed locations.

D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:

1. 5-1/2 inches thick with a thermal resistance of 21 deg F x h x sq. ft./Btu at 75 deg F.

2.4 SOUND ATTENUATION INSULATION

A. Provide sound attenuation blankets/insulation at all new and modified interior partitions.

B. Approved Manufacturers:

1. Product: MinWool-1200 Sound Attenuation Fire Batt Insulation, Johns Manville Insulations, Denver CO.
2. Thermafiber, Sound Attenuation Fire Blankets, Wabash, IN.
3. Certainteed Corporation, Valley Forge PA.
4. Owens-Corning Fiberglass Corp., Toledo OH.

2.5 AUXILIARY INSULATING MATERIALS

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

C. Asphalt Coating for Cellular-Glass Block Insulation: Cutback asphalt or asphalt emulsion of type recommended by manufacturer of cellular-glass block insulation.

D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

2.6 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:

1. Available Products:

   a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
   b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
   c. Gemco; Spindle Type.

2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

1. Available Products:

   a. AGM Industries, Inc.; RC150.
   b. AGM Industries, Inc.; SC150.
   c. Gemco; Dome-Cap.
   d. Gemco; R-150.
   e. Gemco; S-150.

2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:

   a. Crawlspaces.
   b. Ceiling plenums.
   c. Attic spaces.
   d. Where indicated.

C. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space between face of insulation and substrate to which anchor is attached.

1. Available Products:

   a. Gemco; Clutch Clip.

D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

1. Available Products:

   a. AGM Industries, Inc.; TACTOO Adhesive.
   b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
   c. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF PERIMETER INSULATION / PROTECTION BOARD

A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

C. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.

D. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.6 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Install 3-inch- thick, unfaced glass-fiber blanket insulation over suspended ceilings at partitions in a width that extends insulation 48 inches on either side of partition.

3.7 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.8 INSULATION SCHEDULE

A. Exterior Wall Thermal Insulation: R-10, unfaced, Extruded-Polystyrene Board Insulation.

B. Roof Thermal Insulation: R-30, Faced, Glass-Fiber Blanket Insulation,
1. Locate at underside of existing roof, concealed above ceiling construction.

C. Acoustical Insulation at partitions: R-11, unfaced, sound attenuation fire blankets. Provide at all interior partitions.

END OF SECTION 07210

SECTION 07260 - UNDER-SLAB VAPOR BARRIER/RETARDER

PART 1 – GENERAL

1.1 SUMMARY

A. Products Supplied Under This Section

1. Vapor Barrier, seam tape, mastic, pipe boots, detail strip for installation under concrete slabs.

B. RELATED SECTIONS

1. Section 03300 Cast-in-place Structural Concrete.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM E 1745-97 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil.
or Granular Fill Under Concrete Slabs.
2. ASTM E 154-88 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.
3. ASTM E 96-95 Standard Test Methods for Water Vapor Transmission of Materials.
4. ASTM E 1643-98 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. American Concrete Institute (ACI)

1. ACI 302.1R-96 Vapor Barrier Component (plastic membrane) is not less than 10 mils thick.

1.3 SUBMITTALS

A. Quality Control / Assurance

1. Comply with Section 01330.
2. Independent laboratory test results showing compliance with ASTM & ACI Standards.
3. Manufacturer's samples, literature .
4. Manufacturer's installation instructions for placement, seaming and pipe boot installation.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Vapor Barrier:

1. Vapor Barrier membrane must have the following properties.

a. Manufactured from prime virgin resins
b. Water Vapor Barrier ASTM E-1745 Meets or exceeds Class A
c. Water Vapor Transmission Rate ASTM E-96 0.006 gr./ft2/hr. or lower
d. Permeance Rating ASTM E-96 0.01 perms or lower
e. Puncture Resistance ASTM D-1709 minimum 2200 grams
f. Tensile Strength ASTM D-882 minimum 50.0 lbf/in

2. Vapor Barrier

A. Stego Wrap Vapor Barrier by Stego Industries LLC, 949.493.5460.
B. Approved equal.

2.2 ACCESSORIES

A. Seam Tape
1. Tape must have the following qualities:
a. Water Vapor Transmission Rate ASTM E 96 0.3 perms or lower.

2. Seam Tape

a. Stego Tape by STEGO INDUSTRIES LLC, San Juan Capistrano, CA (877) 464-7834 www.stegoindustries.com
b. Approved equal.

B. Vapor Proofing Mastic

1. Mastic must have the following qualities:

a. Water Vapor Transmission Rate ASTM E 96 0.3 perms or lower

2. Mastic

a. Stego Mastic by STEGO INDUSTRIES LLC, San Juan Capistrano, CA (877) 464-7834 www.stegoindustries.com.
b. Approved equal.

C. Pipe Boots:

1. Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 – EXECUTION

3.1 PREPARATION

A. Level and tamp or roll aggregate, sand or tamped earth base.

3.2 INSTALLATION

A. Install Vapor Barrier/Retarder:

1. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643-98.

   a. Unroll Vapor Barrier/Retarder with the longest dimension parallel with the direction of the pour.
   b. Lap Vapor Barrier/Retarder over footings and seal to foundation walls.
   c. Overlap joints 6 inches and seal with manufacturer's tape.
   d. Seal all penetrations (including pipes) per manufacturer's instructions.
   e. No penetration of the Vapor Barrier/Retarder is allowed except for reinforcing steel and permanent utilities.
   f. Repair damaged areas by cutting patches of Vapor Barrier/Retarder, overlapping damaged area 6 inches and taping all four sides with tape.

END OF SECTION 07260

SECTION 07410 - MANUFACTURED METAL ROOFING PANELS

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Conditions of the Contract and Division 01 Specification Sections apply to this section.

1.2 SUMMARY

A. Section includes pre-formed metal roof system complete with perimeter and flashing details.

1. All pipes, penetrations, walls, and curbs must be raised to 8" above finished height of roofing system.

2. Coping, counterflashings, and drip edges will be replaced using factory finished kynar 22 gauage metal with continuous clip. The coping should cover the entire parapet wall to the outside of the decorative concrete. The face of the coping should cover the decorative concrete a minimum of 4".

3. 1/4 :12 full tapered insulation needs to be installed over entire existing roofing system. Tapered insulation shall be made of 1.5 pounds per foot density EPS. Tapered insulation needs be fastened down according to FM 1-90 using either mechanical fasteners or adhesive. All plumbing, piping, conduits, etc that must be raised due to the tapered insulation are the responsibility of the roofing contractor.

1.4 SUBMITTALS FOR REVIEW

A. Shop Drawings showing layout of every roof panel and structural supporting member required in the installation with side laps and end laps marked within 1% deviation of their actual location.

1. Provide details for edge conditions, seams, joints, corners, panel profiles, assembly anchoring techniques, round and square flashings and counter flashings.

2. Provide roof insulation make-up plan indicating layout, thickness of tapered insulation, and installation methods that have been accepted or approved by an authorized manufacturer's representative to achieve R-value and warranty.

B. Samples illustrating thickness, finish, color and textures of materials.

C. Product Data: Include manufacturer's detailed material and system description, panel and field seam installation instructions, engineering performance and finish specifications. Indicate hat channel and fastener spacing.

D. Specimen Warranty: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the Manufacturer and the Owner.

E. Any material submitted as equal to the specified material must be accompanied by a report signed and sealed by a professional engineer licensed in the state in which the installation is to take place. This report shall show that the submitted equal meets the Design and Performance criteria in this specification. Substitution requests submitted without licensed engineer approval will be rejected for non-conformance.

1.5 SUBMITTALS FOR INFORMATION

A. Design and Test Reports: Provide the following certified test reports from an independent testing laboratory:

1. Independent laboratory testing report for system design load and seam integrity.

2. Professional engineer's documentation that roofing system incorporates sufficient allowance for stress and movement.

3. A letter from an officer of the manufacturing company certifying that the materials furnished for this project are the same as represented in tests and supporting data.

4. Manufacturer's verifications that the panels are factory roll formed.

5. UL 1897: Test report must be submitted for windstorm rating no less than that specified in Design and Performance Criteria article. The proposed roof system must have approval over specified substrate with steel framing spaced no further apart than as specified.

6. FM 4470: Test report must be submitted for windstorm rating no less than that specified in Design and Performance Criteria article. The proposed roof system must have approval over specified substrate with steel framing spaced no further apart than as specified.

7. ASTM E108 or similar evidence of Class A Fire Resistance

B. Mill production reports certifying that the steel thicknesses are within allowable tolerances of the nominal or minimum thickness or gauge specified.

C. Design Loads: Submit copy of manufacturer's minimum design load calculations according to ASCE 7-05, Method 2 for Components and Cladding, completed by a registered professional engineer employed by the system manufacturer as a full-time staff engineer. In no case shall the design loads be taken to be less than those detailed in Design and Performance Criteria article.

D. Qualification Data for Roofing Installer. Refer to Quality Assurance Article below.

E. Certification of work progress inspection frequency. Refer to Quality Assurance Article below.

F. Pre-installation Roofing Conference Proceedings. Refer to Quality Assurance Article below.

1.6 CONTRACT CLOSEOUT SUBMITTALS

A. General: Comply with Requirements of Division 01 Section Closeout Submittals.

B. Special Project Warranty: Provide specified warranty for the Project, executed by the authorized agent of the Manufacturer.

C. Roofing Maintenance Instructions. Provide a manual of manufacturer's recommendations for maintenance of installed roofing systems.

D. Insurance Certification: Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

E. Demonstration and Training Schedule: Provide a schedule of proposed dates and times for instruction of Owner's personnel in the maintenance requirements for completed roofing work. Refer to Part 3 for additional requirements.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer who has completed the Manufacturer's Approved Roofing Contractor course and is currently certified for the installation of this roof system.

B. If required, fabricator/installer shall submit work experience and evidence of adequate financial Responsibility. The Owner's representative reserves the right to inspect fabrication facilities in determining qualifications.

C. Source Limitations: Obtain all components of roof system from a single manufacturer, including roll goods materials if required. Secondary products that are required shall be recommended and approved in writing by the roofing system Manufacturer.

1. Upon request of the Architect or Owner, submit Manufacturer's written approval of secondary components in list form, signed by an authorized agent of the Manufacturer.

2. Manufacturer shall have direct authority and control over all fabrication of steel components as well as the raw materials used in their fabrication.

D. Source Quality Control: Manufacturer shall have in place a documented, standardized quality control program such as ISO-9001 approval.

E. Engage the Manufacturer's Field Representative to conduct required periodic inspections of work in progress as described herein and shall furnish written documentation of all such inspections.

F. Manufacturer shall provide the Owner project with a written statement that they will provide a site inspection three days per week that confirms that the project is being constructed as specified, by an experienced, full time employee of the company.

1.8 PRE-INSTALLATION CONFERENCE

A. Convene a pre-roofing conference approximately two (2) weeks before scheduled commencement of roofing system installation and associated work.

B. Require attendance of installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in and around roofing which must precede or follow roofing work (including mechanical work if any), Architect, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of the Work, including (where applicable) Owner's insurers, testing agencies and governing authorities.

C. Objectives of conference to include:

1. Review foreseeable methods and procedures related to roofing work, including set up and mobilization areas for stored material and work area.

2. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by others.

3. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.

4. Review roofing system requirements (drawings, specifications and other contract documents).

5. Review required submittals both completed and yet to be completed.

6. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

7. Review required inspection, testing, certifying and material usage accounting procedures.

8. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not mandatory requirement).

9. Record discussions of conference including decisions and agreements (or disagreements) reached and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

10. Review notification procedures for inclement weather or non-working days.

D. The Owner's Representative will designate one of the conference participants to record the proceedings and promptly distribute them to the participants for record.

E. The intent of the conference is to resolve issues affecting the installation and performance of roofing work. Do not proceed with roofing work until such issues are resolved the satisfaction of the Owner and Engineer of Record. This shall not be construed as interference with the progress of Work on the part of the Owner or Engineer of Record.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's responsibilities:

1. All roof panels shall be shipped from the manufacturer with polystyrene or similar cushioned packaging material separating the individual panels to minimize flexing, stressing, scratching or otherwise damaging the material during transit to the job.

2. Fully cover steel with tarpaulins or similar protective cover during transit to prevent dirt and debris from coming in contact with the finished goods.

B. Installer's responsibilities:

1. Stack pre-finished materials to prevent twisting, bending, abrasion and denting and elevate one end to facilitate moisture run-off.

2. Unload roof panels using a boom or crane, supporting the panels in at least two locations during lifting, and never lift more than three panels at a time.

3. Protect moisture-sensitive materials and water-based from the weather.

4. Inspect materials upon delivery. Reject and remove physically damaged or marred material from project site.

1.10 PROJECT CONDITIONS

A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage and protection requirements for roofing system.

1. Protection:

a. Protect completed roofing from subsequent construction operations. Comply with Manufacturer's recommendations.

b. Do not overload roof with stored materials.

c. Support no roof-mounted equipment directly on the roofing system.

B. Ascertain that work of other trades which penetrates the roof or is to be made watertight by the roof is in place an approved prior to installation of roofing.

1.11 DESIGN AND PERFORMANCE CRITERIA

A. Thermal Expansion and Contraction

1. Completed metal roofing and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, fasteners, or reducing performance ability.

2. The design temperature differential shall be not less than [200] °F.

3. A framing system shall be used separating panel seams from the deck so that fasteners anchoring panel seams together may not thermally bridge between interior and exterior temperatures.

B. System shall be capable of accommodating all expected, normal building movement without any transmittal of expansion or contraction through or along the seam.

C. System shall be capable of installation with all seam and flashing sealants in continuous, full compression.

D. System shall meet all design and performance criteria that is consistent with the Class 1 Roof Covering Section of the Factory Mutual Research Corporation (FMRC) Approval Guide.

E. Underwriters' Laboratories, Inc., (UL) Class A fire rating per UL 790. The steel framing spacing as specified for this project in article 3.3 shall not be greater than the steel framing specified in the UL listing.

F. Factory Mutual Research (FM), wind uplift resistance classification: Roof assembly shall be classified as FM1-90, as defined by FM 4470. The steel framing spacing as specified for this project in article 3.3 shall not be greater than the steel framing specified in the FM listing.

1.12 MANUFACTURER'S INSPECTIONS

A. When the project is in progress, the roofing system manufacturer will provide the following:

1. Keep the Architect or Owner informed as to the progress and quality of the work as observed.

2. Provide periodic job site inspections.

3. Report to the Architect in writing any failure or refusal of the Contractor to correct unacceptable practices called to the Contractor's attention.

4. Confirm after completion that manufacturer has observed no applications procedures in conflict with the specifications other than those that may have been previously reported and corrected.

1.13 WARRANTIES

A. Manufacturer shall execute a single warranty covering of the following criteria. Multiple-source warranties are not acceptable.

1. Manufacturer's thirty (30) year watertight warranty, including coverage for all trim, flashings, and penetrations associated with the roof area. This must be non pro-rated and have a no dollar limit value.

2. Twenty (20) year coverage on finish including checking, crazing, peeling, chalking, fading and/or adhesion.

3. Twenty (20) year material coverage.

4. Warranty shall commence on date of substantial completion.

5. Installer shall provide manufacturer with 5 year warranty covering roofing system installation and water-tightness.

PART 2 — PRODUCTS

2.1 PRODUCTS, GENERAL

A. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Equals must be submitted before bid date and preapproved to allow all parties to bid equal systems. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.

B. Substitutions: Products proposed as equal to the products specified in this Section shall be submitted in accordance with Bidding Requirements and Division 01 provisions.

1. Proposals shall be accompanied by a copy of the manufacturer's standard specification section. That specification section shall be signed and sealed by a professional engineer licensed in the state in which the installation is to take place. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.

2. Include a list of three (3) projects of similar type and extent, located within a one hundred mile radius from the location of the project. In addition, the three projects must be at least ten (10) years old and be available for inspection by the Architect, Owner or Owner's Representative.

3. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.

4. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

2.2 ACCEPTABLE MANUFACTURERS

A. Basis-of-Design: The design is based upon R-Mer Lite II Roofing Systems engineered and manufactured by

The Garland Company or District approved equal
Steve Lampman
Telephone: (949) 322-1770
Website: www.garlandco.com

2.3 FLAT SEAM ROOFING SYSTEM

A. General

1. The products, quality, and performance criteria specified shall be regarded as the minimum standard of quality required for the project.

2. Basis of Design: R-MER LITE II System manufactured by the Garland Company, Cleveland, OH. or preapproved equal. All products must be manufactured and/or provided by the same manufacturer offering the 30 year warranty on the completed system.

B. Materials

1. Panel Material: Steel sheet, Aluminum-Zinc Alloy Coated, ASTM A792, Coating Designation AZ-50, in thickness of .0157 for field panel, 36 in. by coil, chemically treated, commercial, lock-forming quality.

2. Steel Framing System: Aluminum-Zinc Alloy Coated, ASTM A792, Coating Designation AZ-50 .0336 by min. chemically treated, commercial, lock-forming quality.

3. Accessory Components: Aluminum-Zinc Alloy Coated, ASTM A792, Coating Designation AZ-50 .0336 or .0217, chemically treated, commercial, lock-forming quality.

C. Steel Finishes - Roof Membrane

1. Silicone modified polyester, epoxy primer baked both sides, as approved by finish coat manufacturer.

PROPERTY	TEST METHOD	SMP
Pencil Hardness	ASTM D3363 NCCA II-2	F-H
Bend	ASTM D-4145 NCCA II-19	2-T

Cross-Hatch Adhesion	ASTM D3359	no loss of adhesion
Gloss (60° angle)	ASTM D523	90+/-5%
Reverse Impact	ASTM D2794	no cracking or loss of adhesion
Nominal Thickness	ASTM D1005	
Primer Topcoat		0.2 mils 0.8 mils
TOTAL		1.0 mil

* Subject to minimum quantity requirements

D. Accessories:

1. Job Installed In-Seam Sealant: Modified polyisobutylene tape, 3/32" thick by 2" wide, minimum.

   a. Seaming material shall be a comprised of a pre-formed, non-hardening polyisobutylene rubber based elastic compound designed for use where space tolerance is limited.

   b. Material shall be furnished in a two-sided, moisture-proof, self-adhering tape form that shall accommodate compression, extension, elongation in a form fitting profile without exhibiting memory tendency in order to allow for permanent or semi-permanent surface irregularities or structural expansion/contraction within the system.

   c. Elongation: 25% Maximum

   d. Recovery: 2% Maximum

   e. Solids: 100% Maximum

   f. Odor: None

   g. Cure Time: Non-Curing

   h. Flow: Slight

   i. Color: Gray

   j. Adhesion (Metal): Peel: 15l lbs./lin. in. j. Shear: 55 lbs./in.

k. Seamability: 100% cohesion of mating surfaces

l. Cold Temperature: Passes -30°F. Flex over 1" Mandrel

m. Softening Point: 200°F.

2. Factory Applied Sealant:

   a. Sealant must consist of a specified hot melt (100% solids thermoplastic material) in a 100% consistent application to affect a permanent, water-tight seal in a full compression configuration.

3. One component urethane meeting 360% elongation (ASTM D 412) and Tear Resistance of 140 lbs./in. (ASTM D 1004).

4. One component acrylic terpolymer meeting FS TT-S-00230.

5. Framing System Fasteners:

   a. Metal Deck: FM 4470 Pinch point, fluorocarbon coated #14 fastener.

   b. Concrete Deck: FM 4470 masonry tip and tread, fluorocarbon coated #14 fastener

   c. Lightweight Concrete Deck: Fasteners should go into the deck below unless pullout tests can confirm that the system will meet all wind uplift requirements.

6. Seam Screws: Sheet Metal Fastener size #10 or #12 by 3/4" or 1" supplied by roof system manufacturer.

7. Wood Nailers, Curbs and Sleepers: California Redwood, #2 grade. No treated wood utilizing salt-base preservatives shall be allowed. Material safety Data Sheets must be provided to the roofing manufacturer for verification of preserving agents prior to the installation of any pressure treated wood.

8. Miscellaneous Fasteners:

   a. TEK #1 or #4 screws

   b. Expanding fasteners 1/4" min.

9. Prefabricated Stack Flashings: Flexible pre-fabricated round stack flashings with integrated pressure ring shall be used for all round pipe flashings as furnished by roof system manufacturer.

10. Temporary Night Sealant: Self-contained, two-component urethane foam.

11. Unitized Vents: Spun-aluminum, one way moisture vapor relief vents as furnished by roof system manufacturer.

12. Seam Bar: 1" x 3/32" 6063T aircraft grade aluminum bar with eight (8) mil white primer coat.

13. Retrofit drain system: provided by the membrane manufacturer or preapproved equal.

2.4 FABRICATION

A. In order to maximize quality control and conform to inorganic coating manufacturers' warranty limitations, all roll forming processes shall be done at the manufacturer's factory. Absolutely no roll forming will be permitted on the job site.

B. Exercise careful compliance with specified requirements for fabricated profile, dimensional, and structural requirements.

C. Provision shall be made for the roof system to self-ventilate and breathe according to ASTM E241 guidelines.

1. Ventilation shall be shown to be free-flowing between panels in each contiguous roof area.

D. Roofing system shall be designed to resist capillary action of water at any slope.

E. Tolerances:

1. Roof system shall be designed to accommodate normal building dimension tolerances without panel distortion or weaving.

2. Panels shall not be shimmed to straighten an out-of-line structure.

3. Follow the correct published panel alignment recommendations of the manufacturer without variation.

2.5 SOURCE QUALITY CONTROL

A. Manufacturer shall furnish written documentation that all roof panels, flashing, trim, seam attachment devices, framing members, weather-exposed accessories, tape, caulking and sealants were furnished by this single-source company.

B. Manufacturer shall furnish mill production documentation of specifications for steel coil stock used in the fabrication of the roof system, without organic coating per ASTM A446, ASTM A525, ASTM A527 or ASTM A792.

C. Manufacturer shall furnish all other documentation as required herein.

PART 3 — EXECUTION

3.1 EXECUTION, GENERAL

A. Comply with requirements of Division 01 Section "Execution Requirements."

3.2 PREPARATION

A. Design system so that the panel installation may be started and/or terminated at any given point in the area.

1. It is understood that the ongoing operations of the Owner are of a critical nature as to leak sensitivity. Do not work on more roof area than can be restored completely watertight in one day.

B. Remove existing loose material, dirt and debris from the roof area. All accumulations of asphalt or other repair materials shall be removed to provide a smooth, flat substrate without imperfections that will be evident in the finished work.

1. Existing metal details and other metal accessories specified for re-use that interfere with the installation of the new roof system shall be carefully removed and set aside for re-use.

2. Any metal described above that will come in contact with the new roof shall be checked for type and replaced or protected if galvanic action may be a problem.

C. Strip existing contaminating material from all metal components that are indicated to be re-utilized. Protect these metal components. Replace damaged components with new of similar type and dimension.

D. Replace wood blocks and/or sleepers indicated to be replaced with new pressure-treated wood, redwood, or other form of blocking acceptable to the Manufacturer.

1. Do not use pressure-treated wood containing salt-based preservatives or materials corrosive to steel. Provide Material Safety Data Sheets to the roofing manufacturer for verification prior to installation.

E. Remove pipes, conduits or equipment indicated to be abandoned and removed.

F. All curbs, soil stacks, and other interior flashing surfaces shall be extended to a minimum of 8" above the new horizontal roof surface or shall be pressure sealed at the top edge.

G. The prepared substrate shall be a minimum 3/8":12" slope prior to the installation of the roof system.

H. Contractor to verify all horizontal and vertical measurements and layout prior to manufacturing of and installation of roofing.

3.3 INSTALLATION

A. Install roof system when the atmospheric dry bulb temperature is minimum 40°F and rising.

B. Install all components of the roof system in exact accordance with the manufacturer's standard published procedures as applicable to these project conditions and substrates. The roof system shall be installed at no less than 3/8":12" slope.

C. Install all required vapor retarder, air seals and preliminary tapered, insulating substrates required per enclosed specifications.

D. Lay out and anchor all roof framing sections according to the approved roof plan.

E. Steel framing system installation

1. The steel framing system shall be installed around the entire perimeter of the roof, all curbs and boxes and as closely to the existing edge and vertical walls as possible.

2. The entire roof area shall then be measured and laid out to determine the designed or practical use of the furnished panels. The framing system shall be installed to the roof surface so that the framing system may be fastened through the existing roof and into the roof deck or structured supports with the entire perimeter of all steel panels covering the fastening flange of the metal framing system.

3. Steel framing sections shall be spaced a maximum of 6 ft as specified by the FM 1- 90 wind uplift approval. Steel framing sections shall be installed by fastening to the specified deck type with the deck fastener type specified in subparagraph 2.3.D.5. Fasten framing sections every 12" o.c. staggered for wood, steel, and structural concrete decking.

4. A pre-fabricated drain or ridge line framing system shall be installed along the bottom of all valleys, including along the leading edge of crickets and saddles.

5. The adjoining ends of framing sections shall be overlapped. All overlapped adjoining ends shall be fastened to the substrate together. Ends that adjoin or abut the sides of frames shall be lap cut so that there are no gaps between adjoining sections.

F. Install rigid board insulation shall be provided and installed to fill all voids between the prepared roof substrate and the roof panel. If installing over an existing metal roof panel, fill all flutes or spaces between panel seams or ribs to create a flat roof surface in the plane of intended roof slope.

G. Steel roof membrane installation

1. All panels and other components of the work shall be installed and anchored to the framing supports, making provision for the critical concerns specified below.

2. Seam tape shall be applied to the tops of all framing sections occurring in secondary framing systems, or along leading edge of crickets or saddles, centered along the top of the framing sections. The paper seam tape backer shall be removed.

3. The steel roof panels shall be applied over the framing sections, beginning at the valley or lowest point of the roof, assuring that the panels completely cover the tops of the steel framing sections. The steel panel shall be aligned so that it overlaps the preceding panel by approximately 1-1/2" but does not extend beyond the edge of the top of the underlying framing section.

4. As steel roof panels are being aligned, factory seams of adjacent panels must be staggered a minimum of 6".

5. Panel surfaces shall be completely clean of all dirt, debris, oils, and moisture prior to the installation of seam tape. 3/32" thick by 2" wide seam tape shall be applied to the underside of the overlapping portion of adjoining pieces of metal along the scored center line of tape. This will leave 1" of tape exposed. Fold the 1" of exposed butyl tape over the top side of the panel and apply pressure to create a smooth and even seal. End-lap seam tape 1" where necessary. Walk in the seam tape so that tape adheres well to underside and topside of top panel.

6. Remove the underside half of the seam tape paper backer and press the panels together by walking the length of the seam. The topside half of the paper backer is then removed.

7. The compression bar shall be laid on top of the field seam with the lip of the compression bar facing down and setting against the leading edge of the butyl tape exposed on the top side of the roof panel. When laying compression bars a gap of 1/8" shall be maintained between each compression bar. The last hole in adjacent compression bars shall be no further apart that 1" center to center.

8. The seam fasteners shall be placed approximately 18" o.c., beginning at the middle of the panel and working towards the ends, so that all slack is distributed throughout the length of the panels.

9. Installing seam fasteners in every hole of the compression bar shall complete the final seaming; each fastener will be spaced approximately 1 1/4" o.c. Fastener guns with adjustable clutch shall be used on all fastening panels and accessories. Final seaming is to occur, for all panels installed, at the end of each day.

a. All seam fasteners shall be set so that the seam is fully compressed, with caution being taken not to over-torque or under-torque the fasteners

b. Final seaming shall not be completed at the walls or vertical surfaces until the wall flashing system is installed.

c. A seam fastener shall be placed in the corner of every panel

10. Blind seams shall be completed after all panels are in place.

a. All seam screws shall be set so that the seam is fully compressed, with caution being taken not to over-torque or under-torque the fasteners.

b. Using the marks placed on the panels as a guide to the location of the underlying steel framing section, the installer shall snap a chalk line the entire length of the valley, ridge, or secondary framing section.

c. The paper backer shall be carefully removed from the seam tape prior to fastening the panel.

d. The final blind seaming shall be completed by installing seam fasteners as specified between the stabilizing fasteners, assuring that the fasteners penetrate the underlying sealant.

H. Steel flashings installation at curb and wall

1. Factory fabricated wall flashing pieces shall be installed so that the leading edge of the deck flange lines up with the top of the underlying framing section.

2. Install seam tape and seam bar as specified for the steel membrane.

3. The wall flashing piece shall press against the vertical wall with a spring tension action.

4. The final seaming along the vertical portion of the metal flashing shall be completed by installing seam fasteners every 1" o.c.

a. 3/32" x 2" Seam tape shall be applied to the underside of the overlapping piece, allowing approximately 1/8" of tape to be exposed beyond the leading edge. The paper seam tape backer shall be removed.

b. The seamed area of metal shall be pressed onto the underlying section at appropriate overlap, beginning at the vertex of the angle, so that there is no gap where the two pieces adjoin.

c. The first seam fastener shall be installed directly into the angle, securely anchoring this spot, to the underlying flashing.

d. All seam fasteners shall be set so that the seam is fully compressed, with caution being taken not to over-torque or under-torque the fasteners.

e. The heads of the seam fasteners shall never extend beyond the edge of the seam nor occur greater than 1/4" away from the edge of the seam. The adjoining sections of metal shall be seamed together with an overlap a minimum of 2".

f. The inside and outside corners shall be mitered and shall be installed with seam tape and seam fasteners as described above.

I. Flashing installation at pipes, projections, pitch pans and conduits.

1. All soil stacks shall receive new pre-fabricated unitized stack flashings.

a. The base flange on the unitized flashing shall receive seam tape to the underside of the leading edge of the flange so that approximately 1/8" of tape extends beyond the edge of the metal. The paper seam tape backer shall be removed.

b. The flexible rubber upper portion of the flashing shall be cut to the size of the O.D. of the pipe, as inscribed on the flashing.

c. A bead of caulking shall be applied around the pipe, approximately 2" above the point where the flexible rubber will terminate. The flashing shall then be slid down over the pipe so that the caulking bead is compressed as full contact with the roof is made.

d. A stainless steel pipe clamp shall be installed to the upper seal area of the flexible rubber top.

e. The final seaming shall be completed by installing seam fasteners every 1" O.C. around the base.

f. All seam fasteners shall be set so that the seam is fully compressed, with caution being taken not to over-torque or under-torque the fasteners.

g. The heads of the seam fasteners shall never extend beyond the edge of the seam nor occur greater than 1/4" away from the edge of the seam.

2. All conduits and mechanical lines and pipes shall be installed resting on redwood or treated wood weigh displacement supports. All copper pipes shall be protected from exposing the roof to galvanic reactions.

a. The conduit or pipe shall be anchored to the wood block with fasteners and brackets of similar metal to that of the pipe.

b. Wood blocks shall be of sufficient size and spacing to adequately support the conduit or pipe above the roof membrane, without bowing.

3. All closed top round flashing shall be flashed with a pre-fabricated wrap-around style unitized flashing.

   a. The base flange on the unitized flashing shall receive seam tape to the underside of the leading edge of the flange so that approximately 1/8" of tape extends beyond the edge of the metal. The paper seam tape backer shall be removed.

   b. The flexible rubber upper portion of the flashing shall be cut to the size of the O.D. of the pipe, as inscribed on the flashing.

   c. A bead of caulking shall be applied around the pipe, at the top of the unitized flashing

   d. A stainless steel pipe clamp shall be installed to the upper seal area of he flexible rubber top.

   e. The final seaming shall be completed by installing seam fasteners every 1-1/4" o.c. around the base.

   f. All seam fasteners shall be set so that the seam is fully compressed, with caution being taken not to over-torque or under-torque the fasteners.

   g. The heads of the seam fasteners shall never extend beyond the edge of the seam nor occur greater than 1/4" away from the edge of the seam.

J. Counter flashing installation

1. Prefabricated counter flashings shall be installed as required along all perimeter walls and over all interior flashings that do not have a protective flange covering the top of the base flashing

2. Seam tape or sealant shall be applied to the back side of the fastening flange of the counter flashing piece. The paper seam tape backer shall be removed.

3. The counter flashing shall be installed in place with appropriate, required fasteners placed 6"-12" o.c. through the center of the fastening flange and anchored so that the flange is secured in place in a spring compression situation. The adjoining sections of metal shall overlap a minimum of 1/2" and a seam fastener shall be installed through both pieces of metal to anchor them to the wall or substrate.

4. A bead of urethane sealant shall be applied to the top edge of the metal, centered over the edge, and tooled to shed water.

K. Vent installation

1. One-way, moisture vapor relief vents shall be installed on the roof area.

2. One vent shall be installed in a central location of every major roof panel, over 200 square feet, and aligned for a consistent appearance.

3. A 4" round hole shall be cut at each vent location.

4. 3/32" x 2" Seam tape shall be applied to the underside of the prefabricated vent, allowing approximately 1/8" to extend beyond the edge of the metal. The paper seam tape backer shall be removed.

5. The vent shall be pressed to the roof surface and centered over the 4" hole.

6. The final seaming shall be completed by installing seam fasteners every 1" o.c. around the base.

   a. All seam fasteners shall be set so that the seam is fully compressed, with caution being taken not to over-torque or under-torque the fasteners.

   b. The heads of the seam fasteners shall never extend beyond the edge of the seam nor occur greater than 1/4" away from the edge of the seam.

L. Protective coating installation

1. All excess seam tape shall be trimmed away even with the edge of the seam bare on both sides, using a plastic putty knife (do not use utility knives).

2. After all work is complete and the roof has been inspected and approved by the material manufacturer and the owner, a protective coating shall be applied to all seam areas in a 2" width centered on the fasteners. This should be masked off on both sides using painters tape. Painters tape should be removed within 24 hours of installation.

3. Protective coating shall be applied to all inside and outside corner seams, along the tops of seams in projections, and around all sump pan and through wall scupper seams, etc.

4. Protective coating shall be applied to all field seam and other mechanically fastened areas, and over all caulking applications.

5. Protective coating is to be applied within 72 hours of completion of seam areas.

3.4 CLEANING

A. Clean installed work in accordance with the manufacturer's instructions.

B. Replace damaged work than cannot be restored by normal cleaning methods.

3.5 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated during roofing procedures. Comply with requirements of authorities having jurisdiction

3.6 FINAL INSPECTION

A. At completion of roofing installation and associated work, meet with Contractor, Architect, installer, installer of associated work, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.

B. Inspect roofing work and flashing of roof penetrations, walls, curbs and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.

C. Repair or replace deteriorated or defective work found at time above inspection as required to a produce an installation which is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

D. Notify the owner upon completion of corrections.

E. Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.

F. Immediately correct roof leakage during construction. If the Contractor does not respond within twenty-four (24) hours, the Owner will exercise rights to correct the Work under the terms of the Conditions of the Contract.

3.7 DEMONSTRATION AND TRAINING

A. At a time and date agreed to by the Owner, instruct the Owner's facility manager, or other representative designated by the Owner, on the following procedures:

1. Roof troubleshooting procedures.

2. Notification procedures for reporting leaks or other apparent roofing problems.

3. Roofing maintenance.

4. The Owner's obligations for maintaining the roofing warranty in effect and force.

5. The Manufacturer's obligations for maintaining the roofing warranty in effect and force.

END OF SECTION 07410

SECTION 07600 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Sheet metal flashings in connection with roofing.
2. Reglet and counter flashing assemblies.
3. Miscellaneous metal flashing and counter flashing as required, except where provided under Division 15 or Division 16.
4. Coping caps.
5. Splash pans where downspouts empty onto roofing.
6. Drip flashings.
7. Roof pipe flashings.
8. Metal louvers not specified in Division 15.
9. Other sheet metal items, not necessarily specified herein or in other sections, but required to prevent penetration of water into building.

C. Related Sections:

1. Section 07520: Cold Process Monolithic Built-Up Roofing
2. Section 07920: Joint Sealants.
3. Section 09220: Portland Cement Plaster and Metal Lath
4. Division 15: Mechanical.
5. Division 16: Electrical.

1.02 SUBMITTALS

A. General: Submit following items in accordance with Section 01330.

B. Shop Drawings: Submit for fabricated sheet metal indicating shapes, details, methods of joining, anchoring and fastening, thicknesses and gages of metals, concealed reinforcement, expansion joint details, sections, and profiles.

C. Samples: Submit Samples for materials or assemblies as requested.

D. Product Data: Submit brochures of manufactured items.

1.03 QUALITY ASSURANCE

A. Drawings and requirements specified govern. Provide the Work of this section in conformance with the Architectural Sheet Metal Manual published by SMACNA for conditions not indicated or specified and for general fabrication of sheet metal items.

B. Materials shall conform to following standards:

1. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

2. ASTM A 653 - Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

3. ASTM B 370 - Copper Sheet and Strip for Building Construction.

4. ASTM B 749 - Lead and Lead Alloy Sheet, Strip and Plate Products.

C. Pre-installation Meetings: Refer to Division 7 roofing sections as appropriate. Attend the pre-installation and inspection meetings for roofing Work.

1.04 DELIVERY, STORAGE AND HANDLING

A. Do not install bent and/or otherwise damaged materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Galvanized Sheet Steel: ASTM A 653, coating designation G90, hot-dip galvanized.

B. Copper Plate, Sheet and Strip: ASTM B 370, cold-rolled, tempered. Copper sheet and strip shall be cold-rolled-temper.

C. Sheet Lead: ASTM B 749, Type L50049 or L51121, weighing not less than 4 pounds per square foot.

D. Stainless Steel: Plate, sheet and strip shall conform to ASTM A 167, Type 304 or Type 316, No. 4 finish on exposed surfaces and No. 2 finish on concealed surfaces unless otherwise specified or indicated. Furnish Type 304 for general applications and Type 316 where exposed to acidic or alkaline conditions.

E. Fastenings:

1. Galvanized Steel: Nails, rivets, and other fastenings furnished in connection with galvanized sheet steel Work shall be sealed with rust resistive coating. Rivets shall be tinned. Nails and other fastenings shall be zinc-coated.

2. Stainless Steel: Nails, rivets and other fastenings furnished in connection with stainless steel Work, shall be 300 series alloy to match alloy of stainless steel being fastened.

F. Soldering Flux: Raw muriatic acid for galvanized steel; rosin for tin, lead and tinned copper; non-corrosive soldering salts for uncoated copper and acid-type flux formulated for soldering stainless steel.

G. Solder: ASTM B 32, Grade 50A. Name of product manufacturer and grade designation shall be stamped or cast onto each bar.

2.02 FABRICATION

A. General:

1. Accurately form sheet metal Work to dimensions and shapes indicated and required. Cope finish molded and brake metal shapes with true, straight, sharp lines and angles and, where intersecting each other, to a precise fit. Unless otherwise specified, all galvanized sheet steel shall be 22 gage. Exposed edges of sheet metal shall have a 1/2 inch minimum hemmed edge.

2. Soldering of sheet steel or copper shall be performed with well-heated copper soldering iron or soldering torch, joints full flowing, neat and consistent. Thoroughly clean materials at joints before soldering, and tin coppers before soldering. Exposed soldering on finished surfaces shall be scraped smooth. Lock seam Work shall be fabricated flat and true to line and soldered along its entire length. Acid-fluxed Work shall be neutralized after fabrication.

3. Form and install sheet metal Work to provide proper allowances for expansion and contraction, without causing undue stresses in any part of completed Work. Installation shall be water and weathertight.

B. Reglet Type Counterflashing: Where roof comes in contact with vertical surfaces, provide counterflashing. Set top of counterflashing 8 inches above roof deck unless otherwise indicated, and extend down at least 5 inches or to top of cant strip. Counterflashing and reglet shall be 22 gage galvanized sheet steel. Lap counterflashing and reglet 3 inches minimum at splices and miter at angles, or supply special metal corner fittings. Reglet and method of securing flashing shall be so constructed that flashing is firmly locked in place, but may be readily removed for replacement.

C. Splash blocks: Provide splash blocks for all downspouts, which empty onto lower roofs.

D. Louvers, Fixed: For sizes 2' x 3' maximum (Provide heavier gages as required for sizes indicated on Drawings).

1. Gages: #22 gage for spans to 24", #20 gage for spans to 36".

2. Type: Similar to SMACNA Plates #102, #103A-2 frame, #103D-1 louvers, folded U-frame Plate #108B

a. Insect Screen: 8 mesh with #27 gage galvanized wire

E. Miscellaneous Flashing: Unless otherwise indicated, miscellaneous flashing shall be fabricated of galvanized steel. Exterior doors and windows, unless covered by overhangs shall be provided with 22 gage galvanized steel drip flashing as detailed.

F. Roof Pipe Flashings: Provide welded seam 4 pound lead flashings. Field fabricated flashings shall also be welded.

PART 3 - EXECUTION

3.01 PREPARATION

A. Concrete and masonry materials in contact with sheet metal shall be painted with alkali resistant coating, such as heavy-bodied bituminous paint. Wood in contact with sheet metal shall be painted with 2 coats of aluminum paint or one coat of heavy-bodied bituminous paint.

3.02 INSTALLATION

A. General: Coordinate with installation of underlayment indicated in the Drawings and specified in Section 09220.

B. Reglets: Install reglets at constant height above cant or as indicated. Provide minimum 3 inch lap at end splices of reglets. Caulk laps solidly.

C. Counterflashing:

1. Install at constant horizontal elevation across roof slope and slope at constant height above cant or as indicated.

2. Provide minimum 3 inch lap at all end splices of counterflashing.

D. Galvanized sheet steel parapet coping and flashing shall be continuous over top of parapet to form a watertight cap, with waterproof seams at approximately 10 feet on center, or as indicated. Anchor coping to outside of wall with a continuous cleat face nailed at 24 inch centers. Coping shall be fastened on inside wall with hex head screws and bonded sealing washers through oversized holes in the back of the coping. Corners and angles shall be lapped and soldered; do not install joint sealant.

1. Finish paint Galvanized sheet steel parapet copings per Section 09912.

F. Prefabricated Louvers: Install plumb and level; securely anchor; seal watertight to adjoining construction. Install screens, cranks, and blackout plates where required.

3.03 TESTING

A. Perform field water testing to demonstrate installation is watertight. Continue testing with a continuous hose stream applied at base of installation for at least 30 minutes. If leaking is observed, discontinue test and repair installation, then test until satisfactory results are obtained.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANING

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION 07620

SECTION 07810 - CEMENTITIOUS FIREPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Cementitious spray-applied fireproofing installed on steel.

C. Related Sections:

1. Section 03300: Cast-In-Place Concrete.
2. Section 05120: Structural Steel.
3. Section 05300: Steel Deck.

1.02 SYSTEM DESCRIPTION

A. Regulatory Requirements:

1. UL Fire Resistance Directory.
2. CBC Standard No. 43.8 - Thickness and Density Determination for Spray-Applied Fireproofing.
3. CBC Standard No. 43.9 - Methods for Calculating Fire Resistance of Steel, Concrete and Wood Construction.
4. Products, installation, and fireproofing thickness shall conform to applicable code requirements for required fire-resistive ratings.

1.03 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings to indicate members and components to receive fireproofing. Indicate various ratings and thicknesses required.

B. Product Data:

1. Submit manufacturer's specifications for materials with copies of code and UL approvals.

2. Submit manufacturer's recommended application instructions.

C. Material Samples: Submit 12 inch x 12 inch sprayed Sample. Prepare Samples accurately; apply required thickness and density of fireproofing material.

D. Test Reports: Submit reports of tests performed by an authorized independent testing laboratory, indicating conformance with performance criteria specified below.

1.04 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. ASTM E 84 - Surface Burning Characteristics of Building Materials.

2. ASTM E 119 - Fire Tests of Building Construction and Materials.

3. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

4. ASTM E 605 - Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members.

5. ASTM E 736 - Cohesion/Adhesion of Sprayed Fire-Resistive Material Applied to Structural Members.

6. ASTM E 760 - Effect of Impact on Bonding of Sprayed Fire-Resistive Materials Applied to Structural Members.

7. ASTM E 761 - Compressive Strength of Sprayed Fire-Resistive Materials Applied to Structural Members.

8. ASTM E 859 - Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members.

9. ASTM E 937 - Corrosion of Steel by Sprayed Fire-Resistive Material Applied to Structural Members.

10. ASTM G 21 - Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. Qualifications of Installer: Minimum 5 years experience in successfully installing specified fireproofing materials and certified in writing by the manufacturer to install specified products.

1.05 DELIVERY, STORAGE AND HANDLING

A. Material shall be delivered in original unopened packages, fully identified as to manufacturer, branch or other identifying data, and bearing proper Underwriters Laboratories, Inc. labels for fire-resistance classification.

B. Material shall be stored above grade, under cover and in a dry location until ready for installation. Bags exposed to water before installation shall be considered unsuitable for use and discarded. Stock of material is to be rotated and installed before its expiration date.

1.06 PROJECT CONDITIONS

A. A minimum temperature of 40 degrees F for air and substrate must be maintained for 24 hours before, during, and for 24 hours after installation of the sprayed fireproofing.

B. Provide ventilation to allow proper drying of fireproofing during and after its installation. In poorly ventilated areas lacking natural ventilation, provide forced air circulation as required.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. W.R. Grace Construction Products
B. Cafco
C. Approved equal.

2.02 MATERIALS

A. Sprayed fireproofing: W.R. Grace Monokote Type MK-6/CBF, cementitious products by Cafco. The material shall be factory-blended, cementitious fireproofing.

1. Performance Criteria:

a. Dry Density: Field density shall be measured in accordance with ASTM E 605. Minimum average density shall be that listed in UL Fire Resistance Directory, ICBO Evaluation Report, or as required by authorities having jurisdiction.

b. Deflection: Material shall not crack or de-laminate from surface to which it is installed when tested in accordance with ASTM E 759.

c. Bond Impact: Material subject to impact tests in accordance with ASTM E 760 shall not crack or de-laminate from the surface to which it is installed.

d. Bond Strength: Fireproofing, when tested in accordance with ASTM E 736, shall have a minimum average bond strength of 200 psf and a minimum individual bond strength of 150 psf.

e. Air Erosion: Maximum allowable weight loss of fireproofing material shall be 0.005 gm./sq.ft. when tested in accordance with ASTM E 859.

f. Compressive Strength: Fireproofing shall not deform more than 10 percent when subjected to compressive forces of 1000 psf when tested in accordance with ASTM E 761.

g. Abrasion Resistance: No more than 6 inches shall be abraded or removed from fireproofed substrate when tested in accordance with established test methods.

h. Impact Penetration: Fireproofing material shall not show a loss of more than 2-1/4 inches when subjected to impact penetration tests in accordance with established test methods.

i. Surface Burning Characteristics: Material shall exhibit following surface burning characteristics when tested in accordance with ASTM E 84; flame spread-0 and smoke development-0.

2. Sprayed fireproofing material shall have been tested and reported by Underwriters' Laboratories, Inc. in accordance with procedure of ASTM E 119.

3. Sprayed fireproofing material and application shall meet requirements of OSHA regulation 29 C.F.R. Section 1926.58, which regulates use of asbestos in construction, and shall be free of mineral wool.

4. Fireproofing product shall be tested in accordance with ASTM G 21, and shall show resistance to mold growth when inoculated with aspergillus niger, and mixed spore cultures (Tappi T487-M54 and ASTM G 21). Mold inhibitor shall be provided by the manufacturer.

B. Mixing water shall be clean, fresh and suitable for domestic consumption and free from such amounts of mineral or organic substances that would affect installation of fireproofing material.

C. Bonding Agent: Rohm and Haas, MC-76, or equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Surfaces to receive sprayed fireproofing shall be free of oil, grease, paints/primers, loose dirt or other foreign substances which may impair proper adhesion of fireproofing to substrate. Where necessary, clean surfaces to receive fireproofing by a method recommended by fireproofing material manufacturer.

B. Installation of sprayed fireproofing shall not begin until surfaces to receive fireproofing have been inspected, to determine if surfaces are acceptable to receive fireproofing material.

3.02 PREPARATION

A. Before installation of fireproofing, clips, hangers, support sleeves, and other attachments required to penetrate fireproofing shall be installed.

B. Ducts, piping, equipment or other suspended material or equipment, which would interfere with installation of fireproofing material, shall not be installed until fireproofing Work is complete.

C. Bonding agent shall be installed to soffit of precast concrete planks. Coverage shall be 1000 square feet per gallon. If diluted with water on a one-to-one ratio, coverage shall be 500 square feet per gallon.

3.03 APPLICATION

A. Provide equipment and application methods that conform to manufacturer's application instructions as reviewed.

B. Thickness of fireproofing shall conform to CBC Chapter 7 and Table 7A, for types and locations of members to be protected.

3.04 FIELD QUALITY CONTROL

A. The Owner will select and pay an independent testing laboratory to sample and verify thickness and density of fireproofing in accordance with provisions of UBC Standard 7-6.

B. The results of tests will be made available to all parties at the completion of installation.

3.05 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.06 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION 07810

SECTION 07841 - THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.02 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

B. Related Sections include the following:

1. Division 7 Section "Fire-Resistive Joint Systems."

1.03 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

   a. Penetrations located outside wall cavities.

   b. Penetrations located outside fire-resistance-rated shaft enclosures.

3. L-Rated Systems: Provide through-penetration firestop systems with L-ratings indicated at both ambient temperatures and 400 deg F (204 deg C).

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

2. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.

3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each through-penetration firestop system, show each type of construction

inspecting agency

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.

2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration

1. Types of penetrating items.

2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.

3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

D. Qualification Data: For Installer.

E. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and

manufacturer.

C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to Owner.

2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

   a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.

   b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

      1) UL in its "Fire Resistance Directory."
      2) OPL in its "Directory of Listed Building Products, Materials, & Assemblies."
      3) ITS in its "Directory of Listed Products."

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.08 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, systems that are produced by one of the following manufacturers:

1. Hilti, Inc.
2. 3M; Fire Protection Products Division.
3. Specified Technologies Inc.
4. USG Corporation.
5. Or equal

2.02 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:
   a. Slag-/rock-wool-fiber insulation.
   b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   c. Fire-rated form board.
   d. Fillers for sealants.
2. Temporary forming materials.

3. Substrate primers.

4. Collars.

5. Steel sleeves.

2.03 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.

3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.04 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.03 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."

2. Contractor's name, address, and phone number.

3. Through-penetration firestop system designation of applicable testing and inspecting agency.

4. Date of installation.

5. Through-penetration firestop system manufacturer's name.

6. Installer's name.

3.05 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.

B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.06 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.07 THROUGH-PENETRATION FIRESTOP SYSTEM

A. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Where OPL-classified systems are indicated, they refer to alpha-numeric design numbers in OPL's "Directory of Listed Building Products, Materials, & Assemblies."

C. Where ITS-listed systems are indicated, they refer to design numbers listed in ITS's "Directory of Listed Products," "Firestop Systems" Section.

D. Firestop Systems are indicated on the drawings.

END OF SECTION 07841

SECTION 07842 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes fire-resistive joint systems for the following:

1. Floor-to-wall joints.

2. Head-of-wall joints.

3. Wall-to-wall joints.

B. Related Sections include the following:

1. Division 7 Section "Through-Penetration Firestop Systems" for systems installed in openings in walls and floors with and without penetrating items.

2. Division 7 Section "Joint Sealants" for non-fire-resistive joint sealants.

1.02 PERFORMANCE REQUIREMENTS

A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.

B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, and with movement capabilities and L-ratings indicated as determined by UL 2079.

1. Load-bearing capabilities as determined by evaluation during the time of test.

C. Perimeter Fire-Resistive Joint Systems: For joints between edges of fire-resistance-rated floor assemblies and exterior curtain walls, provide systems of type and with ratings indicated below and those indicated in the Fire-Resistive Joint System Schedule at the end of Part 3, as determined by UBC Standard 26-9 and UL 2079.

1. UL-Listed, Perimeter Fire-Containment Systems: Integrity ratings equaling or exceeding fire-resistance ratings of floor or floor/ceiling assembly forming one side of joint.

D. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive

joint system design designation of testing and inspecting agency acceptable to Owner that demonstrates compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.

C. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.

D. Qualification Data: For Installer.

E. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

B. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to Owner.

2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:

   a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.

   b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.07 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the fire-resistive joint systems indicated for each application in the Fire-Resistive Joint System Schedule on the drawings.

2.02 FIRE-RESISTIVE JOINT SYSTEMS

A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

B. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.

2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.03 INSTALLATION

A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.

2. Apply fill materials so they contact and adhere to substrates formed by joints.

3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.05 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHBN.

B. Designation System for Joints at the Intersection of Fire-Resistance-Rated Floor or Floor/Ceiling Assembly and an Exterior Curtain-Wall Assembly: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHDG:

C. Fire-Resistive Joint Systems: As indicated on Drawings.

END OF SECTION 07842

SECTION 07920 - JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.02 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:

   a. Construction joints in cast-in-place concrete.

   b. Control and expansion joints in unit masonry.

   c. Joints between different materials

   d. Perimeter joints between materials and frames of doors, windows and louvers.

   e. Control and expansion joints in ceilings and other overhead surfaces. Joints between different materials.

   f. Other joints as indicated.

2. Exterior joints in the following horizontal traffic surfaces:

   a. Isolation and contraction joints in cast-in-place concrete slabs.

   b. Other joints as indicated.

3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

   a. Control and expansion joints on exposed interior surfaces of exterior walls.

   b. Perimeter joints of exterior openings where indicated.

   c. Tile control and expansion joints.

d. Vertical joints on exposed surfaces of concrete masonry unit walls and partitions.

e. Perimeter joints between interior wall surfaces and frames of interior doors and windows.

f. Joints between plumbing fixtures and adjoining walls, floors, and counters.

g. Other joints as indicated.

4. Interior joints in the following horizontal traffic surfaces:

a. Isolation joints in cast-in-place concrete slabs.

b. Control and expansion joints in tile flooring.

c. Other joints as indicated.

5. Related Sections include the following:

a. Division 4 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.

b. Division 7 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.

c. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.

d. Division 9 Section "Ceramic Tile" for sealing tile joints.

e. Division 9 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

1.03 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.04 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in General & Supplementary Conditions "Project Management and Coordination."

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).

2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.02 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.

2. Sealant Primers for Nonporous Substrates: 250 g/L.

3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.03 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Manufacturers

1. Dow Corning Corp.

2. GE Silicones

3. Mameco International Inc.

4. Pecora Corp.

5. Sika Corp

6. Tremco

E. Substitutions: Section 01330 – Submittal Procedure

F. Products Description

1. High Performance General Purpose Exterior (Nontraffic) Sealant Polyurethane; ASTM C920,

a. Grade NS, Class 25, Uses M, G, and A; multi-component.

b. Type: A manufactured by TREMCO or Equal

c. Color: Custom colors matching finished surfaces

d. Applications: Use for:

1) Control, expansion, and soft joints in masonry
2) Joints between concrete and other materials
3) Joints between metal frames and other materials
4) Other exterior nontraffic joints for which no other sealant is indicated.

5) General Purpose Traffic Bearing Sealant: Polyurethane; ASTM C920, Grade P, Class 25, Use

2. T; multi-component.

   a. Type: B manufactured by Tremco or equal

   b. Color: Standard colors matching fnished surfaces.

   c. Applications: Use for exterior and interior pedestrian and vehicular traffic bearing joints.

3. Exterior Compressible Gasket Expansion Joint Sealer: ASTM D2628, hollow neoprene (polychloroprene) compression gasket.

   a. Type: C manufactured by Tremco or equal

   b. Color: Color to match joint color

   c. Size and Shape: As indicated on Drawings

   d. Applications: Use for exterior wall expansion joints.

4. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, non-drying, non-skinning, non-curing.

   a. Type: D manufactured by Tremco or equal

   b. Applications: Use for concealed sealant bead in sheet metal work and concealed sealant bead in siding overlaps.

5. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C832, single component, paintable.

   a. Type: E manufactured by Tremco or equal

   b. Color: Standard colors matching finished surfaces as selected

   c. Applications: Use for interior wall and ceiling control joints, joints between door and window frames and wall surfaces, and other interior joints for which no other type of sealant is indicated.

6. Tile Sealant: Acid Etching Mildew resistant Silicone; ASTM C920, Uses M and A; single component, mildew resistant.

   a. Type: F manufactured by Tremco or equal

b. Applications: Use for joints between plumbing fixtures and floor and wall surfaces, and joints between kitchen and toilet rooms counter tops and wall surfaces.

7. Acoustical Sealant: Butyl or acrylic sealant; ASTM C920, Grade NS, Class 12-1/2, Uses M and A; single component, solvent release curing, non-skinning.

a. Type: H manufactured by Tremco or equal

b. Applications: Use for concealed locations only at acoustically rated construction

c. Provide sealant bead between top stud runner and structure and between bottom stud track and floor.

d. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.

e. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

2.04 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, C (closed-cell material with a surface skin) and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.05 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

   a. Concrete.

   b. Masonry.

   c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

   a. Metal.

   b. Glass.

   c. Porcelain enamel.

   d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

H. Installation of Preformed Tapes: Install according to manufacturer's written instructions.

I. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.

2.

3. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.

4. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.

5. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

3.04 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07920

SECTION 08111 - STANDARD STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Standard hollow-metal steel doors.
2. Standard hollow-metal steel frames.

B. Related Sections include the following:

1. Division 8 Section "Fire Rated Glass" for glazed lites in standard steel doors.
2. Division 8 Section "Door Hardware" for door hardware for standard steel doors.
3. Division 9 Section "Painting" for field painting standard steel doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and finishes for each type of steel door and frame specified.

B. Shop Drawings: In addition to requirements below, provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details.
3. Frame details for each frame type, including dimensioned profiles.
4. Details and locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, accessories, joints, and connections.
7. Details of glazing frames and stops showing glazing.
8. Details of conduit and preparations for electrified door hardware and controls.

C. Coordination Drawings: Drawings of each opening, including door and frame, drawn to scale and coordinating door hardware. Show elevations of each door design type, showing

dimensions, locations of door hardware, and preparations for power, signal, and electrified and pneumatic control systems.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).

F. Oversize Construction Certification: For standard steel door assemblies required to be fire rated and exceeding limitations of labeled assemblies; include statement that doors comply with requirements of design, materials, and construction but have not been subjected to fire test.

G. Qualification Data: For Installer and testing agency.

H. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.

D. Fire-Rated Door Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.

1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.
2. Test Pressure: Test according to NFPA 252. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches (1000 mm) or less above the sill.
3. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-protection-rated door assemblies except for size.
4. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber.

1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating standard steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Curries Company; an ASSA ABLOY Group Company.
2. Steelcraft; an Ingersoll-Rand Company.
3. Ceco Door Products; an ASSA ABLOY Group Company.
4. Door Components, Inc.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) zinc-iron-alloy (galvannealed) coating designation.

D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized.

E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153, Class C.

F. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153, Class C.

G. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching standard steel door frames of type indicated.

H. Glazing: Comply with requirements in Division 8 Section "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD STEEL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.

1. Design: Flush panel
2. Core Construction: Manufacturer's standard honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.

   a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

      1) Locations: Interior doors where indicated.

3. Vertical Edges for Single-Acting Doors: Beveled edge.

   a. Beveled Edge: 1/8 inch in 2 inches.

4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.

5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick end closures or channels of same material as face sheets.
6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior door requirements. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

D. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:

1. Hinges: For exterior hollow metal doors, provide minimum 7 gauge hardware reinforcing.

2. For mortise or surface applied hardware as follows: Hinge = ten (10) gauge or equivalent number of threads on doors.

3. Hinge = seven (7) gauge on frames.

4. Lock = twelve (12) gauge or equivalent number of threads.

5. Panic Devices = twelve (12) gauge.

6. Surface Closer = twelve (12) gauge.

7. Hold Open Arm = twelve (12) gauge.

8. Floor Closer = seven (7) gauge.

9. Pivots = seven (7) gauge.

10. All Other Surface-Mounted Hardware: Minimum seven (7) gauge.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD STEEL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
2. Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.

1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
2. Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.

D. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:

1. Hinges: Minimum 7 gauge, secured by not less than 6 spot welds.
2. Pivots: Minimum 12 gauge, secured by not less than 6 spot welds.
3. Lock Face Flush Bolts, Closers, and Concealed Holders: Minimum 12 gauge.
4. All Other Surface-Mounted Hardware: Minimum 12 gauge.

E. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

F. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

G. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

H. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

I. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- wide steel.

J. Plaster Guards: Formed from same material as frames, not less than 0.016-inch thick.

2.5 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch high, unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

1. Provide terminated stops unless otherwise indicated.

2.6 METAL LOUVERS FOR DOORS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Louvers, Inc.
2. Anemostat Door Products.
3. Gulfport Industries, Inc.
4. Hiawatha, Inc.
5. Leslie-Locke, Inc.

B. Louvers within doors and/or louvers within walls, especially at transformer rooms, should be installed with filters.

2.7 FABRICATION

A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Standard Steel Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.

C. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Transom Bar Frames: Provide closed tubular members with no visible face seams or joints; fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
4. Plaster Guards: Weld guards to frame at back of hardware mortises in frames installed in concrete or masonry.
5. Where installed in masonry, leave vertical mullions in frames open at top for grouting.
6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
7. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

1) Three anchors per jamb up to 60 inches in height.
2) Four anchors per jamb from 60 to 90 inches in height.
3) Five anchors per jamb from 90 to 96 inches in height.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof more than 96 inches in height.
5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

8. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.

   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."

1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted door hardware.
2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings such that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of doors and frames.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.8 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish standard steel door and frames after assembly.

B. Metallic-Coated Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

E. Factory-Applied Paint Finish: Manufacturer's standard, complying with ANSI A250.3 for performance and acceptance criteria.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel doors and frames.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory.

B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Standard Steel Frames: Install standard steel frames for doors, transoms and other openings, of size and profile indicated. Comply with SDI 105.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

   a. At fire-protection-rated openings, install frames according to NFPA 80.
   b. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   c. Install frames with removable glazing stops located on secure side of opening.
   d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   e. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.

   a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
4. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
5. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Standard Steel Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: 1/8" to maximum 1/4 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with standard steel door and frame manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c., and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.

B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

D. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08111

SECTION 08120 - INTERIOR ALUMINUM DOORS, DOOR FRAMES, AND GLAZING FRAMES

PART 1 GENERAL

1.1 Summary

A. Section includes:

1. Pre-finished aluminum door frames for interior use.
2. Pre-finished aluminum window frames for interior use.
3. Pre-finished aluminum framing systems for interior use.
4. Pre-finished aluminum and glass doors for interior use.

B. Related sections:

1. Section 08211 – Flush Wood Doors.
2. Section 08410 – Aluminum Entrances and Storefronts.
3. Section 08520 – Aluminum Windows.
4. Section 08710 – Door Hardware.
5. Section 08800 – Glass and Glazing.

1.2 Submittals

A. Submit under provisions of Section 01330.
B. Product data: Manufacturer's fabrication and installation instructions.
   1. Include information on factory finish, glazing gaskets, accessories and other required components.
C. Shop drawings: Submit schedule indicating opening numbers, frame types, dimensions, swings and hardware requirements.
D. Include elevations and details indicating frame types, profiles, conditions at openings, methods and locations of anchoring, glazing requirements, hardware locations and reinforcements for hardware.
E. Samples: Submit the following:
   1. Full range of manufacturer's standard finishes for the Architect's selection.
   2. Where normal color variations are expected, include additional samples to show range of such variation.
F. Instructions: Provide copies of manufacturer's data for fabrication and installation of aluminum door frames.

1.3 Quality Assurance

A. Single Source Responsibility: Provide aluminum frames, aluminum and glass doors and accessories produced by a single manufacturer for each type of product indicated.
B. Manufacturer's qualifications: Company specializing in the manufacturing of door frame systems with a minimum of 10 years of documented experience on a comparable sized project.

1.4 Delivery, Storage and Handling

A. Deliver frames and doors cartoned to provide protection during transit and storage at project site.
B. Inspect frames and doors upon delivery for damage.

1. Repair minor damage to pre-finished products by means as recommended by the manufacturer.
2. Replace frames that cannot be satisfactorily repaired.

C. Store frames at the project site under cover and as near as possible to the final installation location. Do not use covering material that will cause discoloration of aluminum finish.

1.5 Environmental Requirements

A. Do not begin installation of the frames or doors until the area of work has been completely enclosed and the interior is protected from the elements.
B. Maintain temperature and humidity in areas of installation within reasonable limits, as close as possible to final occupancy. If necessary, provide temperature control and ventilation to maintain required environmental conditions.

1.6 Warranty

A. Warrant against defects in manufacturing of materials for a period of 2 years from date of substantial completion.
B. Warrant framing finish against defects, including cracking, flaking, blistering, peeling and excessive fading, chalking and non-uniformity in color for a period of 5 years.

PART 2 PRODUCTS

2.1 Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

A. Provide products manufactured by, or approved equal:

1. Wilson Partitions
   2301 E. Vernon Ave.
   Vernon, CA 90058
   (866) 443-7258
   (323) 908-5451 Fax.
   www.wilsonpart.com

B. Substitutions: Comply with provisions of Section 01600 for substitution requests.

2.2 Materials

A. Aluminum: Controlled alloy billets meeting requirements of ASTM B221, 6063 T5 alloy, to assure compliance with tight dimensional tolerances and maintain color uniformity.

2.3 Extruded Aluminum Window Frames

A. Flat Profile: Provide frames with the following characteristics:
1. Rectilinear design.

2. 1-1/2" typical face profile.
3. 4 ¼" typical width.
4. See drawings for glazing type and thickness.

2.4 Extruded Aluminum Door Frames

A. Flat Profile: Provide frames with the following characteristics:

1. Rectilinear design.
2. 1-1/2" wide typical face profile.
3. Throat width for door units to match partition width. See plans for various door widths.
4. See drawings for glazing type and thickness.

2.5 Fabrication

A. Pre-machine jambs and prepare for hardware, with concealed reinforcement plates, drilled and tapped as required, and fastened within the frame.
B. Provide corner reinforcements and alignment clips for precise butt or mitered connections.
C. Fabricate all components to allow secure installation without exposed fasteners.
D. Manufacturer shall pre-cut and ship all frame materials knock-down.

2.6 Finishes

A. Factory finish extruded frame components so that any part exposed to view upon completion of installation will be uniform in finish and color.
B. Clear Anodic Coating (AC-2): Comply with AAMA 611.

1. Commercial, AAM12C22A21 anodized coating, less than .04 mil minimum thick.

~~C. Light Champagne Anodic Coating (AB-1), Champagne Anodic Coating (AB-2), Light Bronze~~

~~D. Anodic Coating (AB-3), Medium Bronze Anodic Coating (AB-4), Standard Medium Bronze~~

~~E. Anodic Coating (AB-5), Dark Bronze Anodic Coating (AB-6), Standard Dark Bronze Anodic~~

~~F. Coating (AB-7), Black Anodic Coating (AB-8): Comply with AAMA 611.~~

~~1. Class II, AAM12C22A34 anodized coating, 0.4 mil minimum thick.~~

~~G. Flurocryl Coating: Comply with AAMA (2603) 603.8 and AA-DAF-45.~~

~~1. Factory applied painted finish.~~
~~2. Color coat: Dry film thickness 0.8 +/- 0.05 mil.~~
~~3. Color: As selected by Architect.~~
~~4. Manufacturer's standard Tan, White, Gray, Bronze or Black.~~
~~5. Custom color to match Architect's sample.~~

PART 3 EXECUTION

3.1 Examination

A. Examine project conditions and verify that the work of this section may properly commence. Do not proceed with the installation until unsatisfactory conditions have been corrected.
B. Verify that the wall thickness does not exceed manufacturer's recommended tolerances of specified frame throat size.

3.2 Installation

A. Comply with frame manufacturer's printed installation instructions and approved shop drawings. Strictly adhere to maintaining specified wall thickness to insure dimension does not exceed frame throat size specified. Installation not to be attempted in areas where the wall thickness exceeds the tolerance of the specified throat size.
B. Install frames plumb and square, securely anchored to substrates with fasteners recommended by frame manufacturer.

1. Use concealed installation clips to assure that splices and connections are tightly butted and properly aligned.
2. Secure clips to main structural extrusion components and not to snap-in or trim members.
3. Do not use screws or other fasteners that will be exposed to view when installation is complete.

3.3 Adjusting and Cleaning

A. Clean exposed frames promptly after installation, using cleaning methods recommended by frame manufacturer.
B. Touch up marred areas so that touch-up is not visible from a distance of 4 feet. Remove and replace frames that cannot be satisfactorily adjusted.

3.4 Protection

A. Provide protection required to assure that frames will be without damage or deterioration upon substantial completion of the project.

END OF SECTION 08120

SECTION 08211 - WOOD DOORS

PART 1 - GENERAL

1.1 Wood Doors, Non-rated and Fire-rated

A. Flush

B. Factory Glazed

1.2 Related Sections

A. Section 06402 - Architectural Woodwork

B. Section 08110 – Standard Steel Doors and Frames

C. Section 08710 - Finish hardware

1.3 References and Regulatory Requirements

A. UBC 7-2 (97) Positive Pressure Fire Door Standards

B. ASTM E152-81a - Standard Methods of Fire Tests of Door Assemblies.

C. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 1995 Edition.

D. UL 10B - Fire Tests of Door Assemblies, 9th Edition.

E. UBC 43-2 - Fire Tests of Door Assemblies.

F. NFPA 80 - Fire Doors and Windows.

G. Quality Standards:

1. WDMA Industry Standard I.S. 1-A-97 (Window & Door Manufacturers Association).
2. AWI Quality Standards 8th Edition, Version 1.0 2003.
3. ANSI A115. W Series, Wood Door Hardware Standards. (American National Standard Institute)
4. WI - Wood Work Institute (1998)

H. Labeling Agencies

1. Intertek Testing Services-Warnock Hersey (ITS-WH)
2. Underwriters Laboratories, Inc. (UL)

1.4 Door Description

A. Interior Doors (Non-rated)

1. DPC-1, 5 Ply Particleboard Core Door , 1-3/4" (44mm)

B. Interior Doors (Rated)

1. DFP-20, 20 Minute 5 Ply Particle Board Core Door , 1-3/4 (44mm) rated by UL
2. DFM-60, 60 Minute Mineral Core Door , 1-3/4 (44mm) rated by UL
3. DFM-90, 90 Minute Mineral Core Door , 1-3/4 (44mm) rated by UL

1.5 Submittals

A. Submit under provisions of General Conditions.

B. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts, special beveling, blocking for hardware in mineral core doors, identify cutouts.

C. Product Data: Indicate door core materials, thickness, construction, veneer species, cut and matching requirements, factory machining and factory finishing criteria.

D. Construction Samples: Submit one or more of manufacturer's standard samples demonstrating door construction.

E. Finish Samples: A set of 3 illustrating the range of color and grain of the specified door face materials.

F. Manufacturer's Full Lifetime Warranty

1.6 Quality Assurance

A. Meet or exceed WDMA I.S.1-A Premium Grade and/or AWI Version 7 Custom Grade.

1.7 Delivery, Storage, Handling, and Site Conditions

A. Deliver, store, protect and handle products under provisions of WDMA, AWI and manufacturer's instructions.

B. Accept doors on site in manufacturer's standard packaging. Inspect for damage upon receipt.

C. Do not store in damp or wet areas or in areas where light might cause oxidization.

D. HVAC systems should be operating and balanced prior to arrival of doors. Acceptable humidity shall be no less than 25% nor greater than 55%.

E. Break seal on packages while at site to permit ventilation.

1.8 Coordination

A. Coordinate work under provisions of Section 01700.

B. Coordinate the work with door opening construction, door frame and door hardware installation with a pre-installation conference.

1.9 Warranty

A. Provide manufacturer's warranty to the following term:

1. Interior Solid Core Doors: "Full Life of Original Installation" including rehang and refinish if door(s) do not comply with Warranty tolerance standards.

PART 2 - PRODUCTS

2.1 Manufacturer

A. Marshfield DoorSystems, Inc, Marshfield Signature Series Doors quality as defined in this section, or approved equal.

2.2 Workmanship

A. Comply with WDMA/AWI workmanship for veneer faces, vertical edges, crossbands, horizontal edges and dimensional tolerances.

2.3 Materials

A. DOOR CONSTRUCTION GRADE

1. Except as may be otherwise shown on the drawings, fabricate the work of this section to WDMA "Custom Grade/" AWI "Custom Grade".

B. FLUSH DOOR FACING, SLICE OR CUT, MATCHING, AND FINISH

1. Wood Veneer: AWI - A Grade: The veneer species, slice or cut, finish and matching shall be:
   a. Species: White birch
   b. Face Cut: rotary cut.
   c. Finish: Paint.

C. GLAZING OF FLUSH WOOD DOORS

1. Glazing shall be by the wood door manufacturer

D. DOORS IN PAIRS OR SETS

1. Specify per project requirements. Door schedule shall reflect pairs and sets by door numbers.

2. The veneer, slice or cut, finish and veneer matching shall match. Matching between paired doors shall be selected for compatibility of color.

2.4 Fabrication

A. DOOR AND TRANSOM PANEL CORE CONSTRUCTION

1. Non-rated: ANSI A208. 1-LD-2 Particleboard.
2. 20 minute Fire-Rated: ANSI A208. 1 LD-2, Particleboard.
3. 45, 60 or 90 minute Fire-Rated: Mineral Core.
4. Bond stiles and rails to core, abrasive sand core assembly to achieve uniform thickness.

B. VERTICAL EDGES (STILES)

1. Non-rated
   a. Edges to match face veneer. (May include veneer banding and structural composite lumber backers or innerplies).

2. 20 Minute Rated
   a. Fire treated stiles, edges to match face veneer. (May include veneer banding and structural composite lumber backers or innerplies).

3. 20 Minute Rated Pairs
   a. Fire treated stiles, edges to match face veneer. (No metal edges or astragal required) (May include veneer banding and structural composite lumber backers or innerplies).

4. 45, 60, 90 Minute Rated Pairs
   a. Mineral core door stiles to be veneer banded to match faces veneer over manufacturer's edge for improved screw holding. (Metal edges required).

5. Mineral Core
   a. Mineral core door stiles to be veneer banded to match faces veneer over manufacturer's edge for improved screw holding.

C. HORIZONTAL EDGES (RAILS)

1. Mill option structural composite lumber or hardwood lumber.

D. ADHESIVES

1. Facing Adhesive: Type 1 - Waterproof.

E. INNERBLOCKING FOR MINERAL CORE FIRE DOORS

1. Supply innerblocking for all surface applied hardware - Through bolts not accepted.

F. MACHINING FOR RATED DOORS

1. Factory fit and machine doors for frame and finish hardware in accordance with

hardware and NFPA 80 requirements and dimensions. Do not machine for surface hardware. Apply appropriate fire labels.

2.5 Accessories

A. LOUVERS

1. Louvers to be furnished by the door manufacturer, species and finish to match door.
2. Wood louver blades to be flat.

B. GLAZING STOPS

1. Non-Rated:
   a. Wood, of the same species/compatible with door species, with mitered corners.
   b. Metal Vision Frames.

2. Fire-Rated:
   a. Flush, wood veneer clad PVC, of same species as door facing.

B. GLASS & GLAZING IN WOOD DOORS

1.Glass and glazing provided by the wood door manufacturer

2.6 Factory Finish

A. Factory finish doors in accordance with WDMA G-17 Finish System Description or AWI Division 1500-S-4 - Finish System Standards. Factory finish to be water based stain and ultraviolet (UV) cured polyurethane sealer to comply with EPA Title 5 guidelines for Volatile Organic Compounds (VOC) emissions limitations. Finish must meet or exceed performance standards of TR-6 catalyzed polyurethane. Color shall be Marshfield DoorSystems, Inc. Enviroclad UV TM Designer or custom color as specified in section 2.3.B.

B. Custom factory finish doors in accordance with approved sample.

C. Factory finished doors to be installed just prior to substantial completion.

PART 3 - EXECUTION

3.1 Examination

A. Verify substrate opening conditions.

B. Verify that opening sizes and tolerances are acceptable and ready to receive this work.

C. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

3.2 Installation

A. Install fire-rated and non-rated doors in accordance with NFPA 80, manufacturers' instructions and fire rated labeling requirements.

B. Trim non-rated door width by cutting equally on both jamb edges.

C. Trim door height by cutting bottom edges to a maximum 3/4 inch (19 mm).

D. Trim fire door height at bottom edge only, in accordance with fire rating requirements.

E. Pilot drill screw and bolt holes using templates provided by hardware manufacturer. (Use threaded through bolts for half surface hinges).

F. Coordinate installation of doors with installation of frames and hardware

G. Install door louvers and light kits plumb and level.

H. Reseal or refinish any doors that required site alteration.

3.3 Warranty Tolerances

A. Conform to WDMA standards and testing methods for warp, cup, bow and telegraphing.

3.4 Adjusting

A. Adjust work under provisions Division 1.

B. Adjust doors for smooth and balanced door movement.

3.5 Door and Frame Components Schedules

A. Refer to Door and Frame Schedule on Drawings.

END OF SECTION 08211

SECTION 08311 - ACCESS PANELS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Steel access panels, except those specified under Divisions 15 or 16.

C. Related Sections:

1. Section 09260: Gypsum Board.
2. Section 09310: Tile.
3. Division 15: Mechanical
4. Division 16: Electrical

1.02 SUBMITTALS

A. Shop Drawings:

1. Indicate sizes, materials, thickness, fabrication methods, panel door and frame reinforcement, anchorage, and installation details.
2. Provide layout drawings, indicating dimensioned locations of proposed access panels, size of each panel, and installation details. Determine and indicate required access panels in finished surfaces, whether furnished under this section or as part of the Work of Divisions 15 and 16.

1.03 QUALITY ASSURANCE

A. Panels shall be provided with UL listings and labels.

B. Access panels and frames shall be products of one manufacturer.

1.04 DELIVERY, STORAGE AND HANDLING

A. Panels and Frames: Provide protection as required by manufacturer to protect panels from damage during shipping and storage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Access Panels:

Non-Rated	Milcor	Karp	Nystrom
Ceramic Tile	MS	DSC214M	APTM
Plaster	K	DSC214M	APPW
Drywall, Plaster Veneer	DW	DSC214M	APWB
Rated B-Label			
Ceramic Tile	MS	KRP150FR	APFR
Plaster	M	KRP150PR	APFR-WP
Drywall, Plaster Veneer	M	KRP150FR	APFR-WP

B. Unless otherwise indicated, provide brushed stainless steel finish for panels installed in ceramic tile. Provide prime coat finish suitable for field painting for panels installed in other finishes.

PART 3 - EXECUTION

3.01 GENERAL

A. Provide access panels in finish construction where indicated on the Drawings, wherever required for access to concealed mechanical and electrical equipment, and where required by codes. Panels indicated on architectural Drawings shall be furnished under this section. Required panels for access to equipment, but not indicated on architectural Drawings, shall be furnished as part of the Work requiring the access.

3.02 INSTALLATION

A. Install panels accurately in location, perfect alignment, plumb, straight and true. Brace to prevent displacement by adjacent Work.

B. Examine panels after installation for proper opening, closing and clearances. Replace damaged or defective panels.

3.03 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION 08311

SECTION 08334 - OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Electric-motor-operated overhead coiling grilles.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for miscellaneous steel supports.
2. Division 7 Section "Joint Sealants" for weatherproof joints at hoods.
3. Division 9 Section "Painting" for field-applied paint finish.
4. Division 16 Sections for electrical service and connections for powered operators, and accessories.

1.3 DEFINITIONS

A. Operation Cycle: One cycle of a door is complete when it is moved from the closed position to the fully open position and returned to the closed position.

1.4 PERFORMANCE REQUIREMENTS

A. Operation-Cycle Requirements: Provide overhead coiling grille components and operators capable of operating for not less than 20,000 cycles and for 10 cycles per day.

1.5 SUBMITTALS

A. Product Data: For each type and size of overhead coiling grille and accessory.

1. Summary of forces and loads on walls and jambs.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.

C. Samples for Initial Selection: Manufacturer's color charts showing full range of colors available for units with factory-applied finishes.

D. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below.

1. Grille Curtain: 12-inch- square assembly with rods, spacers, and vertical links.
2. Guides: 6 inches long.

E. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling grilles through one source from a single manufacturer.

1. Obtain operators and controls from overhead coiling grille manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

D. Warranty

1. Provide minimum warranty for a period of 2 years from the time of Substantial Completion against defects in workmanship and materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Basis-of-Design: Cookson Company

a. Type FMG - Motor (Gearhead - Vertical) Operated Rolling Grille
b. Aluminum Clear Anodized
c. Face of Wall Mounted
d. Standard Pattern 5014-M92
e. Phantom Featheredge (Cordless)

2. Approved Equal

2.2 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

A. The grille curtain shall be constructed of solid 5/16" diameter horizontal aluminum rods on 2" centers with 1/8" aluminum hinged vertical connecting links (5/8" deep by 3-3/4" high) 9" on center. The finish on the rods and links shall be 204-R1 clear anodized.

B. The bottom bar shall consist of an extruded aluminum tube measuring 4" high by 1-3/4" deep and shall include a cordless safety edge system. The finish on the bottom bar shall be 204-R1 clear anodized.

C. The guides shall be constructed of a 1/4" thick continuous aluminum wall angle connected to 1-1/2" by 2-1/2" by 1/8" thick continuous extruded aluminum guide section. Continuous nylon wearstrips shall be inserted on both sides of the guide to eliminate metal-to-metal contact. The aluminum all angle and the aluminum guide shall be 204-R1 clear anodized finish.

D. The brackets shall be constructed of steel not less than 1/4" thick. The finish on the brackets shall be one (1) coat of aluminum prime paint.

E. The barrel shall be steel tubing of not less than 6" in diameter. Oil tempered torsion springs shall be capable of correctly counter balancing the weight of the curtain. The barrel shall be designed to limit the maximum deflection to .03" per foot of opening width. The springs shall be adjusted by means of an exterior wheel. The finish on the barrel shall be one (1) coat of bronze rust-inhibiting paint.

F. The hood shall be fabricated from .040 aluminum sheet and shall be formed to fit the curvature of the brackets. The finish on the hood shall be 204-R1 clear anodized.

2.3 OPERATION

A. The grille shall be operated at a speed of 2/3 foot per second by an open drip-proof electric motor with gear reducer in oil bath. The motor operator shall include a geared limit switch, and an electrically interlocked emergency chain operator. The motor starter shall be housed in a NEMA 1 housing and include a magnetic reversing starter size 0, a 24 volt control transformer, and complete terminal strip to facilitate field wiring. The motor operator shall be activated by key-operated 3 position station in a NEMA 1 enclosure. The motor shall be size as required by the grille 460 volts three phase. The motor operator shall be mounted to the grille bracket as shown on drawings. All be mounted to the grille bracket as shown on drawings. All motor operators shall be U.L. listed.

B. The grille shall have installed on the bottom bar the manufacturer's automatic safety control device that will automatically reverse the door if the device detects an obstruction in the downward travel of the door.

1. The automatic safety control device shall consist of a rubber boot attached below the bottom bar with a switch secured to the back of the bottom bar. The automatic safety control device shall operate with air wave technology and shall not rely on pneumatic pressure or electrical contacts to operate. The automatic safety control device shall create an air wave that shall be detected by the switch which reverses the downward direction of the rolling door.

2. The automatic safety control device shall not require a connection cord or any means of electrical connection to the motor control panel.

3. The automatic safety control device shall be of fail-safe construction, and on every cycle shall perform a self diagnostic test. If any part of the automatic safety control device fails, the door closing operation shall change from momentary pressure to constant pressure requiring constant pressure on the close control station to move the door in a downward motion. Repairing the automatic safety control device will automatically return the closing operation to momentary pressure.

4. The operation of the automatic safety control device shall not be subject to interferences by temperature, barometric pressure, water infiltration, or punctures and small tears.

5. The automatic safety control device shall perform with an extremely small amount of impact pressure.

2.4 LOCKING MECHANISMS

A. A. Motor operated grilles shall be secured by means of a cylinder lock in the bottom bar, electrically interlocked to prevent the motor from operating when the grille is locked.

2.5 FINISHES, GENERAL

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Manufacturer's standard mill finish.

C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install grilles and operating equipment, complete with necessary hardware, according to Shop Drawings, manufacturer's written instructions, and as specified.

3.2 ADJUSTING

A. Lubricate bearings and sliding parts; adjust grilles to operate easily, free of warp, twist, or distortion and with tight fit around entire perimeter.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling grilles. Refer to Division 1 Sections "Closeout Procedures and Demonstration and Training."

END OF SECTION 08334

SECTION 08411 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior and interior aluminum-framed storefronts.

   a. Glazing is retained mechanically with gaskets on four sides.

2. Exterior and interior manual-swing aluminum doors.

3. Exterior and interior aluminum door frames.

B. Related Sections include the following:

1. Division 7 Section "Building Insulation" for insulation materials field installed with aluminum-framed systems.
2. Division 7 Section "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
3. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
4. Division 8 Section "Glazing" for glazing requirements to the extent not specified in this Section.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
   a. Wind Design Criteria:
      1) Basic Wind Speed = 70 mph, Exposure 'C'.
   b. Seismic Design Criteria:
      1) Ca = 0.4
      2) Cv = 0.56
      3) Zone 4
      4) Soil Type Sc
2. Thermal movements.

3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
4. Dimensional tolerances of building frame and other adjacent construction.
5. Failure includes the following:

    a. Deflection exceeding specified limits.
    b. Thermal stresses transferred to building structure.
    c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
    d. Glazing-to-glazing contact.
    e. Noise or vibration created by wind and thermal and structural movements.
    f. Loosening or weakening of fasteners, attachments, and other components.
    g. Sealant failure.
    h. Failure of operating units to function properly.

B. Structural Loads:

1. Wind Loads: 70 mph at Exposure C, and as measured in accordance with ASTM E330.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. Test Durations: As required by design wind velocity but not less than 10 seconds.

E. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft..

G. Water Penetration Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

H. Water Penetration Under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

1. Maximum Water Leakage: No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation.

I. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.

J. Average Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

K. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having minimum STC 32 according to ASTM E 413 and an OITC 26 according to ASTM E 1332, as determined by testing according to ASTM E 90.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
3. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of systems, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

F. Welding certificates.

G. Qualification Data: For Installer.

H. Preconstruction Sealant Test Reports: For structural-sealant-glazed systems, compatibility and adhesion test reports from sealant manufacturer indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with

sealants. Include sealant manufacturer's interpretation of test results for sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.

J. Structural-Sealant-Glazing Quality-Control Program: Developed specifically for Project.

K. Field quality-control test and inspection reports.

L. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

M. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.

1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

a. Include structural-sealant-glazing quality-control program development and reporting complying with ASTM C 1401 recommendations including, but not limited to, system material qualification procedures, preconstruction sealant-testing program, and procedures and intervals for system fabrication and installation reviews and checks.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 699 for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Preconstruction Sealant Testing: For structural-sealant-glazed systems, perform sealant manufacturer's standard tests for compatibility and adhesion of sealants with each material that will come in contact with sealants and each condition required by aluminum-framed systems.

1. Test a minimum of five samples of each metal, glazing, and other material.
2. Prepare samples using techniques and primers required for installed systems.

3. For materials that fail tests, determine corrective measures required to prepare each material to ensure compatibility with and adhesion of sealants, including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

E. Accessible Entrances: Comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)", and "Title 24, California Building Code".

F. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Adhesive or cohesive sealant failures.
e. Water leakage through fixed glazing and framing areas.
f. Failure of operating components to function properly.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arcadia, Inc.

2. Other acceptable manufacturers offering equivalent products:
   a. Arch Aluminum & Glass Co., Inc.
   b. CMI Architectural Products, Inc.
   c. Commercial Architectural Products, Inc.
   d. EFCO Corporation.
   e. Kawneer.
   f. Pittco Architectural Metals, Inc.
   g. Tubelite Inc.
   h. United States Aluminum.
   i. Vistawall Architectural Products.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

E. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

F. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type and as follows:

1. Structural Sealant: ASTM C 1184, neutral-curing silicone formulation compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant, and approved by structural-sealant manufacturer for use in aluminum-framed systems indicated.

   a. Color: Black.

2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other system components with which it comes in contact; and recommended by structural and weatherseal sealant and aluminum-framed system manufacturers for this use.

   a. Color: Matching structural sealant.

2.5 DOORS

A. Doors: Manufacturer's standard glazed doors, for manual swing operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.

2. Door Design: As indicated on Drawings:
   a. Narrow stile; 2-1/8-inch nominal width
   b. Medium stile; 3-1/2-inch nominal width
   c. Wide stile; 5-inch nominal width.

   d. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

   a. Provide nonremovable glazing stops on outside of door.

B. Door Hardware: As specified in Division 8 Section "Door Hardware."

2.6 DOOR HARDWARE

A. General: Provide heavy-duty units in sizes and types recommended by entrance system and hardware manufacturers for entrances and uses indicated.

1. Opening-Force Requirements:

   a. Egress Doors: Not more than 5.0 pounds pressure.
   b. Accessible Interior Doors: Not more than 5.0 pounds pressure.

B. Scheduled Door Hardware: Provide door hardware according to the Door Hardware Schedule at the end of Part 3.

1. Named Manufacturer's Products: Product designation and hardware manufacturer are listed in the Door Hardware Schedule at the end of Part 3 to establish minimum requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware.

   a. Provide named hardware manufacturer's products.
   b. Named products are basis-of-design products. Provide named hardware manufacturer's products or comparable products that are equivalent in function and quality and that are recommended and supplied by entrance system manufacturer.

2. References to BHMA Standards: Provide products complying with standards referenced in this Article and with requirements for description, quality, type, and function listed in the Door Hardware Schedule at the end of Part 3.

C. Pivot Hinges:

1. Standard: BHMA A156.4, Grade 1.
2. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

D. Ball-Bearing Butts:

1. Standard: BHMA A156.1, Grade 1, radius corner.
2. Provide nonremovable pins at hinges exposed to outside of door.
3. Provide nonferrous hinges where hinges are exposed to weather.
4. Quantities:

   a. For doors with heights up to 87 inches, provide 3 hinges per leaf.
   b. For doors with heights of greater than 87 and up to 120 inches, provide 4 hinges per leaf.

E. Balanced-Door Hinge Assembly: Manufacturer's standard mechanism with balancing guide roller and top- and bottom-sealed, self-aligning, antifriction bearings, arms, and pivots.

F. Locking Devices, General: Do not require use of key, tool, or special knowledge for operation.

G. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

H. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.

I. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

1. Standard: BHMA A156.3, Grade 1.

J. Cylinders: As specified in Division 8 Section "Door Hardware."

K. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

L. Operating Trim: BHMA A156.6.

M. Removable Mullions:

1. Standard: BHMA A156.3.
2. When used with panic exit devices, provide removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.

N. Closers: With accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use, and adjustable to meet field conditions and requirements for opening force.

1. Standard: BHMA A156.4, Grade 1.

O. Concealed Overhead Holders: BHMA A156.8, Grade 1.

P. Surface-Mounted Holders: BHMA A156.16, Grade 1.

Q. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

R. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
2. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

S. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

T. Silencers: BHMA A156.16, Grade 1.

U. Thresholds: Raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (13 mm).

1. Standard: BHMA A156.21.

V. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

2.7 ACCESSORY MATERIALS

A. Insulating Materials: As specified in Division 7 Section "Building Insulation."

B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

A. Form aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.

3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or panels.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).

E. Storefront Framing: Fabricate components for assembly using head-and-sill-receptor system with shear blocks at intermediate horizontal members.

F. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Doors: Reinforce doors as required for installing hardware.

1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

1. Refer to Drawings for specific finishes.

C. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

1. Color: As selected by Architect from full range of industry colors and color densities.

D. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mils, medium gloss.

a. Color: As selected by Architect from manufacturer's full range.

2.10 SOURCE QUALITY CONTROL

A. Structural-Sealant-Glazed Systems: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, system material qualification procedures, sealant testing, and system fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

F. Install glazing as specified in Division 8 Section "Glazing."

G. Entrances: Install to produce smooth operation and tight fit at contact points.

1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install insulation materials as specified in Division 7 Section "Building Insulation."

I. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

J. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:

   a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
   b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under Part 1 "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft..
2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform static-air-pressure difference of 0.67 times the static-air-pressure difference

specified for laboratory testing under Part 1 "Performance Requirements" Article, but not less than 4.18 lbf/sq. ft. and shall not evidence water penetration.

3. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 ADJUSTING

A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.

1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.

END OF SECTION 08411

SECTION 08450 - ALL-GLASS ENTRANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior and exterior all-glass entrance systems.

B. Related Sections include the following:

1. Division 7 Section "Joint Sealants" for joint sealants installed at interface of all-glass systems and other building components.
2. Division 8 Section "Aluminum Entrances and Storefronts" for storefront systems that incorporate all-glass entrances.
3. Division 8 Section "Door Hardware" for lock cylinders installed in all-glass entrance locksets.
4. Division 8 Section "Glazed Aluminum Curtain Walls" for curtain-wall systems that incorporate all-glass entrances.

1.3 PERFORMANCE REQUIREMENTS

A. Provide systems, including anchorage, capable of withstanding loads indicated without structural failure, deflection exceeding specified limit, support components transferring stresses to glazing, and glazing-to-glazing or glazing-to-support contact as determined by structural analysis.

1. Deflection Normal to Glazing Plane: Limited to 1/175 of clear span or 3/4 inch, whichever is smaller.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details, including the following:

1. Plans, elevations, and sections.
2. Details of fittings and glazing.
3. Hardware quantities, locations, and installation requirements.

4. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Finishes: 6-inch- long sections of patch fittings, rails, and other items.
2. Glass: 6 inches square, showing exposed-edge finish.

D. Qualification Data: For professional engineer.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with all-glass systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating all-glass systems without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of all-glass systems that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures.
2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
3. Failure of operating components to function normally.

B. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ACI Distribution.
2. Arch Aluminum & Glass Co., Inc.
3. Blumcraft of Pittsburgh.
4. Guardian Industries Corp./Float Glass Division.
5. Virginia Glass Products Corp.
6. Vistawall

2.2 MATERIALS

A. Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), tested for surface and edge compression per ASTM C 1048 and for impact strength per 16 CFR 1201 for Category II materials.

1. Class 1: Clear, (fully tempered).

   a. Thickness: 1/2 inch.
   b. Locations: As indicated.

2. Exposed Edges: Flat polished.
3. Butt Edges: Flat ground.
4. Corner Edges: Mitered.

B. Aluminum: ASTM B 221, with strength and durability characteristics of not less than alloy 6063-T5.

1. Stainless-Steel Cladding: ASTM A 666, Type 302 or 304.

2.3 COMPONENTS

A. Patch Fittings: Stainless-steel-clad aluminum.

B. Floating Transom Bar: Steel, clad in metal matching fittings, and in size recommended by manufacturer for application indicated. Include stainless-steel support rods, lateral adjustment, and ceiling channel.

C. Sidelight Channels: Match fitting-metal finish, unless otherwise indicated.

D. Rails:

1. Material: Stainless-steel-clad aluminum.
2. Height: 3-1/2 inches.
3. Style: Flat top, square profile.
4. Locations: As indicated.

E. Accessory Fittings: Match patch fitting and rail metal and finish for the following:

1. Overhead doorstop.
2. Center-housing lock.
3. Glass-support-fin brackets.

F. Anchors and Fastenings: Concealed.

G. Weather Stripping: Sweep type.

2.4 HARDWARE

A. General: Heavy-duty hardware units in sizes, quantities, and types recommended by manufacturer for all-glass entrances indicated. For exposed parts, match fitting metal and finish.

B. Concealed Floor Closers and Top Pivots: Center hung; BHMA A156.4, Grade 1; including cases, bottom arms, top walking beam pivots, plates, and accessories required for complete installation.

1. Swing: Per plans.

a. Positive Dead Stop: Coordinated with hold-open angle, if any, or at angle selected.

2. Hold Open: Automatic, at angle selected.
3. Delayed-Action Closing: Comply with requirements of DSA, authorities having jurisdiction, "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)," whichever are more stringent.
4. Maximum Opening Force:

a. Exterior Doors: 5 lbf.
b. Interior Doors: 5 lbf.

C. Concealed Overhead Holder: BHMA A156.8, Grade 1, with dead-stop setting coordinated with concealed floor closer.

D. Push-Pull Set: PER SCHEDULE OF FINISH HARDWARE, SECTION 08710.

E. Single-Door and Active-Leaf Locksets: Center-housing combination deadbolt and latchbolt with lever handles.

1. Deadbolt operated by key outside and key inside.

F. Inactive-Leaf Locksets: Bottom-fitting or bottom-rail deadbolt.

1. Deadbolt operated by key outside and key inside.

G. Cylinders: As specified in Division 8 Section "Door Hardware.

H. Exit Devices: UL 305.

1. Function: Operation by push-pull when inside operator is locked down (dogged).
2. Latching: At threshold or floor plate and head.
3. Style: Concealed vertical rod in housing style indicated.
4. Provide exit devices on both leaves of pairs of doors.

I. Threshold: Not more than 1/2 inch high with beveled edges providing floor-level change with slope of not more than 1:2.

1. Material: Aluminum, mill finish.

2.5 FABRICATION

A. Provide holes and cutouts in glass to receive hardware, fittings, rails, and accessories before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.

1. Fully temper glass using horizontal (roller-hearth) process and fabricate so, when installed, roll-wave distortion is parallel with bottom edge of door or lite.
2. Factory assemble components and factory install hardware to greatest extent possible.

2.6 STAINLESS-STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Remove tool and die marks and stretch lines or blend into finish.
2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. Stainless-Steel Finish: No. 4, bright, directional polish.

C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install all-glass systems and associated components according to manufacturer's written instructions.

B. Set units level and plumb.

C. Maintain uniform clearances between adjacent components.

D. Lubricate hardware and other moving parts according to manufacturer's written instructions.

E. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware to produce smooth operation and tight fit at contact points and weather stripping.

B. Remove excess sealant and glazing compounds and dirt from surfaces.

END OF SECTION 08450

SECTION 08710 - FINISH HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Door Hardware, including electric hardware.
2. Storefront and entrance door hardware.
3. Power supplies for electric hardware.
4. Padlocks.
5. Cylinders for doors fabricated with locking hardware.

B. Related Sections:

1. Section 06204 - Finish Carpentry: Finish Hardware Installation
2. Section 07920 - Joint Sealers – exterior thresholds
3. Section 08110 - Standard Steel Doors And Frames
4. Section 08120 Interior Aluminum Doors, Door Frames, And Glazing Frames
5. Section 08211 – Flush Wood And Plastic Doors
6. Section 08411 - Aluminum-Framed Entrances And Storefronts
7. Section 08450 - All-Glass Entrances
8. Section 16000 - Electrical
9. Section 16852 - Digital, Addressable Fire-Alarm System

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere.

1. Windows.
2. Cabinets, including open wall shelving and locks.
3. Signs, except where scheduled.
4. Toilet accessories, including grab bars.
5. Installation.
6. Rough hardware.
7. Conduit, junction boxes & wiring.
8. All glass door hardware except cylinders.
9. Automatic operators & actuators.

1.2 REFERENCES:

Use date of standard in effect as of Bid date.

A. American National Standards Institute – ANSI 156.18 – Materials and Finishes.

B. ICC/ANSI A117.1 - 1998 – Specifications for making buildings and facilities usable by physically handicapped people.

C. ADA – Americans with Disabilities Act of 1990

D. BHMA – Builders Hardware Manufacturers Association

E. DHI – Door and Hardware Institute

F. NFPA – National Fire Protection Association

1. NFPA 80 – Fire Doors and Windows
2. NFPA 105 – Smoke and Draft Control Door Assemblies
3. NFPA 252 – Fire Tests of Door Assemblies

G. UL – Underwriters Laboratories

1. UL10C – Positive Pressure Fire Tests of Door Assemblies.
2. UL 305 – Panic Hardware

H. WHI – Warnock Hersey Incorporated State of California Building Code

I. Local applicable codes

J. SDI – Steel Door Institute

K. WI – Woodwork Institute

L. AWI – Architectural Woodwork Institute

M. NAAMM – National Association of Architectural Metal Manufacturers

1.3 SUBMITTALS & SUBSTITUTIONS

A. SUBMITTALS: Submit six copies of schedule per Section 01330. Only submittals printed one sided will be accepted and reviewed. Organize vertically formatted schedule into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:

1. Type, style, function, size, quantity and finish of hardware items.
2. Use BHMA Finish codes per ANSI A156.18.
3. Name, part number and manufacturer of each item.
4. Fastenings and other pertinent information.

5. Location of hardware set coordinated with floor plans and door schedule.
6. Explanation of abbreviations, symbols, and codes contained in schedule.
7. Mounting locations for hardware.
8. Door and frame sizes, materials and degrees of swing.
9. List of manufacturers used and their nearest representative with address and phone number.
10. Catalog cuts.
11. Wiring Diagrams.
12. Manufacturer's technical data and installation instructions for electronic hardware.

B. Bid and submit manufacturer's updated/improved item if scheduled item is discontinued.

C. Deviations: Highlight, encircle or otherwise identify deviations from "Schedule of Finish Hardware" on submittal with notations clearly designating those portions as deviating from this section.

D. If discrepancy between drawings and scheduled material in this section, bid the more expensive of the two choices, not the discrepancy in the submittal and request direction from Architect for resolution.

E. Substitutions per Division 1. Include product data and indicate benefit to the Project. Furnish operating samples on request.

F. Items listed with no substitute manufacturers have been requested by Owner to meet existing standard.

G. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, wiring diagrams, manufacturers' installation, adjustment and maintenance information, and supplier's final inspection report.

1.4 QUALITY ASSURANCE:

A. Qualifications:

1. Hardware supplier: direct factory contract supplier who employs a certified architectural hardware consultant (AHC), available at reasonable times during course of work for project hardware consultation to Owner, Architect and Contractor.

   a) Responsible for detailing, scheduling and ordering of finish hardware. Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.

B. Hardware: Free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.

C. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

D. Fire-Rated Openings: NFPA 80 compliant. Hardware UL10C / UBC Standard 7-2 (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required intumescent seals. Furnish openings complete.

E. Note: scheduled resilient seals may exceed selected door manufacturer's requirements.

F. See 2.6.E for added information regarding resilient and intumescent seals.

G. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions.

H. Pre-Installation Meetings: Initiate and conduct with supplier, installer and related trades, coordinate materials and techniques, and sequence complex hardware items and systems installation. Include manufacturers' representatives of locks, panic hardware and door closers in the meetings. Convene prior to commencement of related work.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Delivery: coordinate delivery to appropriate locations (shop or field).

1. Permanent keys and cores: secured delivery direct to Owner's representative.

B. Acceptance at Site: Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.

C. Storage: Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

1.6 PROJECT CONDITIONS AND COORDINATION:

A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect's approval.

B. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information:

1. Location of embedded and attached items to concrete.

2. Location of wall-mounted hardware, including wall stops.

3. Location of finish floor materials and floor-mounted hardware.

4. Locations for conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.

5. Manufacturer templates to door and frame fabricators.

C. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.

1.7 WARRANTY:

A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' written warranties:

1.	Locksets:	Three years
2.	Exit Devices:	Three years mechanical One year electrical
3.	Closers:	Ten years mechanical Two years electrical
4.	Other Hardware	Two years

1.8 COMMISSIONING:

A. Conduct these tests prior to request for certificate of substantial completion:

1. With installer present, test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.

2. With installer, access control contractor and electrical contractor present, test electrical, electronic and electro-pneumatic hardware systems for satisfactory operation.

3. With installer and electrical contractor present, test hardware interfaced with fire/life-safety system for proper operation and release.

1.9 REGULATORY REQUIREMENTS:

A. Locate latching hardware between 30" to 44" above the finished floor, per California Building Code, Section 1133B.2.5.1.

B. Adjust doors to open with not more than 5.0 lbs pressure to open at exterior doors and 5.0 lbs at interior doors. As allowed per California Building Code, Section 1133B.2.5, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15 lbs.

C. Adjust door closer sweep periods so that from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door, per California Building Code Section 1133B.2.5.1

D. All hardware to meet California Building Code Sections 1133B.2.1, 1133B.2.5.1 and 1003.3.1.8l.

E. Thresholds: Comply with California Building Code Section 1133B.2.4.1.

F. Floor stops: Do not locate in path of travel. Locate no more than 4" from walls.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

A. Listed acceptable alternate manufacturers: submit for review products with equivalent function and features of scheduled products.

ITEM:	MANUFACTURER:	ACCEPTABLE SUB:
Hinges	(HGR) Hager	District Standard
Continuous Hinges	(PMK) Pemko	District Standard
Key System	(C-R) Corbin-Russwin	District Standard
Locks	(SCH) Schlage	District Standard
Fire Exit Devices at Rated Assemblies	(VON) Von Duprin	District Standard
Closers	(LCN) LCN	District Standard
Auto Openers	(BSM) Besam	District Standard
Auto Flush Bolts	(IVE) Ives	DCI
Coordinators	(IVE) Ives	DCI
Silencers	(IVE) Ives	Rockwood
Push & Pull Plates	(IVE) Ives	Rockwood
Kickplates	(IVE) Ives	Rockwood
Stops & Holders	(IVE) Ives	Rockwood
Thresholds	(NGP) NGP	Zero
Seals & Bottoms	(NGP) NGP	Zero
Aluminum Door Locks	(ADA) Adams Rite	None
Deadlatch & Levers	(ADA) Adams Rite	None
Armor Collar	(KEE) Keedex	Adams Rite

2.2 HINGING METHODS:

A. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.

B. Provide closers at all fire-rated door assemblies.

C. Conform to manufacturer's published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.

D. Conventional Hinges: Steel or stainless steel pins and concealed bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.

1. Outswinging exterior doors: non-ferrous with non-removable (NRP) pins and security studs.

2. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.

E. Continuous Hinges:

1. Geared-type aluminum.

a) Use wide-throw units where needed for maximum degree of swing, advise architect if commonly available hinges are insufficient.

2.3 LOCKSETS, LATCHSETS, DEADBOLTS:

A. Mortise Locksets and Latchsets: as scheduled.

1. Chassis: cold-rolled steel, handing field-changeable without disassembly.

2. Latchbolts: 3/4 inch throw stainless steel anti-friction type.

3. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.

a) Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.

4. Furnish solid cylinder collars with wave springs. Wall of collar to cover rim of mortise cylinder.

5. Thumbturns: accessible design not requiring pinching or twisting motions to operate.

6. Deadbolts: stainless steel 1-inch throw.

7. Electric operation: Manufacturer-installed continuous duty solenoid.

8. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.

9. Scheduled Lock Series and Design: Schlage L series, 06A design.

10. Certifications:

    a) ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.

    b) ANSI/ASTM F476-84 Grade 31 UL Listed.

2.4 FIRE EXIT DEVICES AT RATED ASSEMBLIES

A. General features:

1. Independent lab-tested 1,000,000 cycles.

2. Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.

3. 0.75-inch throw deadlocking latchbolts.

4. End caps: impact-resistant, flush-mounted. No raised edges or lips to catch carts or other equipment.

5. No exposed screws to show through glass doors.

6. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.

7. Releasable in normal operation and shall not exceed 15-lb. maximum operating force per CBC 1003.3.1.9 and UBC Standard 10-4, and with 32 lb. maximum pressure under 250-lb. load to the door.

8. Exterior doors scheduled with XP-series devices: Static load force resistance of at least 2000 pounds.

9. Flush end cap design as opposed to typical "bottle-cap" design end cap.

10. Comply with CBC Section 1003.3.1.9.

B. Specific features:

1. Non-Fire Rated Devices: cylinder dogging.

2. Lever Trim: breakaway type, forged brass or bronze escutcheon min .130" thickness, compression spring drive, match lockset lever design.

3. Rod and latch guards with sloped full-width kickplates for doors fitted with surface vertical rod devices with bottom latches.

4. Fire-Labeled Devices: UL label indicating "Fire Exit Devices at Rated Assemblies". Vertical rod devices less bottom rod (LBR) unless otherwise scheduled.

5. Electrically Operated Devices: Single manufacturer source for electric latch retraction devices, electrically controlled trim, power transfers, power supplies, monitoring switches and controls.

2.5 CLOSERS

A. Surface Closers:

1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.
2. ISO 2000 certified. Units stamped with date-of-manufacture code.
3. Independent lab-tested 10,000,000 cycles.
4. Non-sized and adjustable. Place closers inside building, stairs and rooms.
5. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
6. Advanced Variable Backcheck (AVB): where scheduled, these units commence backcheck at approximately 45 degrees.
7. Adjustable to open with not more than 5.0lbs pressure to open at exterior doors and 5.0lbs at interior doors. As allowed per California Building Code, Section 1133B.2.5, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15lbs.
8. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.
9. Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units. EDA arms: rigid main and forearm, reinforced elbow.
10. Exterior door closers: tested to 100 hours of ASTM B117 salt spray test, furnish data on request.
11. Exterior doors: seasonal adjustments not required for temperatiures form 120 degrees F to -30 degrees F, furnish checking fluid data on request.
12. Non-flaming fluid, will not fuel door or floor covering fires.
13. Pressure Relief Valves (PRV) not permitted.

B. Overhead Concealed Closers: Power transmitted to door separately from hanging means. Closer spindle does not support the door. Cast iron cylinders with hydraulically checked rack and pinion construction and single piece forged pistons. Separate non-critical sweep and latch speed valves.

1. (2030) concealable in 1-3/4inch x 4inch tube, single-lever arm & track power transmission, concealed-in-track bumpers where scheduled.

2.6 OTHER HARDWARE

A. Automatic Flush Bolts: Low operating force design.

B. Overhead Stops: Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.

C. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.

D. Door Stops: Provide stops to protect walls, casework or other hardware.

1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where floor type cannot be used, provide wall type. If neither can be used, provide overhead type.

2. Locate overhead stops for maximum possible opening. Consult with Owner for furniture locations. Minimum: 90deg stop / 95deg deadstop. Note degree of opening in submittal.

E. Seals: Finished to match adjacent frame color. Resilient seal material: polyurethane, polypropylene, nylon brush, silicone rubber or solid high-grade neoprene as scheduled. Do not furnish vinyl seal material. UL label applied to seals on rated doors. Substitute products: certify that the products equal or exceed specified material's thickness and durability.

1. Proposed substitutions: submit for approval.

2. Solid neoprene: MIL Spec. R6855-CL III, Grade 40.

3. Non-corroding fasteners at in-swinging exterior doors.

4. Sound control openings: Use components tested as a system using nationally accepted standards by independent laboratories. Ensure that the door leafs have the necessary sealed-in-place STC ratings. Fasten applied seals over bead of sealant.

5. At Fire-rated Doors, Corridor doors, and egress-stair doors, provide Resilient Smoke Seals: UL10C / UBC Standard 7-2 compliant. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements. Where rigid housed resilient seals are scheduled in this section and the selected door manufacturer only requires an adhesive-mounted resilient seal, furnish rigid housed seal at minimum, or both the rigid housed seal plus the adhesive applied seal.

a) Provide smoke seals at rated door and frame locations for corridor doors, interior and exterior egress stair doors, and where required on plans.

F. Automatic door bottoms: low operating force units. Doors with automatic door bottoms plus head and jamb seals cannot require more than two pounds operating force to open when closer is disconnected.

G. Thresholds: As scheduled and per details. Comply with CBC Section 1133B.2.4.1. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.

1. Exteriors: Seal perimeter to exclude water and vermin. Use sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Non-ferrous 1/4inch fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors (SS/FHSL).

2. Fire-rated openings, 90min or less duration: use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, request direction from Architect.

3. Fire-rated openings, 3hour duration: Thresholds, where scheduled, to extend full jamb depth.

4. Acoustic openings: Set units in full bed of Division-7-compliant, leave no air space between threshold and substrate.

5. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.

6. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression.

H. Silencers: Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Omit where adhesive mounted seal occurs. Leave no unfilled/uncovered pre-punched silencer holes.

I. Key Control Software: Same manufacturer as key cylinders, supply to Owner.

2.7 FINISH:

A. Generally BHMA 626 Satin Chromium

1. Areas using BHMA 626 to have push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise noted.

B. Door closers: factory powder coated to match other hardware, unless otherwise noted.

C. Aluminum items: match predominant adjacent material. Seals to coordinate with frame color.

2.8 KEYING REQUIREMENTS:

A. Key System: existing Corbin-Russwin system. Initiate and conduct meeting(s) with Owner to determine system structure, furnish Owner's written approval of the system. Furnish temporary construction-keyed and permanent cylinders. Contractor to demonstrate to the Owner that temporary keys no longer operate the locking cylinders at the end of the project.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS:

A. Can read and understand manufacturers' templates, suppliers hardware schedule and printed installation instructions. Can readily distinguish drywall screws from manufacturers furnished fasteners. Available to meet with manufacturers' representatives and related trades to discuss installation of hardware.

3.2 PREPARATION:

A. Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation.

B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.

1. Notify Architect of code conflicts before ordering material.

2. Locate levers, key cylinders, t-turn pieces, touchbars and other operable portions of latching hardware between 30 inches to 44 inches above the finished floor, per CBC Section 1133B.2.5.1.

3. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.

C. Overhead stops: before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.

D. Existing frames and doors to be retrofitted with new hardware:

1. Field-verify conditions and dimensions prior to ordering hardware. Fill existing hardware cut outs not being reused by the new hardware. Remove existing hardware not being reused, return to Owner unless directed otherwise.

2. Remove existing floor closers not scheduled for reuse, fill cavities with concrete and finish smooth

3. Cut and weld existing steel frames currently prepared with 2-¾" height strikes. Cut an approx. 8" section from the strike jamb and weld in a reinforced section to accommodate specified hardware's strike.

4. Patch and weld flush filler pieces into existing door hardware preparations in steel doors and frames, leave surfaces smooth.

3.3 INSTALLATION

A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.

1. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.

2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.

3. Use manufacturers' fasteners furnished with hardware items, or submit Request for Substitution with Architect.

4. Replace fasteners damaged by power-driven tools.

B. Locate floor stops no more that 4 inches from walls and not within paths of travel. See paragraph 2.2 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is questionable or difficult, contact Architect for direction.

C. Core concrete for exterior door stop anchors. Set anchors in approved non-shrink grout.

D. Locate overhead stops for minimum 90 degrees and maximum allowable degree of swing.

E. Drill pilot holes for fasteners in wood doors and/or frames.

F. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.

3.4. ADJUSTING

A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.

1. Hardware damaged by improper installation or adjustment methods: repair or replace to Owner's satisfaction.

2. Adjust doors to fully latch with no more than 1 pound of pressure.

3. Adjust delayed-action closers on fire-rated doors to fully close from fully-opened position in no more than 10 seconds.

4. Adjust door closers per 1.9 this section.

B. Inspection: Use hardware supplier's consultant or consultant's agent. Include supplier's report with closeout documents.

C. Final inspection: Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following:

1. Re-adjust hardware.

2. Evaluate maintenance procedures and recommend changes or additions, and instruct Owner's personnel.

3. Identify items that have deteriorated or failed.

4. Submit written report identifying problems

3.5 DEMONSTRATION:

A. Demonstrate mechanical hardware and electrical, electronic and pneumatic hardware systems, including adjustment and maintenance procedures.

3.6 PROTECTION/CLEANING:

A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.

B. Clean adjacent wall, frame and door surfaces soiled from installation/reinstallation process.

3.7 SCHEDULE OF FINISH HARDWARE

A. See door schedule in Drawings for Hardware Set assignments.

B. Miscellaneous Material:

HW SET: 01

2	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	EA	FIRE EXIT HARDWARE	9847EO	626	VON
1	EA	FIRE EXIT HARDWARE	9847NL-OP	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
2	EA	OFFSET DOOR PULL	8190-0-O	630	IVE
2	EA	CONCEALED CLOSER	2030 SERIES	689	LCN
2	EA	SECURITY FLOOR STOP	FS18S	BLK	IVE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 02

1	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	EA	DEADLOCK	MS1851S	628	ADA
1	EA	ARMORED TRIM STRIKE	MS4002	628	ADA
1	EA	CYLINDER TURN	09-904	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	EXIT INDICATOR	4089	628	ADA
1	EA	PULL/PUSHBAR	9190-0-NO	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1	EA	ARMOR COLLAR	K-24-26D	626	KEE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 03

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	CLASSROOM LOCK	L9071L 06A	626	SCH
2	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	SET	SMOKE SEALS	5050B H & J	BRN	NGP
1	EA	DRIP CAP	17	AL	NGP
1	EA	DOOR BOTTOM	320S	AL	NGP
			SIGNS AND GRAPHICS BY OTHERS		
		THRESHOLD	THRESHOLD BY OTHERS		

HW SET: 04

2	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	EA	FIRE EXIT HARDWARE	9847EO	626	VON
1	EA	FIRE EXIT HARDWARE	9847NL-OP	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
2	EA	OFFSET DOOR PULL	8190-0-O	630	IVE
2	EA	CONCEALED CLOSER	2030 SERIES	689	LCN
2	EA	SECURITY FLOOR STOP	FS18S	BLK	IVE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 05

1	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	EA	DEADLOCK	MS1851S	628	ADA
1	EA	ARMORED TRIM STRIKE	MS4002	628	ADA
1	EA	CYLINDER TURN	09-904	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	EXIT INDICATOR	4089	628	ADA
1	EA	PULL/PUSHBAR	9190-0-NO	630	IVE
1	EA	SECURITY FLOOR STOP	FS18S	BLK	IVE
1	EA	ARMOR COLLAR	K-24-26D	626	KEE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 06

2	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	EA	FIRE EXIT HARDWARE	9847EO	626	VON
1	EA	FIRE EXIT HARDWARE	9847NL-OP	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
2	EA	OFFSET DOOR PULL	8190-0-O	630	IVE
2	EA	ASTRAGAL	137NA	AL	NGP
2	EA	SURFACE CLOSER	4110 DEL EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW	630	IVE
2	EA	SECURITY FLOOR STOP	FS18S	BLK	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
2	EA	DOOR SWEEP	618	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 07

1	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	EA	FIRE EXIT HARDWARE	98NL-OP	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
1	EA	OFFSET DOOR PULL	8190-0-O	630	IVE
1	EA	SURFACE CLOSER	4110 DEL EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	SECURITY FLOOR STOP	FS18S	BLK	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
1	EA	DRIP CAP	17	AL	NGP
1	EA	DOOR BOTTOM	320S	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 08

1	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	EA	FIRE EXIT HARDWARE	98NL-OP	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
1	EA	OFFSET DOOR PULL	8190-0-O	630	IVE
1	EA	SURFACE CLOSER	4110 DEL EDA	689	LCN
1	EA	SECURITY FLOOR STOP	FS18S	BLK	IVE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 09

2	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	EA	PANIC HARDWARE	3347A-EO	626	VON
1	EA	PANIC HARDWARE	3347A-NL-OP	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
2	EA	OFFSET DOOR PULL	8190-0-O	630	IVE
2	EA	CONCEALED CLOSER	2030 SERIES	689	LCN
2	EA	SECURITY FLOOR STOP	FS18S	BLK	IVE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 10

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	CLASSROOM LOCK	L9071L 06A	626	SCH
2	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	SET	SMOKE SEALS	5050B H & J	BRN	NGP
1	EA	DRIP CAP	17	AL	NGP
1	EA	DOOR BOTTOM	320S	AL	NGP
			SIGNS AND GRAPHICS BY OTHERS		
		THRESHOLD	THRESHOLD BY OTHERS		

HW SET: 11

2	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	EA	FIRE EXIT HARDWARE	EL-RX9847EO	626	VON
1	EA	FIRE EXIT HARDWARE	EL-RX9847NL-OP	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
2	EA	OFFSET DOOR PULL	8190-0-O	630	IVE
1	EA	POWER SUPPLY	PS873-2	GRY	VON
2		AUTO OPERATOR	IK-A and IKS-A	626	BSM
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 12

2	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	EA	FIRE EXIT HARDWARE	9847EO	626	VON
1	EA	FIRE EXIT HARDWARE	9847NL-OP	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
2	EA	OFFSET DOOR PULL	8190-0-O	630	IVE
2	EA	CONCEALED CLOSER	2030 BUMPER SERIES	689	LCN
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 13 - NOT USED

2	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	L9080L 06A	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	COORDINATOR	COR X FL COMPLETE	628	IVE
1	EA	ASTRAGAL	139A	600	NGP
2	EA	SURFACE CLOSER	4110 DEL SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW	630	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
2	EA	DOOR SWEEP	618	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 14

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	STOREROOM LOCK	L9080L 06A	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	SET	SMOKE SEALS	5050B H & J	BRN	NGP
1	EA	DRIP CAP	17	AL	NGP
1	EA	DOOR BOTTOM	320S	AL	NGP
1	EA	ARMOR COLLAR	K-24-26D	626	KEE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 15

2	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	L9080L 06A	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	COORDINATOR	COR X FL COMPLETE	628	IVE
1	EA	ASTRAGAL	139A	600	NGP
2	EA	SURFACE CLOSER	4110 DEL SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW	630	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
2	EA	DOOR SWEEP	618	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 16

3	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	FIRE EXIT HARDWARE	98L-BE-F 996L-BE	626	VON
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
1	EA	DOOR BOTTOM	320S	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 17

3	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	PASSAGE SET	L9010 06A	626	SCH
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
			SIGNS AND GRAPHICS BY OTHERS		
		THRESHOLD	THRESHOLD BY OTHERS		

HW SET: 17A

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	PASSAGE SET	L9010 06A	626	SCH
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
			SIGNS AND GRAPHICS BY OTHERS		
		THRESHOLD	THRESHOLD BY OTHERS		

HW SET: 18

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8305-0 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
			SIGNS AND GRAPHICS BY OTHERS		
		THRESHOLD	THRESHOLD BY OTHERS		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 19

4	EA	HINGE	AB750 4.5 X 4.5	630	HGR
1	EA	FIRE EXIT HARDWARE	98L 996L	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOOR BOTTOM	335S	AL	NGP
			SEALS BY FRAME SUPPLIER		
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 20

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	CLASSROOM LOCK	L9071L 06A	626	SCH
2	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	EA	DOOR BOTTOM	335S	AL	NGP
			SEALS BY FRAME SUPPLIER		
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 21

4	EA	HINGE	AB7004.5 X 4.5	630	HGR
1	EA	CLASSROOM LOCK	L9071L 06A	626	SCH
2	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	EA	DOOR BOTTOM	335S	AL	NGP
			SEALS BY FRAME SUPPLIER		
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 22

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	CLASSROOM LOCK	L9071L 06A	626	SCH
2	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
1	EA	DOOR BOTTOM	335S	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 23

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	CLASSROOM LOCK	L9071L 06A	626	SCH
2	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	EA	DOOR BOTTOM	335S	AL	NGP
			SEALS BY FRAME SUPPLIER		
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 24

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	CLASSROOM LOCK	L9071L 06A	626	SCH
2	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOOR BOTTOM	335S	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 25 - NOT USED

8	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	3PT DEADLOCK	MS1852S X 4015 X 4085	628	ADA
1	EA	ARMORED TRIM	MS4002	628	ADA
		STRIKE			
2	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	EXIT INDICATOR	4089	628	ADA
2	EA	PULL/PUSHBAR	9190-0-NO	630	IVE
2	EA	CONCEALED CLOSER	2030 SERIES	689	LCN
2	EA	DOME STOP	FS438	626	IVE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 26

	CYLINDER	VERIFY TYPE & QUANITY OF CYLINDERS
		BALANCE OF HARDWARE BY DOOR SUPPLIER

HW SET: 27

3	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	DEADLOCK	MS1851S	628	ADA
1	EA	ARMORED TRIM STRIKE	MS4002	628	ADA
1	EA	CYLINDER TURN	09-904	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	EXIT INDICATOR	4089	628	ADA
1	EA	PULL/PUSHBAR	9190-0-NO	630	IVE
1	EA	CONCEALED CLOSER	2030 SERIES	689	LCN
1	EA	DOME STOP	FS438	626	IVE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 27A

1	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	EA	DEADLOCK	MS1851S	628	ADA
1	EA	ARMORED TRIM STRIKE	MS4002	628	ADA
1	EA	CYLINDER TURN	09-904	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	EXIT INDICATOR	4089	628	ADA
1	EA	PULL/PUSHBAR	9190-0-NO	630	IVE
1	EA	CONCEALED CLOSER	2030 SERIES	689	LCN
1	EA	SECURITY FLOOR STOP	FS18S	BLK	IVE
1	EA	ARMOR COLLAR	K-24-26D	626	KEE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 28

4	EA	HINGE	AB700 4.5 X 4.5	630	IHGR
1	EA	CLASSROOM LOCK	L9071L 06A	626	SCH
2	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	EA	DOOR BOTTOM	335S	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 29

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	CLASSROOM LOCK	L9070L 06A	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4010 DEL H	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 29A

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	CLASSROOM LOCK	L9070L 06A	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 30

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	PRIVACY SET	L9040 06A L583-363	626	SCH
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1	SET	SMOKE SEALS	5050B H & J	BRN	NGP
			SIGNS AND GRAPHICS BY OTHERS		
		THRESHOLD	THRESHOLD BY OTHERS		

HW SET: 31

4	EA	HINGE	1191 4.5 X 4.5	630	HGR
1	EA	OFFICE LOCK	L9050L 06A L583-363	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	DOME STOP	FS436	626	IVE

HW SET: 32

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	OFFICE LOCK	L9050L 06A L583-363	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
			SEALS BY FRAME SUPPLIER		

HW SET: 33

3	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	CLASSROOM LOCK	L9071L 06A	626	SCH
2	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
1	EA	DOOR BOTTOM	335S	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 34

3	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	STOREROOM LOCK	L9080L 06A	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 34A

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	STOREROOM LOCK	L9080L 06A	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 35

6	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	SET	AUTO FLUSH BOLT	FB41P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	OFFICE LOCK	L9050L 06A L583-363	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	COORDINATOR	COR X FL COMPLETE	628	IVE
1	EA	ASTRAGAL	139A	600	NGP
2	EA	SURFACE CLOSER	4010 DEL	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW	630	IVE
2	EA	DOME STOP	FS436	626	IVE
			SEALS BY FRAME SUPPLIER		
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 36

6	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	FIRE EXIT HARDWARE	9875L-F 996L-NL	626	VON
1	EA	COORDINATOR	COR X FL COMPLETE	628	IVE
1	EA	ASTRAGAL	139A	600	NGP
2	EA	SURFACE CLOSER	4110 DEL EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW	630	IVE
2	EA	DOME STOP	FS438	626	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 37

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	OFFICE LOCK	L9050L 06A L583-363	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
			SEALS BY FRAME SUPPLIER		

HW SET: 38

3	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	STOREROOM LOCK	L9080L 06A	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
1	EA	DOOR BOTTOM	320S	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 39

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	DEADLATCH	4510 SERIES	628	ADA
2	EA	LEVER	4569-01	628	ADA
1	EA	DOME STOP	FS436	626	IVE
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 40

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	PASSAGE SET	L9010 06A	626	SCH
1	EA	DOME STOP	FS436	626	IVE
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 41

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	OFFICE LOCK	L9050L 06A L583-363	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4010 DEL H	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE

HW SET: 42

4	EA	HINGE	1191 4.5 X 4.5	630	HGR
1	EA	STOREROOM LOCK	L9080L 06A	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	DOME STOP	FS436	626	IVE

HW SET: 43

3	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	DEADLOCK	MS1851S	628	ADA
1	EA	ARMORED TRIM STRIKE	MS4002	628	ADA
1	EA	CYLINDER TURN	09-904	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	EXIT INDICATOR	4089	628	ADA
2	EA	OFFSET DOOR PULL	8190-8-N	630	IVE
1	EA	CONCEALED CLOSER	2030 H SERIES	689	LCN
1	EA	DOME STOP	FS438	626	IVE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 44

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	PRIVACY SET	L9040 06A L583-363	626	SCH
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1	SET	SMOKE SEALS	5050B H & J	BRN	NGP
			SIGNS AND GRAPHICS BY OTHERS		
		THRESHOLD	THRESHOLD BY OTHERS		

HW SET: 45

8	EA	HINGE	AB700 4.5 X 4.5	630	HGR
4	EA	OFFSET DOOR PULL	8190-8-N	630	IVE
2	EA	CONCEALED CLOSER	2030 H SERIES	689	LCN
2	EA	DOME STOP	FS438	626	IVE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 46

8	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	SET	AUTO FLUSH BOLT	FB41P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	OFFICE LOCK	L9050L 06A L583-363	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	COORDINATOR	COR X FL COMPLETE	628	IVE
2	EA	SURFACE CLOSER	4110 DEL HEDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW	630	IVE
2	EA	DOME STOP	FS436	626	IVE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 47

3	EA	HINGE	1191 4.5 X 4.5	630	HGR
1	EA	STOREROOM LOCK	L9080L 06A	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	DOME STOP	FS436	626	IVE

HW SET: 48

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	CLASSROOM LOCK	L9070L 06A	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	DOME STOP	FS438	626	IVE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 49

3	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	STOREROOM LOCK	L9080L 06A	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4010	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	SET	SMOKE SEALS	5050B H & J	BRN	NGP
1	EA	DRIP CAP	17	AL	NGP
1	EA	DOOR BOTTOM	320S	AL	NGP
1	EA	ARMOR COLLAR	K-24-26D	626	KEE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 50

2	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	EA	FIRE EXIT HARDWARE	9847EO	626	VON
1	EA	FIRE EXIT HARDWARE	9947L 996L	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
1	EA	COORDINATOR	COR X FL COMPLETE	628	IVE
2	EA	ASTRAGAL	137NA	AL	NGP
2	EA	SURFACE CLOSER	4110 DEL SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW	630	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
2	EA	DOOR SWEEP	618	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 51 - NOT USED

3	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	CLASSROOM LOCK	L9071L 06A	626	SCH
2	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	EA	DOOR BOTTOM	335S	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 52

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	OFFICE LOCK	L9050L 06A L583-363	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL HEDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 53 - NOT USED

4	EA	HINGE	AB700 4.5 X 4.5	630	HGR
1	EA	CLASSROOM LOCK	L9071L 06A	626	SCH
2	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	EA	DOOR BOTTOM	335S	AL	NGP
			SEALS BY FRAME SUPPLIER		
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 54

4	EA	HINGE	AB750 4.5 X 4.5	630	HGR
1	EA	FIRE EXIT HARDWARE	98L 996L	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	EA	DOOR BOTTOM	335S	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 55

3	EA	HINGE	AB750 4.5 X 4.5	630	HGR
1	EA	FIRE EXIT HARDWARE	98L-F 996L	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOOR BOTTOM	335S	AL	NGP
			SEALS BY FRAME SUPPLIER		
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 56

4	EA	HINGE	AB750 4.5 X 4.5	630	HGR
1	EA	FIRE EXIT HARDWARE	98L-F 996L	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	EA	DOOR BOTTOM	335S	AL	NGP
			SEALS BY FRAME SUPPLIER		
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 57 - NOT USED

HARDWARE IS EXISTING

HW SET: 58

3	EA	HINGE	AB750 4.5 X 4.5	630	HGR
1	EA	STOREROOM LOCK	L9080L 06A	626	SCH
1	EA	MORTISE CYLINDER	1080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
1	EA	DOOR BOTTOM	320S	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 59

4	EA	HINGE	AB750 4.5 X 4.5	630	HGR
1	EA	FIRE EXIT HARDWARE	98L-BE-F 996L-BE	626	VON
1	EA	SURFACE CLOSER	4010 DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
1	EA	DOOR BOTTOM	320S	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

HW SET: 60

1	EA	CONTINUOUS HINGE	SPFMHD	CLR	PMK
1	EA	FIRE EXIT HARDWARE	33A-NL-OP	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
1	EA	OFFSET DOOR PULL	8190-0-O	630	IVE
1	EA	CONCEALED CLOSER	2030 SERIES	689	LCN
1	EA	SECURITY FLOOR STOP	FS18S	BLK	IVE
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		
1		WEATHERSTRIPPING	WEATHERSTRIPPING BY DOOR SUPPLIER		

HW SET: 61

4	EA	HINGE	AB750 5 X 5	630	HGR
1	EA	FIRE EXIT HARDWARE	98L-F 996L	626	VON
1	EA	RIM CYLINDER	3080 SERIES	626	C-R
1	EA	SURFACE CLOSER	4110 DEL EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	SECURITY FLOOR STOP	FS18S	BLK	IVE
1	SET	SMOKE SEALS	155S H & J	AL	NGP
1	EA	DRIP CAP	17	AL	NGP
1	EA	DOOR BOTTOM	320S	AL	NGP
1	EA	THRESHOLD	THRESHOLD AS REQUIRED		

END OF SECTION

SECTION 08800 - GLAZING

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Glass and glazing as indicated.

C. Related Sections:

1. Section 08120: Interior Aluminum Doors, Door Frames, and Glazing Frames.

2. Section 08211: Flush Wood Doors

3. Section 08411: Aluminum-Framed Entrances and Storefronts.

4. Section 08450: All Glass Entrances

5. Section 08817: Fire-Rated Glass

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive literature and installation recommendations for glass, glazing, and accessories.

B. Material Samples: Submit 6-inch square units of each type of glass specified.

1.03 QUALITY ASSURANCE

A. Labeling: Label each piece of glass and glazing and mirrors with manufacturer's name, and the grade or quality of the material. Labels shall be intact before and after installation.

B. Fire Protective Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire protective assemblies.

C. Comply with the following as a minimum requirement:

1. ASTM C 1036 - Standard Specification for Flat Glass.

2. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass.

3. CPSC 16 CFR 1201 - Safety Standards for Architectural Glazing Materials issued by the Consumer Products Safety Commission.

4. GANA - Glazing Manual.

C. Qualifications of Installer: Minimum 10 years experience installing glass in projects of similar scope and complexity.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver glass and glazing materials with manufacturer's labels intact.

B. Do not remove labels until glass has been installed and inspected by IOR.

C. Protect glass from staining, marking, and damage.

D. Putty and glazing compound shall be delivered to the Project site in manufacturer's original unbroken containers labeled to identify contents.

1.05 PROJECT CONDITIONS

A. Perform glazing when ambient temperature is above 40 degrees F.

B. Perform glazing on clean, dry surfaces only.

1.06 WARRANTY

A. Manufacturer shall provide a 10 year material warranty against distortion or harmonics. Manufacturer shall provide a 20 year material warranty for coatings and thermally or acoustically rated insulation units against deterioration in acoustic or thermal rating.

B. Installer shall provide a 10 year labor warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS AND FABRICATORS

A. To maximum extent possible, provide domestically manufactured and fabricated glass, and provide glass from one manufacturer.

B. Types of glass specified or indicated shall be manufactured or fabricated by one of the following:

1. Pulp Studio, Inc.

2. Viracon

3. Pilkington LOF

4. PPG Glass Technology

2.02 GLASS MATERIALS

A. General: Conform to ASTM C 1036, ASTM C 1048 and to ANSI Z97.1. Label factory cut panes.

B. "EG" – Exterior Glazing:

1. Coated Monolithic Glass: Provide glass having the following characteristics:

a. Basis-of-Design: Viracon VE52M one-inch thick, insulated Low-E coating on Blue glass with 70% VLT approved equal.

1.) ¼" tempered, blue
2.) ½" tempered, air space
3.) ¼" tempered, clear

b. Winter U-value 0.29.
c. Summer U-value 0.26.
d. Shading coefficient 0.32.

C. "GL1" – Typical Interior Laminated Safety Glass: **1/4-inch** nominal thickness: 2 layers of 1/8-inch clear, tempered glass with 0.030 inch thick high strength polyvinyl butyral laminating sheet. Edges of laminated glass shall be treated with Ardis 500, or equal, edge protection to prevent contact of laminating sheet with sealants.

D. "GL2" – Monumental Stair Laminated Safety Glass: **1/4-inch** nominal thickness: 2 layers of 1/8-inch tinted, tempered glass with 0.030 inch thick high strength polyvinyl butyral laminating sheet. Edges of laminated glass shall be treated with Ardis 500, or equal, edge protection to prevent contact of laminating sheet with sealants.

a. Basis-of-Design: Pulp Studio, Inc. Color #6503-790

E. ""GL3" – Stair Guardrail / Balustrade Stair Laminated Safety Glass: **1/2-inch** nominal thickness: 2 layers of 1/4-inch tinted, tempered glass with 0.030 inch thick high strength polyvinyl butyral laminating sheet. Edges of laminated glass shall be treated with Ardis 500, or equal, edge protection to prevent contact of laminating sheet with sealants.

a. Basis-of-Design: Pulp Studio, Inc. Color #6503-790
b. Provide vinyl-applied, custom fritted pattern per Finish Plans / Schedule.

F. See Section 08817 for Fire-rated Glass.

G. Unframed Mirrors: Mirror-quality float glass, 1/4 inch thick, edges finished and polished, double silvered with electro-deposited copper coating plus an organic protective coating, equal to Palmer Products Mirro-Bac Paint. Include polished stainless steel edge channels at top and bottom edges, plus mirror adhesive bonding to wall.

H. Framed Mirrors: Fabricated of one-piece Type 304 stainless steel angle frame, 3/4 inch x 3/4 inch, with continuous integral stiffener on sides and beveled front to hold frame tightly against mirror. Corners shall be heliarc welded, ground and polished smooth. Exposed surfaces shall have stain finish with vertical grain. Mirror shall be fabricated of 1/4 inch mirror glazing quality float glass, free from tong marks. Edges shall be protected by plastic filler strips. Full-size, shock-absorbing, water-resisting, non-abrasive 1/8 inch thick polyethylene padding shall protect backs of mirrors. Mirrors shall be provided with 24 gage galvanized steel back with integral hanging brackets for mounting on concealed, rectangular wall hangers, and shall be secured with concealed Phillips head locking screws on bottom of frame.

2.03 GLASS SETTING MATERIALS

A. Setting Blocks: ASTM C 864, channel shape; having 1/4 inch internal depth, Shore A hardness of 80 to 90 Durometer. Blocks shall be a minimum 2 inch long. Block width shall be approximately 1/16 inch less than the full width of the rabbet. Block thickness shall be at least 3/16 inch, sized for rabbet depth as required.

B. Spacers: ASTM C 864, channel shape, with 1/4 inch internal depth, 3/32 inch flanges, web, 1/8 inch thick, one to 3 inches long. Spacers shall provide Shore A hardness of 40 to 50 Durometer.

C. Vinyl Glazing Channels: Profile compatible with framing system and designed to accommodate glass of specified thickness, light gray in color. Provide for dry glazing aluminum frames where indicated or permitted.

D. Glazing Tape: Poly-isobutylene based sealant tape, conforming to AAMA 804.1, with adhesive one side protected by temporary paper cover, Extru-Seal manufactured by Pecora Corp., No. 303 by Protective Treatments, Inc., or equal.

E. Spring Steel Spacers: Galvanized steel wire or strip designed to position glazing in channel or rabbet sash with stops.

F. Glazing Clips: Galvanized steel spring wire designed to hold glass in position in rabbet sash without stops.

G. Glazing Points (Sprigs): Pure zinc stock, thin, flat, triangular or diamond-shaped pieces, 1/4 inch minimum size.

H. Glazing Sealants for Metal Sash: GE Silicones Silglaze II 2800, GE Silicones Silpruf, GE Silicones 1200 Silicone, and Dow Corning 999A. Polybutylene, oleoresinous, asphalt, and oil base sealants are not permitted. Provide sealant of same color as structural silicone sealant unless otherwise required.

I. Mirror Setting Materials: Manufactured by Palmer Products Corporation, or equal, for installation of mirrors, and as follows:

1. Mirror backing paint: Mirro-Bac Paint, or equal, formulated to protect mirror silvering.

2. Mirror bond coat: Mirro-Mastic Bond, or equal, formulated to isolate deleterious backing materials from mastic and mirror.

3. Mirror mastic: Mirro-Mastic, or equal, formulated for adhering mirrors and glass to substrates.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Glazed cabinet doors, windows, transoms, and fixtures, not otherwise noted or indicated, shall be glazed with clear float glass. Room or entrance doors shall be glazed with clear wire glass.

B. Obscure glass in exterior openings shall be installed with smooth side of glass to weather. Patterned glass shall be installed with pattern running vertically, unless otherwise indicated.

C. Glazing tapes or sealants shall be installed wherever glass contacts wood or metal surfaces. Width of strips shall be as required.

D. Glazing compound shall be neatly and cleanly installed in straight lines, even with inside edge of sash members. Thumb puttying is not permitted.

E. Display Cases and Sliding Glass Doors in Casework: Glass in display cases shall be 1/4 inch thick clear wire glass or float glass as indicated. Edges of glass shall be rounded and polished.

F. Serving windows in cafeterias with speak holes shall be tempered glass.

G. Glazing Aluminum Sash: Glazing material in aluminum sash shall be installed in compound and secured in place with aluminum glazing beads. In addition, horizontal beads shall be installed with 6 inch x one inch, type A, self-tapping, stainless steel, Phillips-head screws, installed into pre-drilled, counter-sunk holes and spaced 2 inches from each end and 9 inches on centers.

H. Speak holes shall be installed according to glass manufacturer's written recommendations.

3.02 INSTALLATION OF GLASS

A. Conform to requirements of GANA Glazing Manual.

B. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.

C. Provide compressible filler rods or equivalent back-up material to prevent sealant from extruding into glass channel weep systems, from adhering to back surface of joints and to control depth of sealant for optimum performance.

D. Force sealants into glazing channels, in manner to eliminate voids and to ensure complete bond of sealant to glass and channel surfaces.

E. Tool exposed surfaces of sealants to provide for drainage away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

F. Where dry glazing of aluminum frame is indicated or permitted, provide vinyl glazing channels installed in accordance with frame manufacturers written recommendations. Do not stretch channels. Miter corners.

G. For tape glazing, furnish tape of thickness to provide approximately 30 percent compression. Cut tape to proper length and install to permanent stops, the entire length of the head and sill first, then to jambs. Butt tape together with no overlap and remove paper backing. Install glass on setting blocks at quarter points and maintain uniform glass edge clearance around entire perimeter of glass. Maintain manufacturer's recommended edge clearance and bite on glass. Install glass firmly into tape with a slight lateral movement to assure proper adhesion. Install tape to removable stop with evenly distributed firmness, smoothing out wrinkles in tape. Secure removable stop in proper position so tape makes contact with glass as stop is installed, forcing contact with glass and completely sealing joint. Remove excess tape from both sides at slight angle over sight line. Do not undercut.

H. Glass in Wood Frames: Install glass with glazing points and setting blocks as required. Seal glass with glazing compound and secure with wood stops. Install stops with fine finishing nails, and set for putty stopping.

I. Patterned Glass: Install glass with one patterned smooth surface on the weather side.

J. Wire Glass: Install glass for fire doors in accordance with installation requirements of NFPA 80.

K. Laminated Glass: Sashes, which are to receive laminated glass, shall be weeped to the outside to permit water in the channel to drain from the frame.

L. Unframed Mirrors: Walls shall be clean, dry, plumb, rigid and smooth. Install mirror backing paint to back of mirror and to edges. Install mirror bond coat over painted backing, wood

backing, concrete and masonry to receive mirrors. Bond coat is not required over vitreous surfaces. Install sufficient mirror adhesive to provide 100 percent coverage when mirror is installed. Install mirror into place, providing 3/16 inch clearance between mirror and substrate. Support mirrors with temporary edge channels to allow mastic set-up, and where indicated or required, provide permanent top and bottom edge channels.

M. Framed Mirrors: Walls shall be clean, dry, plumb, rigid and smooth. Install mirrors with concealed mounting devices, and secure with concealed screws on bottom of mirror. Conform to manufacturers written recommendations.

3.03 PROTECTION AND CLEANING

A. Protect exterior glass from breakage by furnishing crossed streamers attached to framing and away from glass surface. Do not directly install markers to glass surfaces. Remove non-permanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method recommended by glass manufacturer. Glazing, which cannot be cleaned to a required condition, shall be deemed defective Work.

D. Remove and replace glass, which is broken, chipped, cracked, abraded, or damaged during construction.

E. Not Used

F. Wash glass on both faces not more than 4 days before Substantial Completion. Wash glass by method recommended by glass manufacturer. Do not furnish harsh cleaning agents, caustics, abrasives, or acids for cleaning. Polish glass both sides and leave free of soil, streaks, and labels.

3.04 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 08817 - FIRE-RATED GLASS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fire-rated glazing materials installed as vision lights in fire-rated doors.
2. Fire-rated glazing materials installed as transoms, borrowed lites, and windows in fire-rated frames.

B. Related Sections include the following:
1. Section 06402 "Interior Architectural Woodwork" for wood frames for doors, sidelights, transoms, borrowed lights.
2. Section 08111 "Standard Steel Doors and Frames" for vision panels in interior doors and interior vision panel (borrowed lites) frames.
3. Section 08211 "Wood Doors" for vision panels in interior doors.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM E2074-00: Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
2. ASTM E2010-01: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.

B. American National Standards Institute (ANSI):
1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings

C. Consumer Product Safety Commission (CPSC):
1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials

D. Glass Association of North America (GANA):
1. GANA – Glazing Manual.
2. FGMA – Sealant Manual.

E. National Fire Protection Association (NFPA):
1. NFPA 80: Fire Doors and Windows.
2. NFPA 252 – Fire Tests of Door Assemblies.
3. NFPA 257 – Fire Tests of Window Assemblies.

F. Underwriters Laboratories, Inc. (UL):
1. UL 9 – Fire Tests of Window Assemblies.
2. UL 10B – Fire Tests of Door Assemblies.
3. UL 10C – Positive Pressure Fire Tests of Door Assemblies.

G. Standard Council of Canada:
   1. ULC Standard CAN4-S104: Fire Tests of Door Assemblies.
   2. ULC Standard CAN4-S106: Fire Tests of Window Assemblies.
   3. CAN/ULC-S101M: Standard Methods of Fire Endurance Tests.

H. Division of the State Architect (DSA).

1.3 PERFORMANCE REQUIREMENTS

A. Fire-rated glass ceramic clear and wireless glazing material with surface-applied film listed for use in impact safety-rated locations such as doors, transoms and borrowed lites with fire rating requirements ranging from 20 minutes to 90 minutes with required hose stream test.

1.4 SUBMITTALS

A. Comply with requirements of Section 01300.

B. Product data: Submit manufacturer's technical data for each glazing material required, including installation and maintenance instructions.

C. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

D. Product Test Listings: From UL indicating fire-rated glass complies with requirements, based on comprehensive testing of current product.

E. Glazing Schedule/Identification: Use same identifications indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

F. Samples: Submit, for verification purposes, approx. 8-inch by 10-inch sample for each type of glass indicated.

1.5 QUALITY ASSURANCE

A. Glazing Standards: FGMA Glazing Manual and Sealant Manual.

B. Fire Protective Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire protective assemblies.

C. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E 152, labeled and listed by UL or other certification agency acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials under provisions of Section 01330.

B. Deliver materials to specified destination in manufacturer's or distributor's packaging, undamaged, complete with installation instructions.

C. Store off ground, under cover, protected from weather and construction activities.

1.7 WARRANTY

A. Provide manufacturer's limited warranty under provisions of the General Conditions.

B. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIRE-RATED GLAZING MATERIALS
1. Basis-of-Design:

a. Supplier: FireLite® NT as supplied by Technical Glass Products, Kirkland, Washington, 1-800-426-0279, fax 1-800-451-9857, e-mail sales@fireglass.com, web site www.fireglass.com.

B. District, Architect, and DSA approved equal.

C. Properties:
1. Thickness: 3/16 inch.
2. Film: Fire-rated surface film as approved by manufacturer.
3. Weight: 2.4 lbs./sq. ft.
4. Approximate Visible Transmission: 88 percent.
5. Approximate Visible Reflection: 9 percent.
6. Hardness (Vicker's Scale): 700.
7. Fire-rating: 20 minutes to 3 hours for doors; 20 minutes to 90 minutes for other applications.
8. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
9. Positive Pressure Test: UL 10C, UBC 7-2 and 7-4; passes.
10. Surface Finish: Premium (polished).

D. Labeling: Permanently label each piece with the UL logo and fire rating in sizes iondicated on approved plans, and with the FireLite label only for sizes that exceed the listing as approved by DSA.

E. Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E2074-00 and ASTM E2010-01, NPFA 252 and NFPA 257.

2.2 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

A. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent. Glass panels that exceed 1,393 sq. inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.

B. Glazing Compound: DAP 33 putty.

C. Silicone Sealant ahll be approved by Glass Manufacturer: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable.
   1. Basis of Design, Available Products:
      a. Dow Corning 795 - Dow Corning Corp.
      b. Silglaze-II 2800 - General Electric Co.
      c. Spectrem 2 - Tremco Inc.

D. Setting Blocks: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.

E. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

2.3 FABRICATION

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
   2. Minimum required face or edge clearances.
   3. Observable edge damage or face imperfections.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

C. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.2 INSTALLATION (GLAZING)

A. Comply with referenced FGMA standards and instructions of manufacturers of glass, glazing sealants, and glazing compounds.

B. Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.

C. Set units of glass in each series with uniformity of pattern, draw, bow, and similar characteristics.

D. Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.

E. Place setting blocks located at quarter points of glass with edge block no more than 6 inches from corners.

F. Glaze vertically into labeled fire-rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.

G. Place glazing tape on free perimeter of glazing in same manner described above.

H. Install removable stop and secure without displacement of tape.

I. [Use specified glazing compound, without adulteration; bed glazing material in glazing compound; entirely fill all recess and spaces. Provide visible glazing compound with smooth and straight edges.]

J. Install in vision panels in fire-rated doors to requirements of NFPA 80.

K. Install so that appropriate UL markings remain permanently visible.

3.3 PROTECTION AND CLEANING

A. Protect glass from contact with contaminating substances resulting from construction operations. Remove any such substances by method approved by glass manufacturer.

B. Wash glass on both faces not more than four days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

3.4 GLAZING SCHEDULE

A. Glazing materials shall meet the following:
   1. Locations, sizes, ratings, and listings shall be per approved plans.
   2. Manufacturer's data and requirements
   3. CBC Chapter 7, glazing requirements.
   4. UBC Standard 7-2, Fire Tests of Door Assemblies.
   5. UBC Standard 7-4, Fire Tests of Window Assemblies.

END OF SECTION

SECTION 08911 - GLAZED ALUMINUM CURTAIN WALL

PART 1 - GENERAL

1.01 SUMMARY

A. Related Documents: Conditions of the Contract, Division 1 - General Requirements, and Drawings apply to Work of this Section.

B. Section Includes:
   1. Aluminum curtain wall systems, complete with reinforcing, shims, anchors, and attachment devices.
   2. Accessories necessary to complete Work.

C. Products Furnished, but Not Installed Under this Section: Inserts and anchoring devices that are to be built into structure.

D. Related Sections:

   1. Section 05500 - Metal Fabrications.
   2. Section 07900 - Joint Sealers.
   3. Section 08411 - Aluminum Entrances and Storefronts.
   4. Section 08450 - All Glass Entrances.
   5. Section 08710 - Door Hardware.
   6. Section 08810 - Glass and Glazing.

1.02 REFERENCES

A. Aluminum Association (AA):

1.	DAF-45	Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association (AAMA):

1.		Aluminum Curtain Wall Design Guide Manual.
2.	501.2	Field Check of Metal Curtain Walls for Water Leakage.
3.	2605	Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
4.	606.1	Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
5.	607.1	Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
6.	608.1	Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.
7.	701.2	Specifications for Pile Weatherstripping.
8.	Manual #10	Care and Handling of Architectural Aluminum From Shop to Site.

C. American National Standards Institute (ANSI):

1.	Z97.1	Specifications and Methods of Test for Safety Glazing Material Used in Buildings.

D. American Society for Testing and Materials (ASTM):

1.	A36	Structural Steel.
2.	A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3.	A525	General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
4.	A526	Sheet Steel, Zinc Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
5.	B209	Aluminum and Aluminum-Alloy Sheet and Plate.
6.	B221	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
7.	B308	Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded.
8.	C716	Installing Lock-Strip Gaskets and Infill Glazing Materials.
9.	C920	Elastomeric Joint Sealants.
10.	E283	Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
11.	E330	Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
12.	E331	Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
13.	E773	Test Method for Seal Durability of Sealed Insulating Glass Units.
14.	E774	Sealed Insulating Glass Units.

E. Consumer Product Safety Commission (CPSC):

1.	16 CFR 1201	Safety Standard for Architectural Glazing Materials.

F. Federal Specifications (FS):

1.	TT-P-645A	Primer, Paint, Zinc Chromate, Alkyd Type.

G. Glass Association of North America (GANA):

1.		Glazing Manual.

H. Steel Structures Painting Council (SSPC):

1.	SP2	Hand Tool Cleaning.
2.	SP3	Power Tool Cleaning.
3.	Paint 12	Cold-Applied Asphalt Mastic (Extra Thick Film).

1.03 SYSTEM REQUIREMENTS

A. General Standard: In addition to requirements shown or specified, comply with applicable provisions of Aluminum Curtain Wall Design Guide Manual for design, materials, fabrication and installation of component parts.

B. Design Requirements:
1. Metal stick framed systems with interior and exterior exposed metal framing.
2. System manufacturer shall provide low profile entrance frames as an integral part of the curtain wall system.]
3. System manufacturer shall provide curtainwall systems, including necessary modifications to meet specified requirements and maintaining visual design concepts.
4. Perimeter conditions shall allow for installation tolerances, expansion and contraction of adjacent materials, and sealant manufacturer's recommended joint design.

5. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage or moisture disposal.
6. Requirements shown by details are intended to establish basic dimension of unit, sight lines and profiles of members.
7. Do not assume glass, sealants, and interior finishes contribute to framing member strength, stiffness, or lateral stability.
8. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
9. Anchors, fasteners and braces shall be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
10. Allow for expansion and contraction due to structural movement without detriment to appearance or performance.
11. System shall drain to exterior face of wall, water entering joints and condensation occurring within system by drain holes and gutters of adequate size to evacuate water without infiltration to interior or the top of lower lites of glass.
12. Provide concealed fastening.
13. Metal faces are required to be visually flat under all lighting conditions, subject to acceptance of Architect.
14. Use dense EPDM isolators to maintain adequate compression on glazing material.
15. Provide uniform color and profile appearance at components exposed to view.
16. Provide interior dense EPDM gasket with sealed corners, with maximum 30% compression when glazed, to create a water and air seal.
17. Provide pre-punched pressure plates to ensure correct quantity and spacing of fasteners.
18. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

C. Performance Requirements:
   1. Uniform Load: A static air design load of 40 psf shall be applied in a positive and negative direction in accordance with ASTM E 330. At structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

D. Structural Requirements:
   1. Deflection under uniform loading: When tested in accordance with ASTM E330 at design pressure, maximum deflection of exterior member shall not exceed L/175 for spans up to 13'-6" or L/240 + 1/4" for spans greater than 13'-6".
   3. Parallel to wall and corner mullion deflections: 75% of glass edge bite or 3/8 inch, whichever is less.
   3. Compression flanges of flexural members may be assumed to receive effective lateral bracing only from:
      a. Anchors to building structure and
      b. Horizontal glazing rails or interior trim, which are in actual contact with compression flange.
   4. Do not regard points of contra-flexture as lateral braces or as end points of un-braced length; un-braced length is actual distance between effective lateral braces as defined above.

5. Where framing member reaction is resisted by continuous element, maximum assumed effective length of the resisting element is 4 times bearing length, but not more than 12 inches.

E. Thermal Requirements: Framing systems shall accommodate expansion and contraction movement due to surface temperature differential of 180°F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance or other detrimental effects.

F. Seismic: When tested to AAMA 501.4, system must meet design displacement of 0.010 x the story height and ultimate displacement of 1.5 x the design displacement, 0.015 x the story height, and 0.025 x the story height.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data:
1. Submit manufacturer's descriptive literature for each manufactured products.
2. Include information for factory finishes, accessories and other required components.
3. Include color charts for finish indicating manufacturer's standard colors available for selection.

C. Shop Drawings:
1. Submit drawings indicating elevations, detailed design, dimensions, member profiles, joint locations, arrangement of units, member connections, and thickness of various components.
2. Show following items:
   a. Details of special shapes.
   b. Reinforcing.
   c. Anchorage system.
   d. Interfacing with building construction.
   e. Provisions for system expansion and contraction

4. Indicate glazing details, methods, locations of various types and thickness of glass, and internal sealant requirements.
5. Clearly indicate locations of exposed fasteners and joints for Architect's acceptance.
6. Clearly show where and how manufacturer's system deviates from Contract Drawings and these Specifications.

E. Samples:
1. Submit manufactures samples indicating quality of finish in required colors.
2. Where normal texture or color variations are expected, include additional samples illustrating range of variation.
3. Submit samples of sealants for color selection.

G. Certificates:
1. Submit manufacturer's certification stating that installed system is in compliance with specified requirements.

I. Manufacturer's Instructions: Submit manufacturer's printed installation instructions. Include detailed instructions describing each step of re-glazing procedures.

J. Warranty: Submit specified warranties.

1.05 QUALITY ASSURANCE

A. Single Source Responsibility:
   1. Provide curtainwall systems that are products of a single manufacturer.

B. Engineer Qualifications: Professional Structural Engineer registered in State where Project is located.
C. Installer Qualifications: Certified in writing by system manufacturer as qualified for specified systems.

1.06 PRE-INSTALLATION CONFERENCE

A. Conduct pre-installation conference in accordance with Section 01310.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01600.
B. Protect finished surfaces to prevent damage.
C. Do not use adhesive papers or sprayed coatings, which become firmly bonded when exposed to sun.
D. Do not leave coating residue on surfaces.
E. Deliver glass units with manufacturer's labels intact on interior side of glass. Ensure labels indicate glass thickness, unit location, glass strength and orientation of units in vertical position.
F. Protect glass edges and corners to prevent chipping, cracking, and other similar damages.

1.08 PROJECT CONDITIONS

A. Ensure ambient and surface temperatures and joint conditions are suitable for installation of materials.

1.09 WARRANTY

A. Provide warranties in accordance with the General Conditions.
B. Provide written warranty in form acceptable to Owner jointly signed by manufacturer, installer and Contractor warranting work to be watertight, free from deflective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 1 year from date of Substantial Completion.
C. Warranty shall cover following:
   1. Complete watertight and airtight system installation within specified tolerances.
   2. Glass and glazing gaskets will not break or "pop" from frames due to design wind, expansion or contraction movement or structural loading.
   3. Glazing sealants and gaskets will remain free from abnormal deterioration or dislocation due to sunlight, weather or oxidation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS AND PRODUCTS

A. Subject to compliance with requirements indicated, provide products by the following:

1. Basis-of-Design: Vistawall Architectural Products, Terrell, TX.
   a. Product: RELIANCE WALL - 1/4" Glazing: 2-1/2" x 6-1/2" mullion profiles; pressure glazed, front set, exterior glazed, stick wall system.

B. Substitutions: Submit under provisions of Section 01600, a minimum of 10 days prior to bid date.

2.02 FRAMING MATERIALS AND ACCESSORIES

A. Aluminum:
   1. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.

B. Internal Reinforcing:
   1. ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
   2. Shapes and sizes to suit installation.
   3. Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with FS TT-P-645.

C. Inserts and Anchorage Devices:
   1. Manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars or tubes.
   2. Hot-dip galvanize steel assemblies after fabrication, comply with ASTM A123, 2.0 ounce minimum coating.

D. Fasteners:
   1. Non-magnetic stainless steel, compatible with materials being fastened.
   2. Provide nuts or washers of design having the means to prevent disengagement; deforming of fastener threads is not acceptable.
   4. Provide concealed fasteners wherever possible.
   5. For exposed locations, provide countersunk flathead fasteners with finish matching item fastened.

E. Shims: Non-staining, non-ferrous, type as recommended by system manufacturer.

G. Protective Coatings: Cold applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.

H. Glazing Gaskets:
   1. Compression type design, exterior replaceable, extruded EPDM. Interior is a dense EPDM [closed cell EPDM sponge] gasket.
   2. Comply with ASTM C509 or C864.

3. Profile and hardness as necessary to maintain uniform pressure for watertight seal.
4. Manufacturer's standard black color.

I. Internal Sealants: Types recommended by system manufacturer to remain permanently elastic, tacky, non-drying, non-migrating and weather-tight.

2.03 GLASS AND GLAZING ACCESSORIES

A. Refer to Section 08810.

2.04 SYSTEM FABRICATION

A. Take accurate field measurements to verify required dimensions prior to fabrication.
B. Location of exposed joints is subject to Architect's acceptance.
C. Provide dense EPDM continuous isolator to separate exterior pressure plates and interior framing members.
D. Fabricate components in accord with approved shop drawings. Remove burrs and ease edges. Shop fabricate to greatest extent practicable to minimize field cutting, splicing, and assembly. Disassemble only to extent necessary for shipping and handling limitations.
E. Steel Components:
   1. Clean surfaces after fabrication and immediately prior to application of primer in accord with SSPC-SP2 or SSPC-SP3 at manufacturer's option.
   2. Apply specified shop coat primer in accord with manufacturer's instructions to provide 2.0 minimum dry film thickness.
F. Fabricate components true to detail and free from defects impairing appearance, strength or durability. Fabricate custom extrusions indicated and as necessary for complete installation.
G. Fabricate components to allow for accurate and rigid fit of joints and corners. Match components carefully ensuring continuity of line and design. Ensure joints and connections will be flush and weather-tight. Ensure slip joints make full, tight contact and are weather-tight.
H. Reinforce components as required at anchorage and support points, at joints, and at attachment points for interfacing work.
I. Provide structural reinforcing within framing members where required to maintain rigidity and accommodate design loads.
J. System design and sealants to accommodate internal weep and drainage system not visible to the exterior.
K. Head and sill extrusions act as gutter and weep water to exterior; do not penetrate sections with fasteners.
L. Allow for adequate clearance around perimeter of system to enable proper installation and for thermal movement within system.
M. Separate dissimilar metals with protective coating or preformed separators to prevent contact and corrosion.

2.05 FINISH

A. Organic Coating (high performance fluorocarbon):
   1. Comply with requirements of AAMA 2605.

2. Surfaces cleaned and given conversion coating pre-treatment prior to application of 0.3 mil dry film thickness of epoxy or acrylic primer following recommendations of finish coat manufacturer.
3. Finish coat of 70% minimum fluorocarbon resin fused to primed surfaces at temperature recommended by manufacturer, 1.0 mil minimum dry film thickness.
4. Acceptable coatings are Trinar by Akzo Coatings, Inc.; Nubelar by Glidden Company; Fluoroceram by Morton International, Inc.; Duranar by PPG Industries Inc.; and Fluropon by Valspar Corporation.
5. Provide in either 2, 3, or 4 coat system as required for color selected.
6. Custom colors as selected by Architect.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01400.

B. Verify dimensions, tolerances, and method of attachment with other Work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and applicable provisions of AAMA Aluminum Curtain Wall Design Guide Manual.

B. Align assemblies plumb and level, free of warp or twist, aligning with adjacent Work.

C. Tolerances:
   1. Limit variations from plumb and level:
      a. 1/8 inch in 20'-0" vertically and horizontally.
      b. 1/4 inch in 40'-0" either direction.
   2. Limit offsets in theoretical end-to-end and edge-to-edge alignment:
      a. 1/16 inch where surfaces are flush or less than 1/2 inch out of flush and separated by not more than 2 inches.
      b. 1/8 inch for surfaces separated by more than 2 inches.
   3. Step in face: 1/16 inch maximum.
   4. Jog in alignment: 1/16 inch maximum.
   5. Location: 1/4 inch maximum deviation of any member at any location.
   6. Tolerances are not accumulative.

D. Provide attachments and shims to permanently fasten system to building structure.

E. Anchor securely in place, allowing for required movement, including expansion and contraction.

F. Separate dissimilar materials at contract points, including metal in contact with masonry or concrete surfaces, with protective coating or preformed separators to prevent contact and electrolytic action.

G. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weather-tight construction.

H. Glazing:

1. Install glazing gaskets and sealants in accordance with manufacturer's instructions without exception; including surface preparations. Refer to Section 08810 for additional requirements.
2. Outside glazed and held in place with extruded aluminum pressure plates anchored to the mullion using Drill-Flex fasteners spaced no greater than 9" on center.

3.03 CLEANING

A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, and other foreign materials.

B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION 08911

SECTION 09220 - PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior portland cement plasterwork (stucco) on metal lath and solid-plaster bases.
2. Plaster reinforcement.

B. Related Sections include the following:

1. Division 7 Section "Joint Sealants" for acoustical sealants and sealants installed with exterior portland cement plaster (stucco).

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

C. Samples for Initial Selection: For each type of factory-prepared finish coat indicated.

D. Samples for Verification: For each type of textured finish coat indicated; 12 by 12 inches and prepared on rigid backing.
1. Provide samples where supporting handrails (CBC 1133B.4.2.6.1).

1.4 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Interior Plasterwork: Maintain room temperatures at greater than 40 deg F (4.4 deg C) for at least 48 hours before plaster application, and continuously during and after application.

1. Avoid conditions that result in plaster drying out during curing period. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
2. Ventilate building spaces as required to remove water in excess of that required for hydrating plaster in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

C. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

D. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 METAL LATH

A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating, structural quality. 3.4 pounds per square yard, with deformed V-groove, rib depth of not over 1/8-inch.

1. Manufacturers:

a. Alabama Metal Industries Corporation (AMICO).
b. California Expanded Metal Products Company (CEMCO).
c. Western Metal Lath & Steel Framing Systems.

2. Diamond-Mesh Lath: Self-furring.

   a. Weight: 3.4 lb/sq. yd.

3. Flat Rib Lath: Rib depth of not more than 1/8 inch (3.1 mm).

   a. Weight: 3.4 lb/sq. yd.

4. 3/8-Inch (9.5-mm) Rib Lath:

   a. Weight: 3.4 lb/sq. yd.

B. Wire-Fabric Lath:

1. Manufacturers:

   a. Davis Wire Corporation.
   b. Jaenson Wire Company.
   c. Keystone Steel & Wire.
   d. K-Lath; Division of Georgetown Wire.

2. Welded-Wire Lath: ASTM C 933; self-furring.

   a. Weight: 1.4 lb/sq. yd.

3. Woven-Wire Lath: ASTM C 1032; self-furring, with stiffener wire backing.

   a. Weight: 1.4 lb/sq. yd.

C. Primary Barrier: Water-resistant Grade D building paper, laminated, vapor-permeable, reinforced kraft-type paper with asphalt-treated core, complying with UBC Standard 14-1, Super Jumbo-Tex, Fortifiber Corporation, Incline Village, NV (775/833-6161 or 800/443-4079), or equivalent product.

D. Secondary Barrier: Self-sealing, fully-adhered rubberized asphalt composite sheet membrane as specified in Section 07650-Flexible Flashing, for sealing around openings, at parapets, at projections from plaster wall finish, and under exterior stucco on horizontal surfaces, excluding ceilings. All surfaces 30 degrees or more inclined from vertical shall be considered horizontal planes.

1. Amico-West, Inc. Fontana, CA (909/350-9280).
2. California Expanded Metal Company (CEMCO), Industry, CA (800/775-2362).
3. Western Metal Lath Co., Riverside, CA (800/365-5284).

E. Plaster Reinforcement, General:

1. Provide separate application of buildings paper (weather-barrier) and mesh (plaster reinforcement).
2. Do not use paper-backed lath.

F. Plaster Reinforcement, Walls: Expanded metal lath complying with ASTM C 847, structural-quality, zinc-coated (galvanized) steel, 3.4 pounds per square yard, with deformed V-groove, rib depth of not more than 1/8-inch.

G. Plaster Reinforcement, Soffits and Other Locations as Indicated: Expanded metal lath, galvanized steel 3.4 pounds per square yard, standard mesh for framing not over 16-inches and 3/8-inch ribbed lath for framing not over 24-inches on center.

H. Wire Ties: Galvanized soft steel wire; 0.048-inch (18 gage).

I. Reinforcement Fasteners: Fasteners to rigidly secure lath and other reinforcement and accessories to substrate in compliance with California Building Code (CBC) Paragraph 2506A.5, keeping lath and other reinforcement minimum ¼-inch away from substrate.

2.3 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required. All material shall be minimum 0.027-inch thickness unless greater thickness is noted. Steel products shall be hot-dipped galvanized.

B. Zinc and Zinc-Coated (Galvanized) Accessories:

1. Manufacturers:

   a. California Expanded Metal Products Company (CEMCO).
   b. Delta Star, Inc.
   c. Flannery, Inc.

2. Foundation Screed: Weep-Aid woven wire weep screed/stucco stop by Stockton Wire Products, size and configuration as indicated on the Drawings, ICC Evaluation Service, Inc. (ICC ES) Report No. 1186.
3. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
4. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
5. Cornerbeads: Fabricated from zinc-coated (galvanized) steel.

   a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.
   b. Small nose cornerbead with perforated flanges; use on curved corners.
   c. Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing masonry corners.
   d. Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum, with expanded flanges; use at locations indicated on Drawings.

6. Casing Beads: Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges. Wire-PNLF by Stockton Wire Products.
7. Control Joints: Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint. Products by Stockton Wire Products indicated.

a. Pointed base screed: Metal-PBS.
b. Narrow V-screed: Metal-NVS.
c. Wide V-screed: Metal-WVS.

8. Expansion Joints: Fabricated from zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
9. Two-Piece Expansion Joints: Fabricated from zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4-to-5/8-inch (6.34-to-16mm) wide; with perforated flanges.

2.4 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in portland cement plaster.

C. Bonding Compound: ASTM C 932.

D. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of not fewer than three exposed threads.

E. Fasteners for Accessories, General: Nails, staples, tie wire and other metal fasteners as recommended by manufacturer and complying with requirements of California Building Code (CBC), Paragraph 2506A.5, of type and size to suit application, galvanized steel, to rigidly secure lath and metal accessories.

F. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), unperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.1 mm) thick, in width to suit steel stud size.

G. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products:

a. OSI Sealants, Inc.; Pro-Series, SC 175 Acoustical Sound Sealant Non-Flammable - Latex.
b. Pecora Corporation; AC-20 + Silicone.
c. Tremco Incorporated; Tremflex 834.
d. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

H. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

1. Products:

a. OSI Sealants, Inc.; Pro-Series SC 170 Acoustical Sound Sealant - Solvent.
b. Pecora Corporation; BA-98.
c. Tremco, Inc.; Tremco Acoustical Sealant.

2.5 PLASTER MATERIALS

A. Portland Cement: ASTM C 150, Type I.

1. Color for Finish Coats: White.

B. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

C. Sand Aggregate: ASTM C 897.

1. Color for Job-Mixed Finish Coats: White.

D. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients. Prepared premix cement-base waterproof textured coating plaster, ANSI A42.2, cement-lime mix, with 20 mesh aggregate, suitable for specified finish texture.

1. Products:

a. Omega Products International, Inc.
b. Highland Stucco & Lime Products, Inc.
c. LaHabra Stucco
d. Meflex Stucco, Inc.

2. Color: As selected by Architect from manufacturer's full range.

E. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems, formulated with colorfast mineral pigments and fine aggregates; for use over portland cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.

F. Bonding Agent: For concrete surfaces, Weld-Crete by Larsen, Thorobond by Thoro System Products or equal as acceptable to plaster finish manufacturer.

G. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.

2.6 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.

1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. ft. (16 kg of fiber/cu. m) of cementitious materials. Reduce aggregate quantities accordingly to maintain workability.

B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:

1. Portland Cement Mixes:
   a. portland cement plaster mix: Parex Fiber 47 manufactured by Paraex, Inc., fiber-reinforced, factory-blended scratch and brown coat plaster mix for three-coat plaster systems, complying with ASTM C 926, or equal.
   b. Aggregate: Clean, graduated sand, ASTM C144 or ASTM C 897, uncoated particles free from silt, loam, clay, salt and other deleterious materials, well-graded in sizes from fine to coarse, for field mixing with factory-blended plaster mix.
   c. Mix: Comply with manufacturer's instructions and recommendations, ASTM C 926 and California Buiding Code (CBC) Table 25A-F.
   d. Admixture: En-Rock FR 100 Base Coat Admix, containing not less than 40 percent polymer solids.

C. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plasters comply with manufacturer's written instructions.

D. Bonding Agent: For concrete surfaces, Weld-Crete by Larsen, Thorobond by Thoro System Products or equal, as acceptable to plaster mix manufacturer, suitable for required surface finish.

E. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Substrate:

1. Sheathing: verify that wall sheathing complies with requirements of plaster system manufacturer.

2. Framing: Coordinate framing installation to provide double studs at expansion joints in plaster, to ensure proper support for attachment of expansion joint trim without transfer or stress across joint.

B. Protection:

1. Protect adjacent Work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering. Provide masking and covers as necessary.
2. Protect against inclement weather during plastering system installation, including infiltration of moisture behind system to prevent wetting of wood framing and sheathing.
3. Protect against wind damage to weather barrier (building papper).

3.3 INSTALLATION, GENERAL

A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.

B. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.

C. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

3.4 UNDERLAYMENT INSTALLATION

A. Building Paper Underlayment (Weather Barrier): Provide separate building paper moisture barrier and metal lath complying with the following. Do not use paper-backed lath.

1. Moisture barrier at walls: Minimum of 2 layers of 60-Minute Grade D kraft-type building paper, installed according to California Building Code (CBC) Section 1402.1, free from holes and breaks other than those necessary for fasteners and building system penetrations.

   a. Apply building paper separate from metal lath.
   b. Apply building paper underlayment horizontally, with upper layer overlapped over lower level not less than 2-inches.
   c. Minimize vertical joints. Where vertical joints occur, lap building paper underlayment not less than 6-inches.

2. Moisture barrier at wall caps, parapets and other weather-exposed horizontal plastered surfaces: Do not use building paper. Provide elastomeric flashing as specified in Section 07650-Flexible Flashing.

B. Penetration Sealing: Seal all penetrations through paper from backside using non-staining sealant as specified in Section 07900-Joint Sealers.

3.5 LATH AND ACCESSORIES INSTALLATION

A. Lath and Accessores Installation, General: Comply with referenced industry standards and California Building Code (CBC), Section 2605A.5.

1. Install lath and accessories in compliance with manufacturer's instructions and recommendations.
2. Install lath with nails or staples to provide minimum ¼-inch furring away from vertical supports or backing, in compliance with California Building Code (CBC), Section 2506A.5 and Table 25A-B, footnote 2.

B. Vertical Stress Relief (Control) and Expansion Joints Installation: Coordinate framing installation to provide double studs stress relief (control) and expansion joints to ensure proper support for attachment of joints without transfer of stress across joint.

1. Install expansion (movement) joints where indicated on Drawings.
2. Provide control joints where indicated on the Drawings.
3. Joints shall extend full width or height of the plaster panel.
4. At sheatherd walls, back expansion joints with full-length, 9-inch iwde strip of flexible (elastomeric) flashing.
5. Install joints with flanges under lath and attach to substrate with nails or staples spaced 6-inches apart on each flange.
6. Break supporting members and sheathing, if provided, behind vertical stress relief joints. Attach separate flanges of vertical stress relief joints and ends of lath on separate supports.
7. Discontinue lath at vertical stress relief (control) joints but keep weather barrier continuous.
8. Install vertical control joints and reveals first. Then, install horizontal control joints.
9. Install expansion joints at transitions from concrete or masonry construction to steel to wood studs framing and at joist line at multi-story construction.

C. Reveals: Install plaster channel screeds and vented channel screeds at locations shown on the Drawings.

1. Discontinue lath behind revels but keep weather barrier continuous. Coordinate framing installation to provide double studs for proper attachment of lath.
2. Provide factory-made intersections at reveal-to-reveal and reveal-to-control joint intersections in aluminum trim.

D. Intersections: Bed and seal intersections and butt joints in sealant, to shed water.

E. Plaster Stops (Casing Beads): Provide casing beads at all location where plaster terminates or abuts dissimilar materials. Apply casing beads where indicated in Drawings and as follows:

1. Apply casing beads at junctions of plaster with concrete and masonry surfaces throughout.
2. Install casing beads around frames of all doors, windows, and louvers which do not provide integral plaster stops.
3. Install casing beads at top and side s of plaster wall panels which abut concrete floors or underside of slab above.
4. Hold casing beads back 3/8-inch minimum and ½-inch maximum from abutting frames and other elements, to provide suitable joint for sealant.

F. Weep Screeds:

1. Provide weep screeds at bottoms of all plaster wall panels and at other locations which may be indicated on Drawings.
2. Provide weep screeds also wherever horizontal transition occurs between stud construction and concrete and masonry construction.
3. Provide weep screeds also where plaster finish terminates at floors and decks.

G. Lath Installation: Install metal lath taut, with long dimension perpendicular to supports, in compliance with California Building Code (CBC), Table 25A-B.

1. Install ribbed diamond mesh ensuring minimum ¼-inch furring away from framing. Lap sides minimum ½-inch and lap ends minimum 1-inch.
2. Nest outside ribs of rib lath together.

H. Corner Reinforcement and Cornerite: Apply corner reinforcement on external arrises, straight, plumb and level as required. Install cornerite on re-entrant, internal angles wherever lath does not extend one full stud space beyond the corner.

I. Metal Plaster Stops: Apply at plaster endings throughout. Apply at junctions of plaster and concrete surfaces throughout. Apply where indicated on Drawings.

J. Opening reinforcement: At woven wire hexagonal mesh reinforcement, place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

3.6 PLASTERING, GENERAL

A. Industry Standard: Comply with detailed requirements of ASTM C 926-Standard Specification of Application of Portland Cement-Based Plaster, in addition to the following requirements.

B. Mixing: Comply with manufacturer's instructions and recommendations. Use only sufficient water to produce mix of a workable consistency and uniform content color, considering substrate conditions suction of base or preceding coats, water content of aggregate, drying conditions and finishing operations.

C. Retempering: Retempering of plaster will not be permitted.

D. Application, General: Force Portland cement plaster through openings in lath and completely embed metal. Continuously apply plaster coasts in one general direction without allowing plaster to dry at edges. If full width of wall cannot be covered at one time, terminate application at natural division of surface such as control joint or inside corner.

E. Curing techniques: Moist cure plaster in conformance to California Building Code (CBC) requirements. Moist curing shall be done with a fine fog spray as soon as plaster has set.

1. Avoid soaking and saturating plaster.
2. On hot and sunny days fog spraying may be needed frequently.

F. Curing Protection: Protect each coat of plaster from curing too rapidly or too slowly. Protect plaster by tarpaulins hung over the outside of building when environmental conditions are detrimental. Protect plaster applied during cold weather against freezing for at least two days after application.

3.7 PLASTERING, BASE COATS

A. First, (Scratch) Coat Application: Use factory-blended plaster mix

1. Apply first (scratch) coat with sufficient material to completely embed lath and form effective keys through lath.
2. Embed and fill all spaces in lath and rod surfaces true without addition of water.
3. Allow plaster to set slightly and then score surfaces in direction perpendicular to direction of supporting framing.
4. Double back will be accepted if weather conditions permit and if approved in advance by plaster system technical consultant.
5. Approximate thickness: 3/8-inch minimum over lath; ¼-inch minimum to 3/8-inch maximum over concrete and masonry.

B. First (scratch) Coat Curing:

1. Minimum Period of Moist Curing: 48 hours.
2. Minimum Interval Between Coats: 48 hours.
3. Repairs: Make all repairs to first (scratch) coast before application of second (brown) coat.

C. Second (brown) Coat Application: Use factory-blended plaster mix.

1. Apply second (brown) coat to first (scratch) coat, bringing surface out to grounds to true surface free of imperfections that will be apparent in finish coat.
2. Reconsolidate plaster by only slightly floating after hydration of cement has commenced and sufficient moisture has evaporated, so that surface has disappeared but before plaster has become too rigid to be moved under float. Immediately cut back plaster 1/16-inch around trim edges with steel trowel so finish coat will be flush with top of edge of trim.
3. Trowel finish surface to slightly rough condition, only enough to ensure bond of finish coat.
4. Approximate thickness: First and Second Coats total ¾-inch minimum over lath; ½-inch minimum to ¾-inch maximum over concrete and masonry.

D. Second (Brown) Coat Curing:

1. Minimum Period of Moist Curing: 48 hours.
2. Minimum Interval Between Coats: 7 days.
3. Make all repairs to first (scratch) coast before application of second (brown) coat.

3.8 FINISH COAT APPLICATION

A. Finish Coat Preparation: Clean basecoat plaster substrate as necessary to ensure bond of finish coat. Patch and smooth basecoat as necessary, removing arrises and high spots.

B. Finish (Smooth) Coat Application: Comply with manufacturer's instructions and recommendations and directions of manufacturer's technical consultant.

1. Mix factory-prepared coating with only water, in accordance with manufacturer's printed instructions.
2. Apply finish to patched, smoothed and cleaned basecoat.
3. Apply finish so that entire wall of soffit panel can be completed in one operation, to eliminate joining lines and overlaps. Cold joints and overlaps will be unacceptable.
4. Apply first coat of acrylic base coating, immediately followed by embedding of glass fiber mesh, smoothing and fully embedding mesh to produce continuous, wrinkle-free installation. Use special detailing mesh where appropriate. Apply additional acrylic base coating and embed glass fiber mesh corner mesh at corners, with mesh continuous at corners and lapped or otherwise treated at flat areas.
5. Break glass fiber mesh at substrate expansion (movement) joints.
6. Apply additional acrylic base coat to completely embed glass fiber mesh so that mesh pattern is not visible. Smooth trowel surface and prepare for application of smooth finish coat.
7. Apply skim coat of acrylic base coat, approximately, 1/16-inch thick over reinforced acrylic base coat. Allow skim coat to begin to set, then double back with second coat approximately 1/16-inch thick, using chrome-plated trowel. Allow second coat to slightly set and then trowel smooth without leaving directional lines or swirls or burnish marks.
8. Finish coat shall be flat, smooth and uniform in appearance .
9. Apply single coat, fully compacting surface.
10. Hand trowel and float upon initial set to a fine and uniform texture, free from swirls and without scaffold lines.

C. Approximate Minimum Thickness: First, Second and Finish Coats total 7/8-inch over lath and 7/8-inch minimum to 1-1/2-inch maximum over concrete and masonry.

D. Finish Texture: Match accepted mockup and, as applicable, adjoining surfaces.

1. Textures shall be applied uniformly, with no variations in color or shade, and free from joinings created by Work interruptions.
2. Unless otherwise indicated, provide finish to match existing Portland cement plaster. Where there is no appropriate existing plaster, provide fine sand finish.

E. Paint Finish: After curing, clean and prepare plaster surface to receive primer and finish coats of paint as specified in Section 09911-Field Painting.

3.9 CUTTING AND PATCHING

A. Cut, patch, replace, and repair plaster as necessary to accommodate other work and to restore cracks, dents, and imperfections. Repair or replace work to eliminate blisters, buckles, crazing

and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.10 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from doorframes, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09220

SECTION 09260 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior gypsum wallboard.
2. Tile backing panels.
3. Non-load-bearing steel framing.

B. Related Sections include the following:

1. Division 5 Section "Cold-Formed Metal Framing" for load-bearing steel framing.
2. Division 6 Section "Rough Carpentry" for wood framing and furring[, and gypsum sheathing applied over wood framing].
3. Division 7 Section "Building Insulation" for insulation and vapor retarders installed in gypsum board assemblies.
4. Division 9 Section "Porcelain Tile" for cementitious backer units installed as substrates for ceramic tile.

1.3 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.

1.5 QUALITY ASSURANCE

A. Comply with the following as a minimum requirements:

1. NFPA or ULI requirements for fire-rated assemblies per ASTM E119.

2. Underwriters Laboratories (ULI) requirements and listings for fire-rated materials and products classification.
3. ASTM C 36 - Gypsum Wallboard.
4. ASTM C 645 - Nonstructural Steel Framing Members.
5. ASTM C 840 - Application and Finishing of Gypsum Board.
6. ASTM C 841 - Installation of Interior Lath and Furring.
7. ASTM C 1002 - Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.
8. ASTM C 1047 - Accessories for Gypsum Wallboard and Gypsum Veneer Base.

B. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Framing and Furring:

a. Clark Steel Framing Systems.
b. Consolidated Systems, Inc.
c. Dale Industries, Inc. - Dale/Incor.
d. Dietrich Industries, Inc.
e. MarinoWare; Division of Ware Ind.
f. National Gypsum Company.
g. Scafco Corporation.
h. Unimast, Inc.
i. Western Metal Lath & Steel Framing Systems.

2. Gypsum Board and Related Products:

a. American Gypsum Co.
b. G-P Gypsum Corp.
c. National Gypsum Company.
d. United States Gypsum Co.

2.2 STEEL SUSPENDED CEILING FRAMING

A. Components, General: Comply with ASTM C 754 for conditions indicated.

B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

C. Hanger Attachments to Concrete: As follows:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.

2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

D. Hangers: As follows:

1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.
2. Rod Hangers: ASTM A 510 (ASTM A 510M), mild carbon steel.

3. Flat Hangers: Commercial-steel sheet, G60, hot-dip galvanized.

a. Size: As indicated.

4. Angle Hangers: ASTM A 653/A 653M, G60, hot-dip galvanized commercial-steel sheet.

a. Minimum Base Metal Thickness: As indicated.
b. Size: As indicated.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch (1.37 mm), a minimum 1/2-inch- (12.7-mm-) wide flange, with G60, hot-dip galvanized zinc coating.

1. Depth: As indicated.

F. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653, G60, hot-dip galvanized zinc coating.

1. Steel Studs: ASTM C 645.

a. Minimum Base Metal Thickness: As indicated.
b. Depth: As indicated.

2. Minimum Base Metal Thickness: As indicated.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

1. Minimum Base Metal Thickness: As indicated.

H. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.

2.3 STEEL PARTITION FRAMING

A. Components, General: As follows:

1. Comply with ASTM C 754 for conditions indicated.
2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with G60 hot-dip galvanized zinc coating.

B. Steel Studs and Runners: ASTM C 645.

1. Minimum Base Metal Thickness: As indicated.
2. Depth: As indicated.

C. Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch- deep flanges.

1. General. Joints installed in or between in or between fire-resistance-rated walls, floor or floors/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved fire-resistant joint system designed to resist the passage of fire for a time period not less than the required fire-resistance rating of the wall, floor or roof in or between which it is installed. Fire-resistant joint systems shall be tested in accordance with CBC Section 712.3. The void created at the intersection of a floor/ceiling assembly and the an exterior curtain wall assembly shall be protected in accordance with CBC Section 712.4.

2. Installation. Fire-resistant joint systems shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and to resist the passage of fire and hot gases.

3. Fire test criteria. Fire-resistant joint systems shall be tested in accordance with requirements of UL 2079.

D. Proprietary Deflection Track: Steel sheet top runner manufactured to prevent cracking of gypsum board applied to interior partitions resulting from deflection of structure above; in thickness indicated for studs and in width to accommodate depth of studs.

1. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Product: Subject to compliance with requirements, provide one of the following:

a. Delta Star, Inc., Superior Metal Trim; Superior Flex Track System (SFT).
b. Metal-Lite, Inc.; Slotted Track.

E. Proprietary Firestop Track: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Product: Subject to compliance with requirements, provide one of the following:

a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
b. Metal-Lite, Inc.; The System.

F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

G. Cold-Rolled Channel Bridging: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange.

1. Depth: As indicated.
2. Clip Angle: 1-1/2 by 1-1/2 inch 0.068-inch- thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: As indicated.
2. Depth: As indicated.

3. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

I. Cold-Rolled Furring Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange.

1. Depth: As indicated.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0312 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

K. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.4 INTERIOR GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Gypsum Wallboard: ASTM C 36.

1. Regular Type:

a. Thickness: As indicated.
b. Long Edges: Tapered.
c. Location: As indicated.

2. Type X:

a. Thickness: As indicated.
b. Long Edges: Tapered.
c. Location: As indicated.

C. Flexible Gypsum Wallboard: ASTM C 36, manufactured to bend to fit tight radii and to be more flexible than standard regular-type panels of the same thickness.

1. Thickness: 1/4 inch.
2. Long Edges: Tapered.
3. Location: At curved partitions. Apply in double layer at curved assemblies.

2.5 TILE BACKING PANELS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Water-Resistant Gypsum Backing Board: ASTM C 630.

1. Core: 5/8 inch, Type X.

C. Cementitious Backer Units: ANSI A118.9.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Custom Building Products; Wonderboard.
b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
c. United States Gypsum Co.; DUROCK Cement Board.

3. Thickness: 1/2 inch.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

a. Cornerbead: Use at outside corners, unless otherwise indicated.
b. Bullnose Bead: Use where indicated.
c. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
d. L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound; use at exposed panel edges and where indicated.
f. Expansion (Control) Joint: Use where indicated.
g. Curved-Edge Cornerbead: With notched or flexible flanges; use at curved openings.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.
2. Glass-Mat, Water-Resistant Backing Panel: As recommended by manufacturer.
3. Cementitious Backer Units: As recommended by manufacturer.

2.8 ACOUSTICAL SEALANT

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

2. Acoustical Sealant for Concealed Joints:

a. Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
b. Pecora Corp.; BA-98.
c. Tremco, Inc.; Tremco Acoustical Sealant.

C. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant[, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24),] complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

D. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant[, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24),] recommended for sealing interior concealed joints to reduce airborne sound transmission.

2.9 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

F. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

1. Furnish concrete inserts and other devises indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed-on fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLING STEEL FRAMING, GENERAL

A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.

1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.

a. Use deep-leg deflection track where indicated.
b. Use proprietary deflection track where indicated.
c. Use proprietary firestop track where indicated.

D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Suspend ceiling hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.

8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet measured lengthwise on each member and transversely between parallel members.

C. Sway-brace suspended steel framing with hangers used for support.

D. Screw furring to wood framing.

E. Wire-tie furring channels to supports, as required to comply with requirements for assemblies indicated.

F. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

G. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLING STEEL PARTITION FRAMING

A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.

1. Where studs are installed directly against exterior walls, install asphalt-felt or foam-gasket isolation strip between studs and wall.

B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

1. Cut studs 1/2 inch short of full height to provide perimeter relief.
2. For fire-resistance-rated and STC-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.

a. Terminate partition framing at suspended ceilings where indicated.

D. Install steel studs and furring as indicated on Drawings

E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.

F. Curved Partitions:

1. Cut top and bottom track (runners) through leg and web at 2-inch intervals for arc length. In cutting lengths of track, allow for uncut straight lengths of not less than 12 inches at ends of arcs.
2. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
3. Support outside (cut) leg of track by clinching steel sheet strip, 1-inch- high-by-thickness of track metal, to inside of cut legs using metal lock fasteners.
4. Begin and end each arc with a stud, and space intermediate studs equally along arcs at stud spacing recommended in writing by gypsum board manufacturer for radii indicated. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.

G. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Install two studs at each jamb, unless otherwise indicated.
2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint.
3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

H. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

I. Z-Furring Members:

1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
4. Until gypsum board is installed, hold insulation in place with 10-inch staples fabricated from 0.0625-inch- diameter, tie wire and inserted through slot in web of member.

3.6 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members using resilient channels, or provide control joints to counteract wood shrinkage.

I. Form control and expansion joints with space between edges of adjoining gypsum panels.

J. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

L. Floating Construction: Where feasible, including where recommended in writing by manufacturer, install gypsum panels over wood framing, with floating internal corner construction.

M. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.

N. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.

1. Space screws a maximum of 12 inches o.c. for vertical applications.

O. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

3.7 PANEL APPLICATION METHODS

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

   a. Stagger abutting end joints not less than one framing member in alternate courses of board.
   b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

B. Multilayer Application on Ceilings: Apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

C. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

1. Z-Furring Members: Apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

D. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

E. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws].

F. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

G. Curved Partitions:

1. Install panels horizontally and unbroken, to the extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. Wet gypsum panels on surfaces that will become compressed where curve radius prevents using dry panels. Comply with gypsum board manufacturer's written recommendations for curve radii, wetting methods, stacking panels after wetting, and other preparations that precede installing wetted gypsum panels.
3. On convex sides of partitions, begin installation at one end of curved surface and fasten gypsum panels to studs as they are wrapped around curve. On concave side, start fastening panels to stud at center of curve and work outward to panel ends. Fasten panels to framing with screws spaced 12 inches o.c.
4. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.
5. Allow wetted gypsum panels to dry before applying joint treatment.

H. Tile Backing Panels:

1. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
2. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
3. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.8 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:

1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies].

2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile and where indicated.
3. Level 3: Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges where indicated.
4. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.
5. Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface where indicated.
   a. **Application: For use where gloss semi-gloss, enamel, or nontextured flat paints are specified or where severe lighting conditions occur. Generally in all areas except where noted otherwise.**

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:

   a. Installation of 80 percent of lighting fixtures, powered for operation.
   b. Installation, insulation, and leak and pressure testing of water piping systems.
   c. Installation of air-duct systems.
   d. Installation of air devices.
   e. Installation of mechanical system control-air tubing.
   f. Installation of ceiling support framing.

END OF SECTION 09260

SECTION 09300 - TACTILE/DETECTABLE WARNING SURFACE TILE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes furnishing and installing cast-in-place tactile tile modules.

1.02 REFERENCES

A. California Code of Regulations (CCR):
   1. 2001 California Building Code (Part 2, Title 24, CCR).

B. United States Equal Employment Opportunity Commission and the United States Department of Justice:
   1. American with Disabilities Act Accessibility Guidelines (ADAAG).

C. United States General Services Administration, Federal Supply Service, Specification Section:
   1. Federal Standard 595B – Colors Used in Government Procurement.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.

B. Samples for Verification Purposes: Submit two (2) tile samples minimum 6"x8" of the kind proposed for use.

C. Shop drawings are required for products specified showing fabrication details; composite structural system; plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.

D. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on a cast-in-place tactile tile system as certified by a qualified independent testing laboratory.

E. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile tile and accessory as required.

F. Manufacturer's Certificate: Certify products meet or exceed requirements.

1.04 CLOSEOUT SUBMITTALS

A. Section 01770 – Closeout Procedures: Requirements for submittals.

B. Project Record Documents: Record actual locations of Tactile/Detectable Warning Surface Tile.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum years documented experience approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept Tactile Warning Surface Tile on site. Inspect for damage.

C. Protect the elements.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install when temperature is 40°F below or when expected to fall below 40°F for 72 hours of installation any period or time within.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Section 01310 – Project Management and Coordination.

1.10 WARRANTY

A. Section 01700 - Execution Requirements: Requirements for warranties.

B. Furnish five year manufacturer's warranty for defective work, breakage, deformation and loosening of tiles.

PART 2 - PRODUCTS

2.01 TACTILE/DETECTABLE WARNING SURFACE TILE

A. Manufacturers:
1. Engineered Plastics Inc., (800) 682-2525 Model Armor Tile.
2. Or equal.
3. Substitutions: Section 01600 - Product Requirements.

2.02 COMPONENTS

A. Vitrified Polymer Composite (VPC) cast-in-place tiles shall be an epoxy polymer composition with an ultra violet stabilized coating employing aluminum oxide particles in the truncated domes. The tile shall incorporate an in-line dome pattern of truncated domes 0.2" in height, 0.9" diameter at the base, and 0.4" diameter at top of dome spaced 2.35" nominal as measured on a diagonal and 1.70" nominal as measured side by side. For wheelchair safety the field area shall consist of a non-slip surface with a minimum of 40 - 90° raised points 0.045" high, per square inch.

1. Dimensions: Tile Assemblies shall be held within the following dimensions and tolerances:

Length and Width:	:	12"x12" nominal
Depth	:	1.400" ± 5% max.
Face Thickness	:	0.1875 ± 5% max.
Warpage of Edge	:	± 0.5% max.

2. Water Absorption of Tile when tested by ASTM-D 570 not to exceed 0.35%.

3. Slip Resistance of Tile when tested by ASTM-C 1028 the combined wet/dry static co-efficient of friction not to be less than 0.90 on top of domes and field area.

4. Compressive Strength of tile when tested by ASTM-D 695-91 not to be less than 18,000 psi.

5. Tensile Strength of Tile when tested by ASTM-D 638-91 not to be less than 10,000 psi.

6. Flexural Strength of Tile when tested by ASTM - C293-94 not to be less than 24,000 psi.

7. Chemical Stain Resistance of Tile when tested by ASTM-D 543-87 to withstand without discoloration or staining - 1% hydrochloric acid, urine, calcium chloride, stamp pad ink, gum and red aerosol paint.

8. Abrasive Wear of Tile when tested by BYK - Gardner Tester ASTM-D 2486* with reciprocating linear motion of 37 ± cycles per minute over a 10" travel. The abrasive medium, a 40 grit Norton Metallite sand paper, to be fixed and leveled to a holder. The combined mass of the sled, weight and wood block to be 3.2 lb. Average wear depth shall not exceed 0.030 after 1000 abrasion cycles measured on the top surface of the dome representing the average of three measurement locations per sample.

9. Fire Resistance: When tested to ASTM E84 flame spread be less than 25.

10. Gardner Impact to geometry "GE" of the standard when tested by ASTM-D 5420-93 to have a mean failure energy expressed as a function of specimen thickness of not less than 450 in. 1bf/in. A failure is noted if a hairline fracture is visible in the specimen.

11. Accelerated Weathering of Tile when tested by ASTM-G26-95 for 2000 hours shall exhibit the following result - no deterioration, fading or chalking of surface of tile.

B. Vitrified Polymer Composite (VPC) Cast-In-Place Tiles embedded in concrete shall meet or exceed the following test criteria:

1. Accelerated Aging and Freeze Thaw Test of Tile when tested to ASTM-D 1037 shall show no evidence of cracking, delamination, warpage, checking, blistering, color change, loosening of tiles or other defects.

2. Salt and Spray Performance of Tile and Adhesive System when tested to ASTM-B 117 not to show any deterioration or other defects after 100 hours of exposure.

C. Color: Yellow conforming to Federal color No. 33538. Color shall be homogeneous throughout the tie.

2.03 INSTALLATION

A. During all concrete pouring and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

B. The specifications of the concrete sealants and related materials shall be in strict accordance with the contract documents and the guidelines set by their respective manufacturers.

C. The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of 4 - 7 to permit solid placement of the Cast-In-Place Tile System. An overly wet mix will cause the Cast-In-Place System to float, therefore under these conditions suitable weights such as 2 concrete blocks or sandbags (25 lb) shall be placed on each tile.

D. Prior to placement of the Cast-In-Place System, the contract drawings shall be reviewed.

E. The concrete pouring and finishing operations require typical mason's tools, however, a 4' long level with electronic slope readout, 25 lb. weights, vibrator and small sledge hammer with 2" x 6" x 20" wood tamping plate are specific to the installation of the Cast-In Place System.

F. The concrete shall be poured and finished, true and smooth to the required dimensions and slope prior to tile placement. Immediately after finishing the concrete, the electronic level should be used to check that the required slope is achieved. The tile shall be placed true and square to the curb edge in accordance with the contract drawings. The Cast-In-Place Tiles shall be tamped or vibrated into the fresh concrete to ensure that the field level of tile is flush to the adjacent concrete surface. The contract drawings indicate that the tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes. The tolerance for elevation differences between tile and adjacent surface is 1/16".

G. Immediately after tile placement, the tile elevation is to be checked to adjacent concrete. The tile elevation and slope should be set consistent with contract drawings to permit water drainage to curb as the design dictates.

H. While concrete is workable a steel trowel shall be used to trowel the concrete around the tile perimeter to the field level of the tile.

I. During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external forces placed on the tile to rock the tile, causing a void between the underside of tile and concrete.

J. Following tile placement, review installation tolerances to contract drawings and adjust tile before the concrete sets, 2 suitable weights of 25 lb each shall be placed on each tile as necessary to ensure solid contact of tile underside of concrete.

K. Following the curing of the concrete, the protective plastic wrap is to be removed from the tile face by cutting the plastic with a sharp knife tight to the concrete/tile interface. If concrete bleeding occurs, a wire brush will clean the residue without damage to the tile surface.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work. If conditions are not acceptable to begin installation of the work notify the contractor and the Owner in writing immediately. Beginning any part of the work indicates acceptance of the conditions by this installer and all remedial work shall be done at this installer expense.

3.02 ERECTION TOLERANCES

A. Section 01430 - Quality Requirements: Tolerances.

B. Maximum Variation From 1/8 inch from required level.

C. Maximum Offset From Indicated Alignment.1/8 inch maximum.

3.03 FIELD QUALITY CONTROL

A. Section 01430 - Quality Requirements 01700 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

3.04 CLEANING

A. Section 01700 - Execution Requirements: Requirements for cleaning.

B. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile tile by method specified by tactile tile manufacturer.

3.05 PROTECTION OF FINISHED WORK

A. Section 01700 - Execution Requirements: Requirements for protecting finished Work.

B. Do not permit traffic over tile surface for a period of 72 hours.

C. Protect tiles against damage during construction period to comply with tactile tile manufacturer's specification.

D. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

END OF SECTION

SECTION 09310 – PORCELAIN TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Ceramic mosaic tile.
2. Glazed wall tile.
3. Porcelain Tile
4. Marble thresholds installed as part of tile installations.
5. Waterproof membrane for thin-set tile installations.
6. Crack-suppression membrane for thin-set tile installations.
7. Metal edge strips installed as part of tile installations.
8. Setting Mortar & Grout.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.
2. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
3. Division 9 Section "Gypsum Board Assemblies" for cementitious backer.

1.3 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. Facial Dimension: Actual tile size (minor facial dimension as measured per ASTM C 499).

C. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.
2. Step Treads: Minimum 0.6.

3. Ramp Surfaces: Minimum 0.8.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Stone thresholds in 6-inch lengths.
5. Metal edge strips in 6-inch lengths.

E. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

F. Product Certificates: For each type of product, signed by product manufacturer.

G. Qualification Data: For Installer.

H. Material Test Reports: For each tile-setting and -grouting product[and special-purpose tile].

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all tile of same type from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

1. Stone thresholds.
2. Waterproofing.
3. Joint sealants.
4. Cementitious backer units.

5. Metal edge strips.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Basis-of-Design Product: The design for each tile type is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. As selected by Architect from manufacturer's full range up to 4 color selections in any one room, any pattern. Any pattern allow for group 4 colors and patterns.

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

1. Where tile is indicated for installation on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

A. Manufacturers:
1. Portobello, or approved equal

B. Unglazed Porcelain Tile at floors: Factory-mounted flat tile as follows:

1. Composition: Porcelain.
2. Surface: Slip-resistant, with abrasive admixture.
3. Module Size: As indicated.
4. Nominal Thickness: 3/8.
5. Face: Plain with cushion edges.
6. Basis-of-Design Product: Portobello, allow for (2) two accents.

C. Glazed Wall Tile: Flat tile as follows:

1. Module Size: As indicated.
2. Thickness: 3/8 inch.
3. Face: Plain with modified square edges or cushion edges .
4. Finish: Mat, clear glaze.
5. Mounting: Factory back-mounted.
6. Basis-of-Design Product: Portobello.

D. Porcelain Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:

1. Base Cove: Cove, module size 2 by 1 inch.
2. Base Cap for Portland Cement Mortar Installations: Bead (bullnose), module size 2 by 1 inch.
3. Base Cap for Thin-Set Mortar Installations: Surface bullnose, module size 2 by 2 inches.
4. Wainscot Cap for Portland Cement Mortar Installations: Bead (bullnose), module size 2 by 1 inch
5. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 2 by 2 inches.
6. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above.
7. External Corners for Portland Cement Mortar Installations: Bead (bullnose), module size 2 by 1 inch.
8. External Corners for Thin-Set Mortar Installations: Surface bullnose, module size 2 by 2 inches.
9. Internal Corners: Cove, module size 2 by 1 inch .
10. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch or less, and finish bevel to match face of threshold.

B. Marble Thresholds: Georgia Marble Company, Vermont Marble Company, or equal, ASTM C503 Group A, tight-grained, sound white marble with little or no veining, beveled edges, fine sand rubbed finish, size and shape as indicated on Drawing. If not indicated, then 2-inches by width of door jamb by ¾-inch thick, length to suit door opening.

2.5 CRACK SUPPRESSION AND WATERPROOF MEMBRANES

A. Manufacturer: TEC Specialty Products, Inc., and H.B. Fuller company, Palatine, IL (847/358-9500 or 800/323-7407).

B. Crack Isolation Membrane: TEC Crack Isolation Membrane (TA-329), two-component, acrylic modified cementitious system designed to bridge substrate cracks up to 1/8-inch prior to installation of ceramic tile.

C. Waterproofing Membrane: TEC Triple Flex Waterproofing, Crack Isolation & Flexible Bonding Mortar(TA- 324), elastomeric membrane for completer waterproofing and crack isolation and for tile setting.

D. Floor Slab Priming and Patching Products: As recommended by manufacturer and compatible with crack isolation membrane.

2.6 TILE SETTING MORTAR

A. Specified Manufacturere: TEC Specialty Products, Inc., and H.B. Fuller Company, Palatine, Il (847/358-9500 or 800/323-7407).

B. Manufacturers:

1. Custom Building Products, Seal Beach, CA (310/598-8808; 800/282-8786).
2. Bostik construction Products, Middleton, MA, (800/726-7845)
3. Laticrete International, Inc., Bethany, CT (800/243-4788)

C. Tile Setting Mortars:

1. Wall tile setting mortar: TEC Full Flex Thin Set Mortar (TA-390) latex-modified Portland cement mortar plus TEC Xtraflex (TA-872) acrylic mortar addititive.
2. Ceramic mosaic floor tile setting mortar at crack isolation membrane: TEC Full Flex Thin Set Mortar(TA-390) plus TEC Xtraflex (TA-872) acrylic mortar additive.
3. Ceramic mosaic floor tile setting mortar at waterproof membrane: TEC Full Flex Thin Set Mortar(TA-390) plus TEC Xtraflex (TA-872) acrylic mortar additive.

4. Porcelain Tile Setting Mortar: TEC Medium Bed Mortar Plus TEC Full Bond acrylic latex additive for additional bond and resilience, suitable for medium bed installations as thin as 1/8-inch and as thick as ¾-inch.

2.7 TILE GROUT

A. Specified Manufacturer: TEC Specialty Products, Inc., an H.B. Fuller company, Palatine, IL.

B. Manufactureres:

1. Custom Building Products, Seal Beach, CA (310/598-8808; 800/282-8786).
2. Bostik Construction Products, Middleton, MA, (800/243-4788).
3. Laticrete International, Inc., Bethany, CT (800/243-4788).

C. Wall Tile Grout: TEC AccuColor(Ta-620) unsanded, polymer-enhanced grout, complying with ANSI/TCA A1184.4, commercially prepared mixture, intergral color as indicated on the drawings or, if not indicated, as selected by Architect. Allow for custom color.

2.8 JOINT SEALERS

A. Wall and Fixture Joint Sealant: Mildew-resistant silicone sealant, white or clear as selected by Architect, as specified in Section 07900- Joint Sealers.

B. Floor Expansion Joint Sealant , Non-Traffic Areas: Single-component, non-sag, as specified in Section 07900-Joint Sealers.

C. Floor Expansion Joint Sealant , Non-Traffic Areas: Single-component, Shore A hardness grater than 35, as specified in Section 07900-Joint Sealers.

2.9 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, stainless steel; ASTM A 666, 300 Series exposed-edge material.

C. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.

2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Grout Sealer: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

1. Products:

a. Bonsal, W. R., Company; Grout Sealer.
b. Bostik; CeramaSeal Grout Sealer.
c. C-Cure; Penetrating Sealer 978.

d. Custom Building Products; Grout Sealer.
e. Jamo Inc.; Penetrating Sealer.
f. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout
g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
i. TEC Specialty Products Inc.; TA-256 Penetrating SiliconeGrout Sealer.

2.11 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.

1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

H. Grout tile to comply with requirements of the following tile installation standards:

1. For tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.
2. For chemical-resistant epoxy grouts, comply with ANSI A108.6.
3. For chemical-resistant furan grouts, comply with ANSI A108.8.

I. At showers, tubs, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

B. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

C. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.

1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.

a. Exterior tile floors.
b. Tile floors in wet areas.

B. Joint Widths: Install tile on floors with the following joint widths:

1. Porcelain Tile: 1/16 inch (1.6 mm).

C. Marble Thresholds: Install marble thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.

1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.

D. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

E. Grout Sealer: Apply grout sealer to grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.6 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Install metal lath and scratch coat for walls to comply with ANSI A108.1A, Section 4.1.

C. Joint Widths: Install tile on walls with the following joint widths:

1. Porcelain Tile: 1/16 inch.
2. Glazed Wall Tile: 1/16 inch.

3.7 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.8 FLOOR TILE INSTALLATION SCHEDULE

A. Tile Installation: Interior floor installation on concrete; portland-cement mortar bed (thinset) bonded to concrete; TCA F112 and ANSI A108.1 AANSI A108.1 BANSI A108.1C.

1. Tile Type: Unglazed Porcelain
2. Thin-Set Mortar: Dry-set Latex- portland cement mortar.
3. Grout: grout.

3.9 WALL TILE INSTALLATION SCHEDULE

A. Tile Installation: Interior wall installation over cementitious backer units; thin-set mortar; TCA W244 and ANSI A108.5.

1. Tile Type: Porcelain tile .
2. Thin-Set Mortar: Dry-set or Latex- portland cement mortar.
3. Grout: Polymer-modified unsanded grout.

END OF SECTION 09310

SECTION 09511 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 REFERENCES

A. ASTM A446 – Specification for Steel Sheet, Zinc-Coated (galvanized) by the Hot Dip Process, Structural (physical) Quality

B. ASTM A641 - Specification for Steel Sheet, Zinc-Coated (galvanized) Carbon Steel Wire

C. ASTM C423 -- Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

D. ASTM C635 – Standard Specification for Metal Suspension Systems for Acoustic Tile and Lay-in Panel Ceilings

E. ASTM C636 – Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

F. ASTM E84 – Test Method for Surface Burning Characteristics of Building Materials

G. ASTM E119 – Fire Test of Building Construction and Materials

H. ASTM E580 – Practice for Application of Ceiling Suspension Systems for Acoustic Tile and Lay-in Panels in Areas Requiring Seismic Restraint

I. ASTM E795 – Practice for Mounting Test Specimens During Sound Absorption Tests

J. ASTM E1111 – Test Method for Measuring Interzone Attenuation of Ceiling Systems

K. ASTM E1264 – Classification for Acoustic Ceiling Products

L. ASTM E1414 – Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum

M. ASTM E1477 – Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating Sphere Reflectometer

N. DIN 5036 – Radiometric and Photometric Properties of Materials

O. ISO 4611 – Plastic – Determination of the Effects of Exposure to Damp, Heat, Water Spray and Salt Mist

P. ISO 11654 – Sound Absorbers for Use in Buildings – Rating of Sound Absorption

Q. ISO 14644 – Classification of Air Cleanliness

R. CISCA (Ceilings & Interior Systems Construction Association) – Ceilings Systems Handbook

S. CISCA (Ceilings & Interior Systems Construction Association) – Acoustical Ceilings – Use and Practice

T. CISCA (Ceilings & Interior Systems Construction Association) – Guidelines For Seismic Restraint Direct Hung Suspended Ceiling Assemblies

U. Danish Society of Indoor Climate – Indoor Climate Label

V. Nordic Council of Ministers – Nordic Swan Eco-label

W. Swedish Asthma & Allergy Association

X. Building Information Foundation RTS – Emission Classification of Building Materials

Y. Collaborative for High Performance Schools (CHPS) – Low-emitting Materials Database

Z. Sustainable Solutions Corporation – "GreenCircle" Certified Recycled Content

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordinate Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension members.
2. Method of attaching hangers to building structure.

   a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
4. Minimum Drawing Scale: 1/8 inch = 1 foot.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. .Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.

E. Qualification Data: For testing agency.

F. Field quality-control test reports.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

H. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor type.

I. Maintenance Data: For finishes to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

   a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
   b. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

   a. Flame Spread: 25.

   b. Smoke-Developed Index: 50 or less.

E. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
2. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
3. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
4. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."

F. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.9 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
3. Hold-Down Clips: Equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: CertainTeed Ceilings
1. Address: P.O. Box 860 Valley Forge, PA 19482
2. Telephone: 800-233-8990
3. Web: www.certainteed.com

2.2 ACOUSTIC CEILING UNITS

A. **ACT-1**: Basis-of-Design: Acoustical Ceiling Panel – Type ACT-1

1. Name: Ecophon Focus Dg

2. Physical Characteristics
   a. Type: XII (per ASTM E1264)
   b. Form: 2 (per ASTM E1264)
   c. Pattern: G (per ASTM E1264)
   d. Size: 48-inches x 48-inches
   e. Thickness
      1) 1-inch

f. Edges: reinforced, painted, offset and square
   1) Offset and double kerfed (2 supporting edges)
   2) Offset (2 non-supporting edges)
g. Finished Surface: Akutex FT
h. Finished Surface Color: White 500
i. Panel Backing: Single layer of smooth, resin-bonded glass tissue
j. Core Composition: Glasswool
k. Recycled Content: 75%
   1) 5% (pre-consumer)
   2) 70% (post-consumer)

3. Performance Criteria
   a. Sound Absorption Rating per ISO 11654 (E-200 mounting)
      1) Class A absorber
   b. Noise Reduction Coefficient (NRC) per ASTM C423 (E-400 mounting)
      1) 0.85 (for 1" thick panels)
   c. Sound Absorption Average (SAA) per ASTM C423 (E-400 mounting)
      1) 0.82
   d. Articulation Class (AC) per ASTM E1111
      1) 180
   e. Light Diffusion per DIN 5036
      1) 99%
   f. Light Reflectance (LR) per ASTM E1477
      1) Minimum 0.85
   g. Humidity Resistance per ISO 4611
      1) Warranted to withstand relative humidity of up to 95% at 104°F without sagging, warping or delaminating for 10-years
   h. Clean Room Classification per ISO 14644-1
      1) Class 6 (M3.5)
   j. Flame Spread Classification per ASTM E84: Class A

4. Suspension System

   a. Basis-of-Design: CertainTeed Ceilings
      1) Name: 15/16" Classic

   b. Physical Characteristics
      1) Structural Classification: Heavy Duty (per ASTM C635)
      2) Flange Size: 15/16"
      3) Color: White

   c. Components
      1) Main Runners
      2) Size: 12'
   d. Cross Tees
      1) Size: 4', 2'
   e. Edge Molding
      1) Profile: As selected by the Architect
   f. Accessories
      1) Edge Support Spring Clips
      2) Only for use with Focus DG 4'x4' (one pair per panel)
      3) Support Clip for 1" thick panels

B. **ACT-2**: Basis-of-Design: Acoustical Ceiling Panel – Type ACT-2

1. CertainTeed Ceilings
   a. Address: P.O. Box 860 Valley Forge, PA 19482
   b. Telephone: 800-233-8990
   c. Web: www.certainteed.com

2. Name: Symphony M

3. Physical Characteristics
   a. Type: III (per ASTM E1264)
   b. Form: 2 (per ASTM E1264)
   c. Pattern: E (per ASTM E1264)
   d. Size: 24-inches x 48-inches
   e. Thickness: 3/4"
   f. Edges: Narrow Reveal for 9/16" grid
   g. Finished Surface: Laminated Overtone
   h. Mold/Mildew inhibitor: BioShield
   i. Finished Surface Color: White
   j. Core Composition: Wet-felted mineral fiber
   k. Recycled Content: 72%
      1) 68% (pre-consumer)
      2) 4% (post-consumer)
4. Performance Criteria
   a. Noise Reduction Coefficient (NRC) per ASTM C423 (E-400 mounting)
      1) .70
   b. Light Reflectance (LR) per ASTM E1477
      1) 0.89
   c. Ceiling Attenuation Class (CAC) per ASTM E1414
      1) 35
   d. Humidity Resistance
      1) Warranted to withstand relative humidity of up to 90% at 104°F without sagging, warping or delaminating for 10-years
   e. Flame Spread Classification per ASTM E84: Class A

5. Suspension System

   a. Basis-of-Design: CertainTeed Ceilings
      a. Product: 9/16" Elite Narrow
   b. Physical Characteristics
      a. Structural Classification: Heavy Duty] (per ASTM C635)
      b. Double web design manufactured of hot-dipped galvanized steel
   c. Flange Size:
      a. 9/16"
   d. Color: White
   e. Components
      a. Main Runners
      b. Size: 12'
      c. Cross Tees
      d. Size: 2'
   f. Edge Molding
      a. Type: angle

b. Profile: As selected by the Architect

2.2 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Cast-in-place anchors.
b. Type: Postinstalled expansion anchors.
c. Type: Postinstalled adhesive anchors.
d. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
e. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 alloy 304 or 316 for bolts; alloy 304 or 316 for anchor.
f. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
3. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- diameter wire.

E. Hanger Rods, Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch-(1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

I. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.

J. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

K. Clean-Room Gasket System: Where indicated, provide manufacturer's standard system, including gasket type indicated below and related adhesives, tapes, seals, and retention clips, designed to seal out foreign material from and maintain positive pressure in clean room.

1. Gasket Type: Closed-cell PVC.
2. Gasket Type: Neoprene.
3. Gasket Type: Antimicrobial.
4. Gasket Type: Manufacturer's standard clean-room gasket.

2.3 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILINGS

A. Braces and Supports: Galvanized steel, size and type to suit application, to rigidly support and secure acoustic ceiling system including support of integral mechanical and electrical components with maximum deflection of 1/360 and to seismically brace ceiling in accordance with applicable Code requirements.

1. Hanger Rods: Mild steel, zinc coated, or protected with rust-inhibitive paint.
2. Flat Hangers: Mild steel, zinc coated, or protected with rust inhibitive paint.
3. Angle Hangers: Angles with legs not less than 7/8-inch wide, formed with 0.0365-inch thick galvanized steel sheet complying with ASTM A446, Coating Designation G90, with bolted connections and 5/16-inch diameter bolts.

B. Hanger Wires: ASTM A461, soft temper, pre-stretched, Class 1 coating, sized so that stress at 3-times hanger designed load (ASTM C635, Table 1, Direct Hung), will be less than yield stress of wire, but provide not less than 12 gage (0.1055-inch diameter).

2.4 ACOUSTICAL SEALANT

A. Products:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corp; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

2. Acoustical Sealant for Concealed Joints:

   a. OSI Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
   b. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
   c. Pecora Corp.; BA-98.
   d. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

C. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, recommended for sealing interior concealed joints to reduce airborne sound transmission.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and UBC Standard 25-2 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.66 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

a. As indicated on reflected ceiling plans.

b. Install panels with pattern running in one direction parallel to long axis of space.
c. Install panels with pattern running in one direction parallel to short axis of space.
d. Install panels in a basket-weave pattern.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

B. Testing Services: Testing and inspecting of completed installations of acoustical panel ceiling hangers shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.

C. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.

1. Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Remove and replace acoustical panel ceiling hangers where test results indicate that they do not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09511

SECTION 09513 - COMPOSITE CORE ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabric-faced, composite core acoustical panels.

B. Suspended metal grid ceiling system.

C. Trim and miscellaneous accessories.

1.2 RELATED SECTIONS

A. Section 09511 - Acoustical Panel Ceilings: Suspension system for acoustical panels specified in this section.

B. Section 15855 - Air Outlets and Inlets - Air diffusers and returns in ceiling.

C. Section 16511 - Interior Luminaires - Light fixtures in ceiling.

D. Section 16852 - Fire Alarm System -- Protected Premises: Fire alarm components located in ceiling.

1.3 REFERENCES

A. ASTM C 423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2000.

B. ASTM C 635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2000.

C. ASTM C 636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 1996.

D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2000a.

E. ASTM E 580 - Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint; 2000.

F. ASTM E 1477 - Standard Test Method for Luminance Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers; 1998a.

G. G. ASTM C 1338 – Standard Test Method for Fungal Resistance

H. CISCA (AC) - Acoustical Ceilings: Use and Practice; Ceilings & Interior Systems Construction Association; 1999.

1.4 SUBMITTALS

A. Submit under provisions of Section 01330.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

C. Verification Samples: Two samples, minimum size 4 by 7 inches (100 x 175 mm), representing actual acoustical panel product.

D. Verification Samples: Two samples, minimum 12 inches (300 mm) long, representing actual suspension system.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's unopened packaging and store unopened in fully enclosed space until ready for installation. Protect products from exposure to sunlight, moisture, and mechanical damage.

B. Handle acoustical panels to avoid soiling exposed surfaces or damaging surfaces and edges.

1.6 PROJECT CONDITIONS

A. Sequence work to ensure that acoustical ceilings are not installed until building is enclosed, permanent heating system is available, dust generating activities have terminated, wet work is complete and dry, and work above ceilings is complete.

B. Maintain temperature within 15 degrees Fahrenheit (8 degrees C) and relative humidity within 10 percent of design conditions for spaces of installation not less than 48 hours before installation begins and thereafter.

1.7 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide acoustical panel manufacturer's standard written ten-year limited warranty.

1.8 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Provide not less than 384 sq. ft. (24 panels) of acoustical ceiling panels of each panel size for Owner's use in maintenance of the project.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design:

1. Acceptable Manufacturer of Acoustical Panels: Hunter Douglas Architectural Products; 1 Hunter Douglas Circle, Thornton, CO 80241. ASD. Tel: 866-556-1235; Fax: 720-872-7850; www.hdtechstyle.com.

2. Product: CLASSIC SERIES – Concealed Grid / clipped.

B. Substitutions:

1. Requests for substitutions may be considered in accordance with provisions of Section 01600.

2.2 ACOUSTICAL PANELS

A. Standard Panels:

1. Provide panels comprising composite structural fiberglass core with non-woven polyester textile surface wrapped on two opposite edges and matching integral hinged support clip on other two edges; with properties as follows:

2. Panel Thickness: 1.125 inches.

3. Panel Size:

a. Panel Size: 48 x 48 inches.

4. Reveal: Panels configured to maintain reveal of 1/4 in (6 mm) between adjacent panels.

5. Panel Color:

a. White

6. Noise Reduction Coefficient (NRC): 0.85, measured in accordance with ASTM C 423 with the equal to or better than absorption coefficient reading at the following specified frequencies:

Frequency:	125	250	500	1000	2000	5000
Absorp Co-ef	0.61	0.82	0.65	0.88	1.04	1.03

7. Surface Burning Characteristics: Flame spread less than 25 and smoke developed less than 50, Class A (1), per ASTM E 84 and ASTM E 1264.

8. Light Reflectance (white only): LR-1 (75%), measured in accordance with ASTM E 1477.

9. Moisture Resistance: Resistant to relative humidity up to 95 percent at 105 degrees F (40.5 degrees C) for 30 days.

10. Mold and Mildew Resistant: In accordance with requirements of ASTM C 665.

11. Fungi Resistant: Inc accordance with requirements of ASTM C 1338.

B. Accessibility: Panels shall be downward accessible by disengaging hinge support rail on one side of panel from the T-Bar Flange or optional A-Mount rail flange without the use of tools. Panel shall swing hinge downward to provide complete access without removal of the panel from the ceiling.

C. ACOUSTICAL PANELS / for Luminescent Application (SEE PLANS FOR LOCATIONS):

1. Provide panels comprising composite structural fiberglass core with non-woven polyester textile surface wrapped on two opposite edges and matching integral hinged support clip on other two edges. Panels without coated back surface that will allow transmission of light when light source is placed behind the panel; with properties as follows:

2. Panel Thickness: 1.125 inches (28.5 mm).

3. Panel without coated back surface

4. Panel Size:

   a. Panel Size: 48 x 48 inches.

5. Reveal: Panels configured to maintain reveal of 1/4 in (6 mm) between adjacent panels.

6. Panel Color:

   a. White

7. Noise Reduction Coefficient (NRC): 0.85, measured in accordance with ASTM C 423 with the equal to or better than absorption coefficient reading at the following specified frequencies:

Frequency:	125	250	500	1000	2000	5000
Absorp Co-ef	0.61	0.82	0.65	0.88	1.04	1.03

8. Surface Burning Characteristics: Flame spread less than 25 and smoke developed less than 50, Class A (1), per ASTM E 84 and ASTM E 1264.

9. Light Reflectance (white only): LR-1 (75%), measured in accordance with ASTM E 1477.

10. Moisture Resistance: Resistant to relative humidity up to 95 percent at 105 degrees F (40.5 degrees C) for 30 days.

11. Mold and Mildew Resistant: In accordance with requirements of ASTM C 665.

12. Fungi Resistant: Inc accordance with requirements of ASTM C 1338.

D. Accessibility: Panels shall be downward accessible by disengaging hinge support rail on one side of panel from the T-Bar Flange or optional A-Mount rail flange without the use of tools. Panel shall swing hinge downward to provide complete access without removal of the panel from the ceiling.

2.3 SUSPENSION SYSTEM

A. General: Provide suspension system as specified in Section 09511.

B. General: Use existing suspension system, modified as indicated on drawings.

C. General: Provide system complying with ASTM C 635, die cut and interlocking components, with matching perimeter moldings and other accessories as required for project conditions.

1. Materials: Formed galvanized steel, commercial quality cold rolled, intermediate duty.

2. Profile: Standard 15/16 in (24 mm) tee shape.

3. Finish: Painted white or.

D. Miscellaneous Trim: Provide matching trim by acoustical panel manufacturer for conditions as follows:

1. Perimeter trim: 'L' channel 15/16" – white.

2. Perimeter trim: 'L' channel 9/16"- white.

3. Reveal Trim (WT1): 'C' Channel with 1/8" reveal to the wall – white.

4. Transition trim from drywall to acoustical panel ceiling.

5. Curved transition trim from drywall to acoustical panel ceiling.

6. Floating edge trim: 1-1/2" Straight for A-Mount application – white.

7. Floating edge trim: 2-7/8" (TF2) Straight – white.

8. Floating edge trim: 5-3/4" (TF5) Straight – white.

9. Curved edge for acoustical panel ceiling, for floating effect. – white.

10. Grid based light trim kit, reveal - white

E. Support Channels and Hangers and Fasteners: Galvanized steel, size and type to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that layout of hangers will not interfere with other work; make adjustments in layout as necessary.

B. Do not begin ceiling installation until services above ceiling are complete except for final trim.

C. Notify Architect of unsatisfactory conditions before proceeding.

3.2 PREPARATION

A. Lay out system to a balanced grid design, with edge units not less than 50 percent of acoustical unit size.

B. Locate system on room axis according to reflected ceiling plan.

3.3 INSTALLATION OF SUSPENSION SYSTEM

A. Install in accordance with requirements of Section 09511.

B. Conform to the requirements of CISCA (AC) - Acoustical Ceilings: Use and Practice.

C. Install in accordance with manufacturer's instructions and ASTM C 636.

D. Install in accordance with manufacturer's instructions and ASTM E 580.

E. Attach hangers to structural members. Do not support ceilings directly from permanent metal forms or steel floor or roof deck.

F. Space hangers or direct mount fasteners not more than 48 inches o.c.

G. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

H. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

I. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently. Do not eccentrically load system or induce rotation of runners.

J. Perimeter Trim: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

3.4 INSTALLATION OF ACOUSTICAL PANELS

A. Install acoustical panels in accordance with manufacturer's written instructions.

B. Fit adjoining panels to form nominal 1/4 inch reveal joints. Scribe and cut panels for accurate fit at perimeter and around penetrations.

C. Hold tile field in compression when performing cuts. Match field cut edges with factory edges in accordance with manufacturer's instructions.

D. Install acoustical panels after above-ceiling work is complete. Install panels level, in uniform plane, and free from warp, twist, and dents.

E. Installation Tolerance: Maximum variation from flat and level surface is 1:360.

3.5 CLEANING AND PROTECTION

A. Clean exposed surfaces of acoustical panel ceilings, including suspension system and edge trim, complying with manufacturer's written instructions for cleaning of minor finish damage. Replace acoustical panels that cannot be cleaned to an appearance matching unmarred panels.

B. Protect installed acoustical panel ceilings until completion of project.

END OF SECTION

SECTION 09651 - RESILIENT FLOOR TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Solid vinyl floor tile.
2. Rubber floor tile.
3. Vinyl composition tile (VCT).
4. Resilient wall base and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.

1. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples, but not less than 12 inches long, of each resilient product color and pattern required.

D. Maintenance Data: For resilient products to include in maintenance manuals.

1.4 PERFORMANCE REQUIREMENTS

A. Provide flooring material that is slip resistant.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.

1.7 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F , in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.
2. Resilient Wall Base and Accessories: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. **RSF-1:** Basis-of-Design:
1. Centiva: Event Plank Cherry series.
   a. Classification: ASTM F 1700-04 Class III Solid Vinyl Tile
   b. Construction: Layered product consisting of wearlayer, decorative film, and backing with pre- and post-consumer content
   c. Overall Thickness: 0.120
   d. Wearlayer Thickness: 0.030
   e. Size: 6′ x36′

f. Edge: Square
g. Surface Texture: Natural Grain
h. Color(s): As indicated on Drawings
i. Warranty: 20 years
j. Test Performance:
   1) ASTM F 137 Flexibility Good
   2) ASTM 2199 Dimensional Stability Good
   3) ASTM F 970 and ASTM F 1914 Residual Indentation Excellent
   4) ASTM E 648 Flammability Class 1 CRF>0.45
   5) ASTM C 1028* Slip Resistance Very Good (*textures)
   6) ASTM D 2047 Passes
   7) ADA Compliant FTC Slip Resistant Classified Product
   8) ASTM E 662 Smoke Density <450
   9) ASTM D 3884 Abrasion Excellent
   10) ITTS 205 Castor Chair Suitability Very Good
   11) ASTM F 925 Chemical Resistance Excellent
k. Underlayment: Altro Everlay Underlayment
   1) Width: 6'-7"
   2) Length (roll): 165'
   3) Thickness: 0.050"
   4) properties: Dimensionally stable
   5) Acoustic Insulation: ISO 14-0-717 = 7 dB
   6) All installation per manufacturer's recommendations

B. **RSF-2 through 5- :** Basis-of-Design:

1. Forbo Marmoleum: Real series.
   a. Classification: ASTM F 2034 Linoleum Sheet Flooring Type I
   b. Construction: Layered product consisting of wearlayer, decorative film, and backing with pre- and post-consumer content
   c. Overall Thickness: 0.120
   d. Wearlayer Thickness: 0.030
   e. Size: 6' x36'
   f. Edge: Square
   g. Surface Texture: Natural Grain
   h. Color(s): As indicated on Drawings
   i. Warranty: 20 years
   j. ASTM E-648/NFPA Critical Radiant Flux: Class 1
   k. ASTM E84 – Class C
   l. EN 425: Suitable for office chairs with castors
   m. Underlayment: Forbo Corkment Underlayment
      1) Width: 79"
      2) Length (roll): 100'
      3) Thickness: 0.080"
      4) Backing: Jute
      5) Properties: Dimensionally stable
      6) Acoustic Insulation: ISO 14-0-717 = 14 dB minimum
      7) All installation per manufacturer's recommendations

C. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products listed in other Part 2 articles.

D. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 COLORS AND PATTERNS

A. Colors and Patterns: As Shown on Drawings.

2.3 RUBBER FLOOR TILE

2.4 RESILIENT WALL BASE

A. Wall Base: ASTM F 1861.
   1. Armstrong World Industries, Inc.
   2. Burke Mercer Flooring Products.
   3. Johnsonite.
   4. Roppe Corporation.

B. Type (Material Requirement): TP (rubber, thermoplastic).

C. Group (Manufacturing Method): I (solid, homogeneous).

D. Style: Cove (with top-set toe).

E. Minimum Thickness: 0.125 inch.

F. Height: 4 inches.

G. Lengths: Coils in manufacturer's standard length.

H. Outside Corners: Premolded.

I. Inside Corners: Premolded.

J. Surface: Smooth.

K. Fire-Test-Response Characteristics:

   1. Flame Spread: 25 or less.

   2. Smoke Developed: 450 or less.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. VCT and Asphalt Tile Adhesives: 50 g/L.
b. Cove Base Adhesives: 50 g/L.
c. Rubber Floor Adhesives: 60 g/L.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:

a. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

E. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

F. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are same temperature as space where they are to be installed.

G. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis, unless shown otherwise on plans.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Premolded Corners: Install premolded corners before installing straight pieces.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.5 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

   a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.

   a. Use commercially available product acceptable to manufacturer.
   b. Coordinate selection of floor polish with Owner's maintenance service.

2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 09651

SECTION 09680 - CARPET

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Tufted carpet.

B. Related Sections include the following:

1. Division 9 Section "Carpet Tile."

1.3 PERFORMANCE REQUIREMENTS

A. Pile height shall not exceed ½".

B. Carpet shall be level loop or cut pile.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Existing flooring materials to be removed.
3. Existing flooring materials to remain.
4. Carpet type, color, and dye lot.
5. Locations where dye lot changes occur.
6. Seam locations, types, and methods.
7. Type of subfloor.
8. Type of installation.
9. Pattern type, repeat size, location, direction, and starting point.
10. Pile direction.
11. Type, color, and location of insets and borders.
12. Type, color, and location of edge, transition, and other accessory strips.

13. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet: 12-inch- square Sample.
2. Exposed Edge Stripping and Accessory: 12-inch- long Samples.

D. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.

E. Maintenance Data: For carpet to include in maintenance manuals specified in Division 1. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

1. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

   a. Flame Spread: 25 or less.
   b. Smoke Developed: 10 or less.

B. Product Substitutions: Refer to Division 1 Section "Product Requirements."

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling."

1.7 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.8 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.

1. Warranty Period: 10 years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 CARPET

A. Basis-of-Design:

1. Bentley Prince Street: Product 4C030

a. Color: As selected by Architect from manufacturer's full range.
b. Pattern: "High Performance"

B. Gauge: 1/12 inch.

C. Stitches: 10.8 per inch.

D. Pile Height: 0.289" for finished carpet per ASTM D 418.

E. Pile density: 6585.

F. Weight: 30 oz./sq. yd. for finished carpet.

G. Primary Backing: "Moisture Guard".

H. Width: 12 feet.

I. Performance Characteristics: As follows:

1. Critical Radiant Flux Classification: Class 1.
2. Dry Breaking Strength: Not less than 100 lbf per ASTM D 2646.
3. Resistance to Insects: Comply with AATCC-24.
4. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC-165.
5. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) per AATCC-16.
6. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC-174.

J. VOC Limits: Provide carpet that complies with the following limits for VOC content when tested according to ASTM D 5116:

1. Total VOCs: 0.5 mg/sq. m x h.
2. 4-PC (4-Phenylcyclohexene): 0.05 mg/sq. m x h.
3. Formaldehyde: 0.05 mg/sq. m x h.
4. Styrene: 0.4 mg/sq. m x h.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the following:

1. Carpet manufacturer.
2. Carpet cushion manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by carpet manufacturer.

1. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:

a. Total VOCs: 10.00 mg/sq. m x h.
b. Formaldehyde: 0.05 mg/sq. m x h.
c. 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.

C. Tackless Carpet Stripping: Water-resistant plywood in strips as required to match cushion thickness and that comply with CRI 104, Section 11.3.

D. Seaming Cement: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

E. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the following:

   a. Carpet manufacturer.

2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the following:

1. Carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Direct-Glue-Down Installation: Comply with CRI 104, Section 8, "Direct Glue-Down Installation."

B. Comply with carpet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

1. Bevel adjoining border edges at seams with hand shears.
2. Level adjoining border edges.

C. Do not bridge building expansion joints with carpet.

D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 15, "Protection of Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION 09680

SECTION 09720 - WALL COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Vinyl wall covering.

B. Related Sections include the following:

1. Division 9 Section "Painting (Professional Line Products" for primers, coatings, and for priming wall surfaces.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams and termination points.

C. Samples for Initial Selection: For each type of wall covering indicated.

D. Samples for Verification: Full width by 36-inch- long section of wall covering from lot to be used for each type of wall covering indicated.

E. Schedule: For wall coverings. Use same designations indicated on Drawings.

F. Maintenance Data: For wall coverings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide wall coverings and adhesives with the following fire-test-response characteristics as determined by testing identical products applied with identical adhesives to substrates per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Surface-Burning Characteristics: As follows, per ASTM E 84:

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire-Growth Contribution: Textile wall coverings complying with acceptance criteria of UBC Standard 8-2.
3. Fire-Growth Contribution: Textile wall coverings tested according to NFPA 265 and complying with Method A test protocol in IBC 2000, Section 803.5.1.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install wall coverings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Covering Material: Full-size units equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in Part 2 "Wall-Covering Products" Article.

B. Products: Subject to compliance with requirements, provide one of the products listed in Part 2 "Wall-Covering Products" Article.

2.2 WALL-COVERING PRODUCTS

A. General: Provide rolls of each type of wall covering from the same run number or dye lot.

1. Vinyl Wall-Covering Standards: Provide mildew-resistant products complying with the following:

a. FS CCC-W-408 and CFFA-W-101 for Type II, Medium-Duty products.
2. Backing Material: Scrim.
3. Repeat: Random.

4. Stain-Resistant Coating: DuPont; Tedlar/Teflon.
5. Colors, Textures, and Patterns: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application, as recommended in writing by wall-covering manufacturer

B. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 9 Section "Painting (Professional Line Products)" and recommended in writing by wall-covering manufacturer for intended substrate.

C. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended by wall-covering manufacturer.

D. Seam Tape: As recommended in writing by wall-covering manufacturer.

E. Metal Primer: Interior ferrous metal primer complying with Division 9 Section Painting (Professional Line Products)] ."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, dirt, and dust.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity.
3. Metals: If not factory primed, clean and apply metal primer.
4. Gypsum Board: Prime with primer recommended by wall-covering manufacturer.
5. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

G. Install wall liner, with no gaps or overlaps, where required by wall-covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried.

3.3 INSTALLATION

A. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.

D. Install reversing every other strip.

E. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.

F. Match pattern 72 inches above the finish floor.

G. Install seams vertical and plumb at least 6 inches from outside corners and 6 inches from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.

H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

I. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

3.4 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09720

SECTION 09841 - ACOUSTICAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes back-mounted acoustical wall panels.

1.3 DEFINITIONS

A. NRC: Noise reduction coefficient.

1.4 SUBMITTALS

A. Product Data: For each type of panel edge, core material, and mounting indicated.

B. Shop Drawings: For acoustical wall panels. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Include elevations showing panel sizes and direction of fabric weave and pattern matching. Indicate panel edge and core materials.

C. Coordination Drawings: Show intersections with wall base, shelves, cabinetry, doors, visual display items, electrical outlets and switches, thermostats, lighting fixtures, air outlets and inlets, speakers, access panels, and other adjacent work. Show operation of casework doors and drawers.

D. Samples for Initial Selection: For each type of fabric facing material from acoustical wall panel manufacturer's full range.

E. Samples for Verification: For the following products. Prepare Samples from same material to be used for the Work.

1. Fabric: Sample from dye lot to be used for the Work, and as follows:

   a. With specified treatments applied.
   b. Show complete pattern repeat.
   c. Mark top and face of fabric.

2. Panel Edge: 8-inch- long Sample showing edge profile, corner, and finish.
3. Core Material: 8-inch- square Sample showing corner.

F. Product Certificates: For each type of acoustical wall panel, signed by product manufacturer.

G. Maintenance Data: For acoustical wall panels to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

H. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Source Limitations: Obtain acoustical wall panels through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical wall panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and acoustical wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

C. Protect panel edges from crushing and impact.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical wall panels until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Air-Quality Limitations: Protect acoustical wall panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

C. Field Measurements: Verify locations of acoustical wall panels by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical wall panels that fail in performance, materials, or workmanship within specified warranty period.

1. Failure in performance includes, but is not limited to, acoustical performance.
2. Failures in materials include, but are not limited to, fabric sagging, distorting, or releasing from panel edge; or warping of core.
3. Warranty Period: Two years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 yards.
2. Acoustical Wall Panel Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than 5 attachment devices.

PART 2 - PRODUCTS

2.1 CORE MATERIALS

A. Glass-Fiber Board: ASTM C 612, Type IA or Types IA and IB; density of 6 to 7 pounds per cubic foot, unfaced, dimensionally stable, molded rigid board, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

B. Tackable, Impact-Resistant, High-Density Face Layer: 1/8-inch- thick layer of compressed molded glass-fiber board with a minimum nominal density of 16 to 18 lb/cu. ft. laminated to face of core.

2.2 BACK-MOUNTED ACOUSTICAL WALL PANELS WITH PERFORATED MINERAL-FIBER BOARD CORE

A. Panel Construction: Manufacturer's standard panel construction consisting of facing material laminated to front face of a core that is 1-inch thick and having a density of 6 to 7 pounds per cubic foot.

B. Facing Material: Fabric from same dye lot; color and pattern as selected by Architect from manufacturer's full range.

1. Koroseal. Product: VWC-1 - HARBOR WEAVE II - color to be selected.

C. Nominal Core Thickness and Overall System NRC 3/4 inch.

D. Panel Width: 48 inches.

E. Panel Height: Fabricated from units as indicated on Drawings; mounting height as indicated on Drawings.

F. Panel Edge: Fully-wrapped by Fabric.

G. Panel Short Edge Detail: Square.

2.3 FABRICATION

A. Sound-Absorption Performance: Provide acoustical wall panels with minimum NRCs indicated, as determined by testing per ASTM C 423 for mounting type specified.

B. Acoustical Wall Panels: Panel construction consisting of facing material adhered to[face,] edges and back border of dimensionally stable core; with rigid edges to reinforce panel perimeter against warpage and damage.

1. Glass-Fiber Board: Resin harden areas of core for attachment of mounting devices.

C. Fabric Facing: Stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other foreign matter. Applied with visible surfaces fully covered.

1. Where square corners are indicated, tailor corners.[Heat seal vinyl fabric seams at corners.]
2. Where radius or other nonsquare corners are indicated, attach facing material so there are no seams or gathering of material.
3. Where fabrics with directional or repeating patterns or directional weave are indicated, mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.

D. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, sags.

E. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, substrates, blocking, and conditions, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of acoustical wall panels.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

1. Cut units to be at least 50 percent of unit width, with facing material extended over cut edge to match uncut edge. Scribe acoustical wall panels to fit adjacent work. Butt joints tightly.

B. Comply with acoustical wall panel manufacturer's written instructions for installation of panels using type of concealed mounting accessories indicated or, if not indicated, as recommended by manufacturer. Anchor panels securely to supporting substrate.

C. Match and level fabric pattern and grain among adjacent panels.

D. Installation Tolerances: As follows:

1. Variation from Level and Plumb: Plus or minus 1/16 inch.
2. Variation of Panel Joints from Hairline: Not more than 1/32 inch wide.

3.3 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that acoustical wall panels are without damage or deterioration at time of Substantial Completion.

B. Replace acoustical wall panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 09841

SECTION 09912 - PAINTING (PROFESSIONAL LINE PRODUCTS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

a. Architectural woodwork.
b. Acoustical wall panels.
c. Toilet enclosures.
d. Metal lockers.
e. Finished mechanical and electrical equipment.
f. Light fixtures.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
a. Furred areas.
b. Ceiling plenums.
c. Pipe spaces.
d. Duct shafts.

3. Finished metal surfaces include the following:

a. Anodized aluminum.

b. Stainless steel.
c. Chromium plate.
d. Copper and copper alloys.
e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

a. Valve and damper operators.
b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 5 Section "Structural Steel" for shop priming structural steel.
2. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
3. Division 6 Section "Exterior Architectural Woodwork" for shop priming exterior architectural woodwork.
4. Division 6 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
5. Division 8 Section "Steel Doors and Frames" for factory priming steel doors and frames.
6. Division 9 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.

E. Alternates: Refer to Division 1 Section "Alternates" for description of Work in this Section affected by alternates.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers]for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

1. Quantity: Furnish Owner with an additional 5 percent, but not less than 1 gal. or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

C. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Benjamin Moore & Co. (Benjamin Moore).
2. ICI Dulux Paint Centers (ICI Dulux Paints).
3. PPG Industries, Inc. (Pittsburgh Paints).
4. Sherwin-Williams Co. (Sherwin-Williams).

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Chemical Components of Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions:

1. Flat Paints and Coatings: VOC content of not more than 50 g/L.
2. Non-Flat Paints and Coatings: VOC content of not more than 150 g/L.

3. Anticorrosive Coatings: VOC content of not more than 250 g/L.
4. Varnishes and Sanding Sealers: VOC content of not more than 350 g/L.
5. Stains: VOC content of not more than 250 g/L.
6. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
7. Restricted Components: Paints and coatings shall not contain any of the following:

    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzene.
    e. Butyl benzyl phthalate.
    f. Cadmium.
    g. Di (2-ethylhexyl) phthalate.
    h. Di-n-butyl phthalate.
    i. Di-n-octyl phthalate.
    j. 1,2-dichlorobenzene.
    k. Diethyl phthalate.
    l. Dimethyl phthalate.
    m. Ethylbenzene.
    n. Formaldehyde.
    o. Hexavalent chromium.
    p. Isophorone.
    q. Lead.
    r. Mercury.
    s. Methyl ethyl ketone.
    t. Methyl isobutyl ketone.
    u. Methylene chloride.
    v. Naphthalene.
    w. Toluene (methylbenzene).
    x. 1,1,1-trichloroethane.
    y. Vinyl chloride.

D. Colors: As selected by Architect from manufacturer's full range.

2.3 CONCRETE UNIT MASONRY BLOCK FILLERS

A. Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers.

1. Benjamin Moore; Moorcraft Super Craft Latex Block Filler No. 285: Applied at a dry film thickness of not less than 8.1 mils.
2. Benjamin Moore; Moore's IMC Latex Block Filler No. M88: Applied at a dry film thickness of not less than 8.1 mils.
3. ICI Dulux Paints; Bloxfil 4000-1000 Interior/Exterior Heavy Duty Acrylic Block Filler: Applied at a dry film thickness of not less than 7.0 to 14.5 mils.
4. Pittsburgh Paints; 6-7 SpeedHide Interior/Exterior Masonry Latex Block Filler: Applied at a dry film thickness of not less than 6.0 to 12.5 mils.
5. Sherwin-Williams; PrepRite Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils.

2.4 EXTERIOR PRIMERS

A. Exterior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex primer for exterior application.

1. Benjamin Moore; Moore's Acrylic Masonry Sealer No. 066: Applied at a dry film thickness of not less than 0.7 mils.
2. Benjamin Moore; Moore's Alkyd Masonry Sealer No. 077: Applied at a dry film thickness of not less than 2.7 mils.
3. ICI Dulux Paints; 2000-1200 Dulux Professional Exterior 100 Percent Acrylic Latex Primer: Applied at a dry film thickness of not less than 1.6 mils.
4. Pittsburgh Paints; 6-603 SpeedHide Interior/Exterior Acrylic Latex Alkali Resistant Primer: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
5. Sherwin-Williams; Loxon Exterior Masonry Acrylic Primer A24W300: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
6. Sherwin-Williams; A-100 Latex Exterior Wood Primer B42W41: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).

B. Exterior Gypsum Soffit Board Primer: Factory-formulated alkyd- or alkali-resistant acrylic-latex primer for exterior application.

1. Benjamin Moore; Moorcraft Super Spec Alkyd Exterior Primer No. 176: Applied at a dry film thickness of not less than 1.8 mils (0.046 mm).
2. ICI Dulux Paints; 2000-1200 Dulux Professional Exterior 100 Percent Acrylic Latex Primer: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
3. Pittsburgh Paints; 6-603 SpeedHide Interior/Exterior Acrylic Latex Alkali Resistant Primer: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
4. Sherwin-Williams; A-100 Exterior Latex Wood Primer B42W41: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).

C. Exterior Wood Primer for Acrylic Enamels: Factory-formulated alkyd or latex wood primer for exterior application.

1. Benjamin Moore; Moorcraft Super Spec Alkyd Exterior Primer No. 176: Applied at a dry film thickness of not less than 1.8 mils (0.046 mm).
2. ICI Dulux Paints; 2000-1200 Dulux Professional Exterior 100 Percent Acrylic Latex Primer: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
3. Pittsburgh Paints; 6-609 SpeedHide Exterior House & Trim Wood Primer 100 Percent Acrylic Latex: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
4. Sherwin-Williams; A-100 Exterior Latex Wood Primer B42W41: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).

D. Exterior Wood Primer for Alkyd Enamels: Factory-formulated alkyd or latex wood primer for exterior application.

1. Benjamin Moore; Moorcraft Super Spec Alkyd Exterior Primer No. 176: Applied at a dry film thickness of not less than 1.8 mils (0.046 mm).
2. ICI Dulux Paints; 2110-1200 Ultra-Hide Durus Exterior Alkyd Primecoat: Applied at a dry film thickness of not less than 1.9 mils (0.048 mm).
3. Pittsburgh Paints; 6-609 SpeedHide Exterior House & Trim Wood Primer 100 Percent Acrylic Latex: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
4. Sherwin-Williams; A-100 Exterior Latex Wood Primer B42W42: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).

E. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.

1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. ICI Dulux Paints; 4160-XXXX Devguard Multi-Purpose Tank & Structural Primer. Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
3. Pittsburgh Paints; 90-712 Pitt-Tech One Pack Interior/Exterior Primer Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
4. Sherwin-Williams; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

F. Exterior Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application.

1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. ICI Dulux Paints; 4020-XXXX Devflex DTM Flat Interior/Exterior Waterborne Primer & Finish: Applied at a dry film thickness of not less than 2.2 mils (0.056 mm).
3. ICI Dulux Paints; 4160-XXXX Devguard Multi-Purpose Tank & Structural Primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
4. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
5. Sherwin-Williams; primer not required over this substrate.
6. Sherwin-Williams; Galvite HS Paint B50WZ3: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).

G. Exterior Aluminum Primer under Acrylic Finishes: Factory-formulated acrylic-based metal primer for exterior application.

1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. ICI Dulux Paints; 4020-XXXX Devflex DTM Flat Interior/Exterior Waterborne Primer & Finish: Applied at a dry film thickness of not less than 2.2 mils (0.056 mm).
3. ICI Dulux Paints; 4160-XXXX Devguard Multi-Purpose Tank & Structural Primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
4. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
5. Sherwin-Williams; primer not required over this substrate.
6. Sherwin-Williams; DTM Acrylic Primer/Finish B66W1: Applied at a dry film thickness of not less than 2.5 mils (0.064 mm).

H. Exterior Aluminum Primer under Alkyd Finishes: Factory-formulated acrylic-based metal primer for exterior application.

1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. ICI Dulux Paints; 4020-XXXX Devflex DTM Flat Interior/Exterior Waterborne Primer & Finish: Applied at a dry film thickness of not less than 2.2 mils (0.056 mm).
3. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
4. Sherwin-Williams; DTM Wash Primer B71Y1: Applied at a dry film thickness of not less than 2.5 mils (0.064 mm).

2.5 INTERIOR PRIMERS

A. Interior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.

1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
2. ICI Dulux Paints; 3030-1200 Bond-Prep Interior/Exterior Waterborne Pigmented Bonding Primer: Applied at a dry film thickness of not less than 1.8 mils (0.046 mm).
3. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
4. Sherwin-Williams; PrepRite Masonry Primer B28W300: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

B. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.

1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
2. ICI Dulux Paints; 1000-1200 Dulux Ultra Basecoat Interior Latex Wall Primer: Applied at a dry film thickness of not less than 1.2 mils (0.031 mm).
3. ICI Dulux Paints; 1030-1200 Ultra-Hide PVA Interior Primer Sealer General Purpose Wall Primer: Applied at a dry film thickness of not less than 1.9 mils (0.048 mm).
4. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
5. Sherwin-Williams; PrepRite 200 Latex Wall Primer B28W200 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

C. Interior Plaster Primer: Factory-formulated latex-based primer for interior application.

1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
2. ICI Dulux Paints; 3210-1200 Ultra-Hide Aquacrylic GRIPPER Stain Killer Primer Sealer: Applied at a dry film thickness of not less than 1.8 mils (0.046 mm).
3. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
4. Sherwin-Williams; PrepRite 200 Latex Wall Primer B28W200 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

D. Interior Wood Primer for Acrylic-Enamel and Semigloss Alkyd-Enamel Finishes: Factory-formulated alkyd- or acrylic-latex-based interior wood primer.

1. Benjamin Moore; Moorcraft Super Spec Alkyd Enamel Underbody and Primer Sealer No. 245: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
2. ICI Dulux Paints; 3210-1200 Ultra-Hide Aquacrylic GRIPPER Stain Killer Primer Sealer: Applied at a dry film thickness of not less than 1.8 mils (0.046 mm).
3. Pittsburgh Paints; 6-855 SpeedHide Latex Enamel Undercoater: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
4. Sherwin-Williams; PrepRite Wall and Wood Primer B49W200 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
5. Sherwin-Williams; PrepRite Classic Interior Primer B28W101 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

E. Interior Wood Primer for Full-Gloss Alkyd-Enamel Finishes: Factory-formulated alkyd- or acrylic-latex-based interior wood primer.

1. Benjamin Moore; Moorcraft Super Spec Alkyd Enamel Underbody and Primer Sealer No. 245: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
2. ICI Dulux Paints; 1120-1200 Ultra-Hide Oil/Alkyd Interior Wood Undercoat: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
3. Pittsburgh Paints; 6-6 SpeedHide Interior Quick-Drying Enamel Undercoater: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
4. Sherwin-Williams; PrepRite Wall and Wood Primer B49W200 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

F. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.

1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. ICI Dulux Paints; 4130-6130 Devshield Rust Penetrating Metal Primer: Applied at a dry film thickness of not less than 2.2 mils (0.056 mm).
3. ICI Dulux Paints; 4160-6130 Devguard Multi-Purpose Tank & Structural Primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
4. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
5. Sherwin-Williams; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

G. Interior Zinc-Coated Metal Primer: Factory-formulated galvanized metal primer.

1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. ICI Dulux Paints; 4160-6130 Devguard Multi-Purpose Tank & Structural Primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
3. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
4. Sherwin-Williams; primer not required over this substrate.
5. Sherwin-Williams; Galvite HS B50WZ30: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

2.6 EXTERIOR FINISH COATS

A. Exterior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for exterior application.

1. Benjamin Moore; Moorcraft Super Spec Flat Latex House Paint No. 171: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
2. ICI Dulux Paints; 2200-XXXX Dulux Professional Exterior 100 Percent Acrylic Flat Finish: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
3. Pittsburgh Paints; 6-600 Series SpeedHide Exterior House Paint Flat Latex: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).
4. Sherwin-Williams; A-100 Exterior Latex Flat House & Trim Paint A6 Series: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).

B. Exterior Low-Luster Acrylic Paint: Factory-formulated low-sheen (eggshell) acrylic-latex paint for exterior application.

1. Benjamin Moore; Moorcraft Super Spec Low Lustre Latex House Paint No. 185: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
2. ICI Dulux Paints; 2402-XXXX Dulux Professional Exterior 100 Percent Acrylic Satin Finish: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
3. Pittsburgh Paints; 6-2000 Series SpeedHide Exterior House & Trim Satin--Acrylic Latex: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
4. Pittsburgh Paints; 90-400 Series Pitt-Tech One Pack High Performance Waterborne Satin DTM Industrial Enamels: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
5. Sherwin-Williams; A-100 Exterior Latex Satin House & Trim Paint A82 Series: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).

C. Exterior Semigloss Acrylic Enamel: Factory-formulated semigloss waterborne acrylic-latex enamel for exterior application.

1. Benjamin Moore; Moorcraft Super Spec Latex House & Trim Paint No. 170: Applied at a dry film thickness of not less than 1.1 mils (0.028 mm).
2. ICI Dulux Paints; 2406-XXXX Dulux Professional Exterior 100 Percent Acrylic Semi-Gloss Finish: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).
3. Pittsburgh Paints; 6-900 Series SpeedHide Exterior House & Trim Semi-Gloss Acrylic Latex Paint: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
4. Sherwin-Williams; A-100 Latex Gloss A8 Series: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).

D. Exterior Full-Gloss Acrylic Enamel for Concrete, Masonry, and Wood: Factory-formulated full-gloss waterborne acrylic-latex enamel for exterior application.

1. Benjamin Moore; Moore's IMC Acrylic Gloss Enamel M28: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. ICI Dulux Paints; 3028-XXXX Dulux Interior/Exterior Acrylic Gloss Finish: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
3. Pittsburgh Paints; 90 Line Pitt-Tech One Pack Interior/Exterior High Performance Waterborne High Gloss DTM Industrial Enamels: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
4. Sherwin-Williams; DTM Acrylic Coating Gloss (Waterborne) B66W100 Series: Applied at a dry film thickness of not less than 2.4 mils (0.061 mm).
5. Sherwin-Williams; SuperPaint Exterior High Gloss Latex Enamel A85 Series: Applied at a dry film thickness of not less than 1.2 mils (0.031 mm).

E. Exterior Full-Gloss Acrylic Enamel for Ferrous and Other Metals: Factory-formulated full-gloss waterborne acrylic-latex enamel for exterior application.

1. Benjamin Moore; Moore's IMC Acrylic Gloss Enamel M28: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. ICI Dulux Paints; 3028-XXXX Dulux Interior/Exterior Acrylic Gloss Finish: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
3. Pittsburgh Paints; 90-300 Series Pitt-Tech One Pack Interior/Exterior High Performance Waterborne High Gloss DTM Industrial Enamels: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

4. Sherwin-Williams; DTM Acrylic Coating Gloss (Waterborne) B66W100 Series: Applied at a dry film thickness of not less than 2.4 mils (0.061 mm).

F. Exterior Full-Gloss Alkyd Enamel: Factory-formulated full-gloss alkyd enamel for exterior application.

1. Benjamin Moore; Moore's IMC Urethane Alkyd Enamel M22: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. ICI Dulux Paints; 4308-XXXX Devguard Alkyd Industrial Gloss Enamel: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
3. Pittsburgh Paints; 7-814 Pittsburgh Paints Industrial Gloss-Oil Interior/Exterior Enamel: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
4. Sherwin-Williams; Industrial Enamel B-54 Series: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).

2.7 INTERIOR FINISH COATS

A. Interior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for interior application.

1. Benjamin Moore; Moorecraft Super Spec Latex Flat No. 275: Applied at a dry film thickness of not less than 1.2 mils (0.031 mm).
2. ICI Dulux Paints; 1200-XXXX Dulux Professional Velvet Matte Interior Flat Latex Wall & Trim Finish: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
3. Pittsburgh Paints; 6-70 Line SpeedHide Interior Wall Flat-Latex Paint: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
4. Sherwin-Williams; ProMar 200 Interior Latex Flat Wall Paint B30W200 Series: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).

B. Interior Flat Latex-Emulsion Size: Factory-formulated flat latex-based interior paint.

1. Benjamin Moore; Moorecraft Super Spec Latex Flat No. 275: Applied at a dry film thickness of not less than 1.2 mils (0.031 mm).
2. ICI Dulux Paints; 1200-XXXX Dulux Professional Velvet Matte Interior Flat Latex Wall & Trim Finish: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
3. Pittsburgh Paints; 6-70 Line SpeedHide Interior Wall Flat-Latex Paint: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
4. Sherwin-Williams; ProMar 200 Interior Latex Flat Wall Paint B30W200 Series: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).

C. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.

1. Benjamin Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).
2. ICI Dulux Paints; 1402-XXXX Dulux Professional Acrylic Eggshell Interior Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
3. Pittsburgh Paints; 6-400 Series SpeedHide Eggshell Acrylic Latex Enamel: Applied at a dry film thickness of not less than 1.25 mils (0.032 mm).
4. Sherwin-Williams; ProMar 200 Interior Latex Egg-Shell Enamel B20W200 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

D. Interior Semigloss Acrylic Enamel: Factory-formulated semigloss acrylic-latex enamel for interior application.

1. Benjamin Moore; Moorcraft Super Spec Latex Semi-Gloss Enamel No. 276: Applied at a dry film thickness of not less than 1.2 mils (0.031 mm).
2. ICI Dulux Paints; 1406-XXXX Dulux Professional Acrylic Semi-Gloss Interior Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
3. Pittsburgh Paints; 6-500 Series SpeedHide Interior Semi-Gloss Latex: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
4. Sherwin-Williams; ProMar 200 Interior Latex Semi-Gloss Enamel B31W200 Series: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).

E. Interior Full-Gloss Acrylic Enamel: Factory-formulated full-gloss acrylic-latex interior enamel.

1. Benjamin Moore; Moore's IMC Acrylic Gloss Enamel No. M28: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. ICI Dulux Paints; 3028-XXXX Dulux Interior/Exterior Acrylic Gloss Finish: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
3. Pittsburgh Paints; 6-8534 SpeedHide Interior Latex 100 Percent Acrylic Gloss Enamels: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
4. Pittsburgh Paints; 90-374 Pitt-Tech One Pack Interior/Exterior High Performance Waterborne High Gloss DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
5. Sherwin-Williams; ProMar 200 Interior Latex Gloss Enamel B21W201: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).

F. Interior Semigloss Alkyd Enamel: Factory-formulated semigloss alkyd enamel for interior application.

1. Benjamin Moore; Moorcraft Super Spec Alkyd Semi-Gloss Enamel No. 271: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
2. ICI Dulux Paints; 1516-XXXX Ultra-Hide Alkyd Semi-Gloss Interior Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.7 mils (0.043 mm).
3. Pittsburgh Paints; 6-1110 Series SpeedHide Interior Enamel Wall & Trim Semi-Gloss Oil: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
4. Sherwin-Williams; ProMar 200 Interior Alkyd Semi-Gloss Enamel B34W200 Series: Applied at a dry film thickness of not less than 1.7 mils (0.043 mm).

G. Interior Full-Gloss Alkyd Enamel for Gypsum Board and Plaster: Factory-formulated full-gloss alkyd interior enamel.

1. Benjamin Moore; Moore's IMC Urethane Alkyd Enamel No. M22: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. ICI Dulux Paints; 4308-XXXX Devguard Alkyd Industrial Gloss Enamel: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
3. Pittsburgh Paints; 7-814 Series Pittsburgh Paints Industrial Gloss-Oil Interior/Exterior Enamel: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
4. Sherwin-Williams; ProMar 200 Alkyd Gloss Enamel B35W200 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

H. Interior Full-Gloss Alkyd Enamel for Wood and Metal Surfaces: Factory-formulated full-gloss alkyd interior enamel.

1. Benjamin Moore; Moore's IMC Urethane Alkyd Enamel No. M22: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. ICI Dulux Paints; 4308-XXXX Devguard Alkyd Industrial Gloss Enamel: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
3. Pittsburgh Paints; 7-814 Series Pittsburgh Paints Industrial Gloss-Oil Interior/Exterior Enamel: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
4. Sherwin-Williams; ProMar 200 Alkyd Gloss Enamel B35W200 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

2.8 INTERIOR WOOD STAINS AND VARNISHES

A. Open-Grain Wood Filler: Factory-formulated paste wood filler applied at spreading rate recommended by manufacturer.

1. Benjamin Moore; Benwood Paste Wood Filler No. 238.
2. ICI Dulux Paints; none required.
3. Pittsburgh Paints; none required.
4. Sherwin-Williams; Sher-Wood Fast-Dry Filler.
5. Sherwin-Williams; none recommended.

B. Interior Wood Stain: Factory-formulated alkyd-based penetrating wood stain for interior application applied at spreading rate recommended by manufacturer.

1. Benjamin Moore; Benwood Penetrating Stain No. 234.
2. ICI Dulux Paints; 1700-XXX WoodPride Interior Solventborne Wood Finishing Stain.
3. Pittsburgh Paints; 77-560 Rez Interior Semi-Transparent Oil Stain.
4. Sherwin-Williams; Wood Classics Interior Oil Stain A-48 Series.

C. Clear Sanding Sealer: Factory-formulated fast-drying alkyd-based clear wood sealer applied at spreading rate recommended by manufacturer.

1. Benjamin Moore; Moore's Interior Wood Finishes Quick-Dry Sanding Sealer No. 413.
2. ICI Dulux Paints; 1902-0000 WoodPride Interior Satin Polyurethane Varnish.
3. Pittsburgh Paints; 6-10 SpeedHide Quick-Drying Interior Sanding Wood Sealer and Finish.
4. Sherwin-Williams; Wood Classics Fast Dry Sanding Sealer B26V43.

D. Interior Alkyd- or Polyurethane-Based Clear Satin Varnish: Factory-formulated alkyd- or polyurethane-based clear varnish.

1. Benjamin Moore; Benwood Interior Wood Finishes Polyurethane Finishes Low Lustre No. 435.
2. ICI Dulux Paints; 1902-0000 WoodPride Interior Satin Polyurethane Varnish.
3. Pittsburgh Paints; 77-7 Rez Varnish, Interior Satin Oil Clear.
4. Sherwin-Williams; Wood Classics Fast Dry Oil Varnish, Satin A66-300 Series.

E. Interior Waterborne Clear Satin Varnish: Factory-formulated clear satin acrylic-based polyurethane varnish applied at spreading rate recommended by manufacturer.

1. Benjamin Moore; Stays Clear Acrylic Polyurethane No. 423, Satin.
2. ICI Dulux Paints; 1802-0000 WoodPride Interior Waterborne Aquacrylic Satin Varnish.

3. Pittsburgh Paints; 77-49 Rez Satin Acrylic Clear Polyurethane.
4. Sherwin-Williams; Wood Classics Waterborne Polyurethane Satin, A68 Series.

F. Interior Waterborne Clear Gloss Varnish: Factory-formulated clear gloss acrylic-based polyurethane varnish applied at spreading rate recommended by manufacturer.

1. Benjamin Moore; Benwood Interior Wood Finishes Polyurethane Finishes High Gloss No. 428.
2. ICI Dulux Paints; 1808-0000 WoodPride Interior Waterborne Aquacrylic Gloss Varnish.
3. Pittsburgh Paints; 77-45 Rez Full-Gloss Acrylic Clear Polyurethane.
4. Sherwin-Williams; Wood Classics Waterborne Polyurethane Gloss, A68 Series.

G. Paste Wax: As recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

   a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
   c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
   c. If transparent finish is required, backprime with spar varnish.
   d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
   e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

   a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
   b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
   c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
10. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky

under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Uninsulated metal piping.
2. Uninsulated plastic piping.
3. Pipe hangers and supports.
4. Tanks that do not have factory-applied final finishes.
5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:

1. Switchgear.
2. Panelboards.
3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

L. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.

2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 EXTERIOR PAINT SCHEDULE

A. Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry): Provide the following finish systems over exterior concrete, stucco, and brick masonry substrates:

1. Flat Acrylic Finish: Two finish coats over a primer.

   a. Primer: Exterior concrete and masonry primer.
   b. Finish Coats: Exterior flat acrylic paint.

2. Low-Luster Acrylic Finish: Two finish coats over a primer.

   a. Primer: Exterior concrete and masonry primer.
   b. Finish Coats: Exterior low-luster acrylic paint.

3. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Exterior concrete and masonry primer.
   b. Finish Coats: Exterior semigloss acrylic enamel.

4. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Exterior concrete and masonry primer.
   b. Finish Coats: Exterior full-gloss acrylic enamel for concrete, masonry, and wood.

B. Concrete Unit Masonry: Provide the following finish systems over exterior concrete unit masonry:

1. Flat Acrylic Finish: Two finish coats over a block filler.

   a. Block Filler: Concrete unit masonry block filler.
   b. Finish Coats: Exterior flat acrylic paint.

2. Low-Luster Acrylic Finish: Two finish coats over a block filler.

   a. Block Filler: Concrete unit masonry block filler.
   b. Finish Coats: Exterior low-luster acrylic paint.

3. Semigloss Acrylic-Enamel Finish: Two finish coats over a block filler.

   a. Block Filler: Concrete unit masonry block filler.
   b. Finish Coats: Exterior semigloss acrylic enamel.

4. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a block filler.

   a. Block Filler: Concrete unit masonry block filler.
   b. Finish Coats: Exterior full-gloss acrylic enamel for concrete, masonry, and wood.

C. Mineral-Fiber-Reinforced Cement Panels: Provide the following finish systems over exterior, mineral-fiber-reinforced cement panels:

1. Flat Acrylic Finish: Two finish coats over a primer.

a. Primer: Exterior concrete and masonry primer.
b. Finish Coats: Exterior flat acrylic paint.

D. Exterior Gypsum Soffit Board: Provide the following finish systems over exterior gypsum soffit board:

1. Flat Acrylic Finish: Two finish coats over an exterior alkyd- or alkali-resistant primer.

   a. Primer: Exterior gypsum soffit board primer.
   b. Finish Coats: Exterior flat acrylic paint.

2. Low-Luster Acrylic Finish: Two finish coats over a primer.

   a. Primer: Exterior gypsum soffit board primer.
   b. Finish Coats: Exterior low-luster acrylic paint.

3. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Exterior gypsum soffit board primer.
   b. Finish Coats: Exterior semigloss acrylic enamel.

4. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Exterior gypsum soffit board primer.
   b. Finish Coats: Exterior full-gloss acrylic enamel for concrete, masonry, and wood.

E. Smooth Wood: Provide the following finish systems over smooth wood siding, wood trim, and other smooth exterior wood surfaces:

1. Flat Acrylic Finish: Two finish coats over a primer.

   a. Primer: Exterior wood primer for acrylic enamels.
   b. Finish Coats: Exterior flat acrylic paint.

2. Low-Luster Acrylic Finish: Two finish coats over a primer.

   a. Primer: Exterior wood primer for acrylic enamels.
   b. Finish Coats: Exterior low-luster acrylic paint.

3. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Exterior wood primer for acrylic enamels.
   b. Finish Coats: Exterior semigloss acrylic enamel.

4. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Exterior wood primer for acrylic enamels.
   b. Finish Coats: Exterior full-gloss acrylic enamel for concrete, masonry, and wood.

5. Full-Gloss Alkyd-Enamel Finish: Two finish coats over a primer.

   a. Primer: Exterior wood primer for alkyd enamels.

b. Finish Coats: Exterior full-gloss alkyd enamel.

F. Wood Trim: Provide the following finish systems over exterior wood trim:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Exterior wood primer for acrylic enamels.
   b. Finish Coats: Exterior semigloss acrylic enamel.

2. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Exterior wood primer for acrylic enamels.
   b. Finish Coats: Exterior full-gloss acrylic enamel for concrete, masonry, and wood.

3. Full-Gloss Alkyd-Enamel Finish Two finish coats over a primer.

   a. Primer: Exterior wood trim primer for full-gloss alkyd enamels.
   b. Finish Coats: Exterior full-gloss alkyd enamel.

G. Plywood: Provide the following finish systems over exterior plywood:

1. Flat Acrylic Finish: Two finish coats over a primer.

   a. Primer: Exterior wood primer for acrylic enamels.
   b. Finish Coats: Exterior flat acrylic paint.

2. Low-Luster Finish: Two finish coats over a primer.

   a. Primer: Exterior wood primer for acrylic enamels.
   b. Finish Coats: Exterior low-luster acrylic paint.

H. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

1. Low-Luster Acrylic Finish: Two finish coats over a rust-inhibitive primer.

   a. Primer: Exterior ferrous-metal primer.
   b. Finish Coat: Exterior low-luster acrylic paint.

2. Semigloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.

   a. Primer: Exterior ferrous-metal primer.
   b. Finish Coats: Exterior semigloss acrylic enamel.

3. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.

   a. Primer: Exterior ferrous-metal primer.
   b. Finish Coats: Exterior full-gloss acrylic enamel for ferrous and other metals.

4. Full-Gloss Alkyd-Enamel Finish: Two finish coats over a rust-inhibitive primer.

   a. Primer: Exterior ferrous-metal primer.

b. Finish Coats: Exterior full-gloss alkyd enamel.

I. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated metal surfaces:

1. Low-Luster Finish: Two finish coats over a galvanized metal primer.

   a. Primer: Exterior galvanized metal primer.
   b. Finish Coat: Exterior low-luster acrylic paint.

2. Semigloss Acrylic-Enamel Finish: Two finish coats over a galvanized metal primer.

   a. Primer: Exterior galvanized metal primer.
   b. Finish Coats: Exterior semigloss acrylic enamel.

3. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a galvanized metal primer.

   a. Primer: Exterior galvanized metal primer.
   b. Finish Coats: Exterior full-gloss acrylic enamel for ferrous and other metals.

4. Full-Gloss Alkyd-Enamel Finish Two finish coats over a galvanized metal primer.

   a. Primer: Exterior galvanized metal primer.
   b. Finish Coats: Exterior full-gloss alkyd enamel.

J. Aluminum: Provide the following finish systems over exterior aluminum surfaces:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Exterior aluminum primer under acrylic finishes.
   b. Finish Coats: Exterior semigloss acrylic enamel.

2. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Exterior aluminum primer under acrylic finishes.
   b. Finish Coats: Exterior full-gloss acrylic enamel for ferrous and other metals.

3. Full-Gloss Alkyd-Enamel Finish: Two finish coats over a primer.

   a. Primer: Exterior aluminum primer under alkyd finishes.
   b. Finish Coats: Exterior full-gloss alkyd enamel.

3.8 INTERIOR PAINT SCHEDULE

A. Concrete and Masonry (Other Than Concrete Unit Masonry): Provide the following paint systems over interior concrete and brick masonry substrates:

1. Flat Acrylic Finish: Two finish coats over a primer.

   a. Primer: Interior concrete and masonry primer.
   b. Finish Coats: Interior flat acrylic paint.

2. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior concrete and masonry primer.
   b. Finish Coats: Interior low-luster acrylic enamel.

3. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior concrete and masonry primer.
   b. Finish Coats: Interior semigloss acrylic enamel.

4. Semigloss Alkyd-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior concrete and masonry primer.
   b. Finish Coats: Interior semigloss alkyd enamel.

B. Concrete Unit Masonry: Provide the following finish systems over interior concrete masonry:

1. Flat Acrylic Finish: Two finish coats over a block filler.

   a. Block Filler: Concrete unit masonry block filler.
   b. Finish Coats: Interior flat acrylic paint.

2. Low-Luster Acrylic-Enamel Finish: Two finish coats over a block filler.

   a. Block Filler: Concrete unit masonry block filler.
   b. Finish Coats: Interior low-luster acrylic enamel.

3. Semigloss Acrylic-Enamel Finish: Two finish coats over a block filler.

   a. Block Filler: Concrete unit masonry block filler.
   b. Finish Coats: Interior semigloss acrylic enamel.

4. Semigloss Alkyd-Enamel Finish: Two finish coats over a filled surface.

   a. Block Filler: Concrete unit masonry block filler.
   b. Finish Coat: Interior semigloss alkyd enamel.

C. Mineral-Fiber-Reinforced Cement Panels: Provide the following finish systems over interior mineral-fiber-reinforced cement panels:

1. Flat Acrylic Finish: Two finish coats.

   a. Finish Coats: Interior flat acrylic paint.

D. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Flat Acrylic Finish: Two finish coats over a primer.

   a. Primer: Interior gypsum board primer.
   b. Finish Coats: Interior flat acrylic paint.

2. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior gypsum board primer.
b. Finish Coats: Interior low-luster acrylic enamel.

3. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior gypsum board primer.
b. Finish Coats: Interior semigloss acrylic enamel.

4. Semigloss Alkyd-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior gypsum board primer.
b. Finish Coats: Interior semigloss alkyd enamel.

5. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior gypsum board primer.
b. Finish Coats: Interior full-gloss acrylic enamel.

6. Full-Gloss Alkyd-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior gypsum board primer.
b. Finish Coats: Interior full-gloss alkyd enamel for gypsum board and plaster.

E. Plaster: Provide the following finish systems over new interior plaster surfaces:

1. Flat Acrylic Finish: Two finish coats over a primer.

a. Primer: Interior plaster primer.
b. Finish Coats: Interior flat acrylic paint.

2. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior plaster primer.
b. Finish Coats: Interior low-luster acrylic enamel.

3. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior plaster primer.
b. Finish Coats: Interior semigloss acrylic enamel.

4. Semigloss Alkyd-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior plaster primer.
b. Finish Coats: Interior semigloss alkyd enamel.

5. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior plaster primer.
b. Finish Coats: Interior full-gloss acrylic enamel.

6. Full-Gloss Alkyd-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior plaster primer.
b. Finish Coats: Interior full-gloss alkyd enamel for gypsum board and plaster.

F. Acoustical Plaster: Provide the following finish system over interior acoustical plaster surfaces:

1. Flat Acrylic-Latex Finish: Two finish coats.

a. Finish Coats: Interior flat acrylic paint.

G. Wood and Hardboard: Provide the following paint finish systems over new interior wood surfaces:

1. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes.
b. Finish Coats: Interior low-luster acrylic enamel.

2. Semigloss Acrylic-Enamel Finish: Two finish coats over a wood undercoater.

a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes.
b. Finish Coats: Interior semigloss acrylic enamel.

3. Semigloss Alkyd-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes.
b. Finish Coats: Interior semigloss alkyd enamel.

4. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a wood primer.

a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes.
b. Finish Coats: Interior full-gloss acrylic enamel.

5. Full-Gloss Alkyd-Enamel Finish: Two finish coats over a wood primer.

a. Primer: Interior wood primer for full-gloss alkyd-enamel finishes.
b. Finish Coats: Interior full-gloss alkyd enamel for wood and metal surfaces.

H. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Flat Acrylic Finish: Two finish coats over a primer.

a. Primer: Interior ferrous-metal primer.
b. Finish Coats: Interior flat acrylic paint.

2. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior ferrous-metal primer.
b. Finish Coats: Interior low-luster acrylic enamel.

3. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior ferrous-metal primer.
   b. Finish Coats: Interior semigloss acrylic enamel.

4. Semigloss Alkyd-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior ferrous-metal primer.
   b. Finish Coats: Interior semigloss alkyd enamel.

5. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior ferrous-metal primer.
   b. Finish Coats: Interior full-gloss acrylic enamel.

6. Full-Gloss Alkyd-Enamel Finish Two finish coats over a primer.

   a. Primer: Interior ferrous-metal primer.
   b. Finish Coats: Interior full-gloss alkyd enamel for wood and metal surfaces.

I. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces:

1. Flat Acrylic Finish: Two finish coats over a primer.

   a. Primer: Interior zinc-coated metal primer.
   b. Finish Coats: Interior flat acrylic paint.

2. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior zinc-coated metal primer.
   b. Finish Coats: Interior low-luster acrylic enamel.

3. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior zinc-coated metal primer.
   b. Finish Coats: Interior semigloss acrylic enamel.

4. Semigloss Alkyd-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior zinc-coated metal primer.
   b. Finish Coats: Interior semigloss alkyd enamel.

5. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior zinc-coated metal primer.
   b. Finish Coats: Interior full-gloss acrylic enamel.

6. Full-Gloss Alkyd-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior zinc-coated metal primer.
   b. Finish Coats: Interior full-gloss alkyd enamel for wood and metal surfaces.

J. All-Service Jacket over Insulation: Provide the following finish system on cotton or canvas insulation covering:

1. Flat Acrylic Finish: Two finish coats. Add fungicidal agent to render fabric mildew proof.

   a. Finish Coats: Interior flat latex-emulsion size.

3.9 INTERIOR STAIN AND NATURAL-FINISH WOODWORK SCHEDULE

A. Stained Woodwork: Provide the following stained finishes over new interior woodwork:

1. Alkyd-Based Stain Satin-Varnish Finish: Two finish coats of alkyd-based clear satin varnish over a sealer coat and interior wood stain. Wipe wood filler before applying stain.

   a. Filler Coat: Open-grain wood filler.
   b. Stain Coat: Interior wood stain.
   c. Sealer Coat: Clear sanding sealer.
   d. Finish Coats: Interior alkyd- or polyurethane-based clear satin varnish.

2. Waterborne Stain Satin-Varnish Finish: Two finish coats of waterborne clear satin varnish over a sealer coat and waterborne interior wood stain. Wipe wood filler before applying stain.

   a. Filler Coat: Open-grain wood filler.
   b. Stain Coat: Interior wood stain.
   c. Sealer Coat: Clear sanding sealer.
   d. Finish Coats: Interior waterborne clear satin varnish.

3. Waterborne Stain Full-Gloss Varnish Finish: Two finish coats of waterborne clear full-gloss varnish over a sealer coat and interior wood stain. Wipe filler before applying stain.

   a. Filler Coat: Open-grain wood filler.
   b. Stain Coat: Interior wood stain.
   c. Sealer Coat: Clear sanding sealer.
   d. Finish Coats: Interior waterborne clear gloss varnish.

4. Alkyd-Based Stain Wax-Polished Finish: Three coats of paste wax over a sealer coat and alkyd-based interior wood stain.

   a. Stain Coat: Interior wood stain.
   b. Sealer Coat: Clear sanding sealer.
   c. Finish Coats: Paste wax.

B. Natural-Finish Woodwork: Provide the following natural finishes over new interior woodwork:

1. Alkyd-Based Satin-Varnish Finish: Two finish coats of alkyd-based clear satin varnish over a sanding sealer. Provide wood filler on open-grain wood before applying first varnish coat.

   a. Filler Coat: Open-grain wood filler.
   b. Sealer Coat: Clear sanding sealer.

c. Finish Coats: Interior alkyd- or polyurethane-based clear satin varnish.

2. Waterborne Satin-Varnish Finish: Two finish coats of waterborne clear satin varnish over a sanding sealer. Wipe wood filler before applying stain.

   a. Filler Coat: Open-grain wood filler.
   b. Sealer Coat: Clear sanding sealer.
   c. Finish Coats: Interior waterborne clear satin varnish.

3. Waterborne Full-Gloss Varnish Finish: Two finish coats of waterborne clear full-gloss varnish over a sealer coat. Wipe filler before applying stain.

   a. Filler Coat: Open-grain wood filler.
   b. Sealer Coat: Clear sanding sealer.
   c. Finish Coats: Interior waterborne clear gloss varnish.

4. Wax-Polished Finish: Three finish coats of paste wax over a sanding-sealer first coat.

   a. Sealer Coat: Clear sanding sealer.
   b. Finish Coats: Paste wax.

END OF SECTION 09912

SECTION 10101 - VISUAL DISPLAY BOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of visual display boards:

1. Porcelain enamel markerboards (for liquid chalk).
2. Tackable Wall Covering: Corked Backed Vinyl Faced Tackboard (Wallcovering) material for direct application to wall substrate (without frame).

B. SUBMITTALS

1. Shop Drawings: Provide shop drawings for each type of chalkboard, markerboard, and tackboard required. Include sections of typical trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories, layout, and installation details.
2. Samples: Provide the following samples of each product for initial selection of colors, patterns, and textures, as required, and for verification of compliance with requirements indicated.

   a. Samples for initial selection of color, pattern, and texture:

      1) Porcelain Enamel Markerboard: Manufacturer's color charts consisting of actual sections of porcelain enamel finish showing the full range of colors available for each type of chalkboard and markerboard required.
      2) Corked Backed Vinyl Faced Tackboards (Wallcovering): Manufacturer's color charts consisting of actual sections of vinyl fabric, showing the full range of colors, textures, and patterns available for each type of vinyl-fabric-faced cork tackboard indicated.
      3) Aluminum Trim and Accessories: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate, showing the full range of colors available.

3. Certificates: In lieu of laboratory test reports, when permitted by the Architect, submit the manufacturer's certification that vinyl-fabric-faced cork tackboard materials furnished comply with requirements specified for flame spread ratings.

C. QUALITY ASSURANCE

1. Fire Performance Characteristics: Provide vinyl-fabric-faced tackboards with surface burning characteristics indicated below, as determined by testing assembled materials composed of facings and backings identical to those required in this section, in accordance with ASTM E 84, by a testing organization acceptable to authorities having jurisdiction.

   a. Flame Spread: 25 or less.
   b. Smoke Developed: 10 or less.

D. WARRANTY

1. Porcelain Enamel Chalkboard Warranty: Furnish the manufacturer's written warranty, agreeing to replace porcelain enamel chalkboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking, provided the manufacturer's instructions with regard to handling, installation, protection, and maintenance have been followed.

   a. Warranty Period: Lifetime of the building.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products may be incorporated in the work include the following:

   a. Greensteel Division, IDT Corp. Dixonville, PA (800/766-4204 or 412/254-4321; local representative Corona, CA 714/371-5931 or 800/ 224-8944).

   b. Claridge Products and Equipment, Inc., Harrison, AR (Western Division, San Leandro, CA 510/351-8183).

   c. Tri-Adco Manufacturing Co., Glendale, AZ (602/842-1204 or 800/266-1204).

   d. ADP/Lemco, Inc., West Jordan, UT (801/280-4000).

B. MARKERBOARDS

1. Specified Manufacturer: Nelson Adams/ GSI, Subsidiary of Polyvision, Inc., Corona, CA (909/340-2800)

2. Acceptable Manufacturers: Equivalent products of the manufacturers listed below will be acceptable in accordance with the "or equal" provision specified in Section 01600- Product Requirements. Equivalent products of other manufacturers will be considered in accordance with the substitution provision specified in Section 01631 - Product Substitutions.

   a. Greensteel Division, IDT corp.Dixonville, PA (800/766-4204 or 412/254-4321; local representative Corona, CA 714/371-5931 or 800/ 224-8944).

   b. Claridge Products and Equipment, Inc., Harrison, AR (Western Division, San Leandro, CA 510/351-8183).

   c. Tri-Adco Manufacturing Co., Glendale, AZ (602/842-1204 or 800/266-1204).

   d. ADP/Lemco, Inc., West Jordan, UT (801/280-4000).

3. Fixed Procelain Marker Boards: NACO/GSI 400 Series, wall mounted, aluminum-framed porcelain enamel markerboards, with punched and wrapped safety corners and concealed fasteners. Cut and clipped corners will not be acceptable. Sizes shall be as indicated on the drawings.

4. Horizontal Sliding Porcelain Enamel Marker Boards: NACO/GSI H-3 Series, Type D, horizontal sliding porcelain enamel markerboard and tackboard assemblies, three sliding panels in heavyduty aluminum-frame with 2-inch high map rail with cork insert and two flag holders, top supported with ball bearing wheeled carriers, nylon bottom guides and continuous aluminum bottom track, sizes as indicated on the drawings, for mounting to wall with concealed fasteners, with mounted in casework as indicated on the drawings. Provide intergrated finger pulls in sliding panels.

5. Aluminum Extrusions: Manufacturer's standard extruded aluminum sections with not less than the strength and durability properties specified in ASTM B221 for 6063-T5 alloy.

6. Marker Boards Panels: NACO/GSI pp-34 Low Gloss Porcelain Marker Surface, balanced, high pressure-laminated porcelain enamel chalkboards of 3-ply construction consisting of face sheet, core material, and backing, suitable for use as projection and writing surface.

    a. Face Sheet: Enameling grade steel especially processed for temperatures used in coating porcelain on steel.

        1.Fabricate fixed markerboards with 28 gage sheet steel face sheet.
        2.Fabricate horizontal sliding makerboards with 24 gage sheet steel face sheet.
        3. Exposed face and exposed edges shall be coated with a 3-coat process consisting of primer, ground coat, and color cover coat, and the concealed face with a 2-coat process consisting of primer and ground coat.
        4. Cover and ground coats shall be fused to steel at the manufacturer's standard firing temperatures, but not less than 1200 deg F (649 deg C).
        5. Color cover coat shall be NACO W402 White.

    b. Panel core:

        1. Fixed markerboards: ½ inch thick particleboard complying with the requirements of ANSI A208.1, Grade 1-M-1.
        2. Horizontal sliding markerboards: Honeycomb core with internal metal sub-frame.

    c. Panel backing: Manufacturer's standard moisture-barrier backing.

    d. Marker Board Surface: Surface shall be capable of the following:

        1. Receiving and holding magnets and acting as a projection screen.
        2. Being marked on with projection ink and water soluble crayons.
        3. Being marked by semi- permanent markers for drawings graphs and other diagrams and symbols which are to remain semi-permanently.
        4. Not require solvent for erasing.

7. Vinyl-Fabric Faced Tackboards Panels: For installation in sliding markerboard assemblies, provide mildew –resistant, washable, vinyl fabric complying with FS CCC-W-

W-408, Type 11, weighing not less than 13 ounces per square yard, laminated to ¼-inch thick cork sheet.

a. Fire performance: Provide fabric that has a flame spread rating of 25 or less when tested in accordance with ASTM E84.
b. Backing: Make panels rigid by factory laminating cork face sheet under pressure to ¼ inch-thick hardboard backing.
c. Color and texture: As indicated on Drawings or, if not indicated, as selected by Architect.

8. Accessories for Wall-Mounted Markerboards:

a. Map Rail: Furnish map rail at top of each wall-mounted unit, complete with the following accessories:

1. Display Rail: Provide continuous cork display rail approximately 1 or 2 inches(25 or 50mm) wide, as indicated, integral with map rail.
2. End Stops: Provide one end stop at each end of map rail.
3. Map Hooks: Provide 2 map hook with flexible metal clips for every 48 inches(1220 mm) of map rail or fraction thereof.

b. Flag Holder: Provide two flag holders for each room

9. Framing and Trim Finish: Clear anodized aluminum AA-M12C22A31 (Mechanical Finish: as fabricated, nonspecular; Chemical Finish: etched, medium matte; Anodic Coating: Class 11 Architectural, clear film thicker than 0.4 mil (0.01mm).

C. TACKABLE WALL COVERING:

1. Cellulose Backed Vinyl Faced Tackboard (Wallcovering): Koroseal. Product: VWC-1 - HARBOR WEAVE II - color to be selected.

2.2 ACCESSORIES

A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch-thick aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units wherever possible; keep joints to a minimum. Miter corners to a neat, hairline closure.

1. Where the size of boards or other conditions exist that require support in addition to the normal trim, provide structural supports or modify the trim as indicated or as selected by the Architect from the manufacturer's standard structural support accessories to suit the condition indicated.
2. The manufacturer's standard screw-on trim with Phillips flat-head screws.
3. Chalktray: Furnish the manufacturer's standard continuous, solid extrusion-type aluminum chalktray with ribbed section and smoothly curved exposed ends, for each chalkboard.
4. Map Rail: Furnish map rail at the top of each unit, complete with the following accessories:

a. Display Rail: Provide continuous cork display rail 2 inches wide, as indicated, integral with the map rail.
b. End Stops: Provide one end stop at each end of the map rail.
c. Map Hooks: Provide 2 map hooks with flexible metal clips for each 4 feet of map rail or fraction thereof.
d. Flagholder: Provide one flagholder for each room.
e. Vinyl Fabric-Faced Tackboard Adhesive: Provide the manufacturer's standard adhesive.

B. FABRICATION

1. Porcelain Enamel Chalkboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.

2. Assembly: Provide factory-assembled chalkboard and tackboard units, except where field-assembled units are required.

a. Make joints only where total length exceeds maximum manufactured length. Fabricate with the minimum number of joints, balanced around the center of the board, as acceptable to the Architect.
b. Provide the manufacturer's standard vertical joint system between abutting sections of markerboard.
c. Provide manufacturer's standard mullion trim at joints between chalkboard and tackboard.

C. FINISHES

1. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
2. Class II Clear Anodized Finish: AA-M12C22A31 (Mechanical Finish: as fabricated, nonspecular; Chemical Finish: etched, medium matte; Anodic Coating: Class II Architectural, clear film thicker than 0.4 mil).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Deliver factory-built chalkboard and tackboard units completely assembled in one piece without joints, wherever possible. Where dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to the Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.

B. Install units in locations and at mounting heights indicated and in accordance with the manufacturer's instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation.

C. Apply adhesive to back of vinyl-fabric-faced tackboards and place in accordance with manufacturer's instructions. Install seams vertically and plumb.

D. Coordinate job-site assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.2 ADJUST AND CLEAN

A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

B. Clean units in accordance with the manufacturer's instructions. Break in chalkboards only as recommended by the manufacturer.

END OF SECTION 10101

SECTION 10125 - DISPLAY CASES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Illuminated display cases.

B. Related Sections include the following:
   1. Division 16 Sections for wiring and other electrical work associated with illuminated display cases.

1.3 DEFINITIONS

A. Display Case: Glazed cabinet with adjustable shelves.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for display cases.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

   1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   2. Show location of tack assembly seams and joints.
   3. Include sections of typical trim members.
   4. Wiring Diagrams: Power, signal, and control wiring for illuminated units.

C. Samples for Initial Selection: For units with factory-applied color finishes as follows:

   1. Actual sections of tack assembly.
   2. Fabric swatches of fabric-faced tack assemblies.
   3. Section of header panel for color selection.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of product through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of display cases and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Fire-Test-Response Characteristics: Provide fabrics with the surface-burning characteristics indicated, as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify recessed openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating products without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hardboard: AHA A135.4, tempered.

B. Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.

C. Polyester Fabric: Nondirectional weave, 100 percent polyester; weighing not less than 15 oz./sq. yd.; with flame-spread index of 25 or less when tested according to ASTM E 84.

D. Extruded-Aluminum Bars and Shapes: ASTM B 221, Alloy 6063.

E. Aluminum Tubing: ASTM B 429, Alloy 6063.

F. Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3, with exposed edges seamed before tempering, and 6 mm thick, unless otherwise indicated.

G. Fasteners: Provide screws, bolts, and other fastening devices made from same material as items being fastened, except provide hot-dip galvanized, stainless-steel, or aluminum fasteners for exterior applications. Provide types, sizes, and lengths to suit installation conditions. Use security fasteners where exposed to view.

2.2 TACK ASSEMBLIES

A. Polyester-Fabric-Faced Tack Assembly: 1/4-inch- thick, polyester-fabric-faced cork sheet factory laminated to 1/4-inch- thick hardboard backing.

2.3 DISPLAY CASE

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: The design for display cases is based on. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Claridge Products and Equipment, Incorporated, Harrison, AR (870) 743-2200.
2. Greensteel, Incorporated, Dixonville, PA (800) 766-4204.
3. Webster Costello.

D. Surface-Mounted, Aluminum-Framed Cabinet: Factory-fabricated cabinet with manufacturer's standard, 2-by-2-inch nominal, tubular aluminum frame; with hardwood-veneer-plywood top and bottom panels, tack assembly over plywood on back inside surface, glazed side panels, and glazed doors at front.

1. Aluminum Finish: Clear anodic.

E. Glazed Sliding Doors: 6-mm-thick tempered glass; unframed; with extruded-aluminum top and bottom track; supported on nylon or ball-bearing rollers; with plastic top guide and rubber bumpers. Equip each door with ground finger pull and adjustable cylinder lock with two keys.

1. Number of Doors: As indicated on Drawings.

F. Shelves: 6-mm-thick tempered glass; supported on adjustable shelf standards and supports.

1. Shelf Width: As indicated on Drawings.
2. Number of Shelves: As indicated on Drawings .

G. Adjustable Shelf Standards and Supports: Provide standards full height of display case.

H. Tack Surface: Polyester-fabric-faced tack assembly.

1. Color: As selected by Architect from full range of industry colors.

I. Illumination System: Concealed top-lighting system consisting of fluorescent-strip fixtures. Include lamps and internal wiring with single concealed electrical connection to building system. Coordinate electrical characteristics with power supply provided.

1. Ballasts: Low-temperature, high-power-factor, low-energy, fluorescent lamp ballasts that comply with CBMA standards and carry its label.

2.4 FABRICATION

A. Fabricate display cases to requirements indicated for dimensions, design, and thickness and finish of materials.

B. Use metals and shapes of thickness and reinforcing to produce flat surfaces, free of oil canning, and to impart strength for size, design, and application indicated.

C. Fabricate cabinets and door frames with reinforced corners, mitered to a hairline fit, with no exposed fasteners.

D. Fabricate exterior units with vents to permit evaporation of moisture trapped inside.

E. Fabricate shelf standards plumb and at heights to align shelf brackets for level shelves.

2.5 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

E. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for electrical power system to verify actual locations of connections before installation of illuminated units.

C. Examine walls and partitions for proper backing for display cases.

D. Examine walls and partitions for suitable framing depth where recessed units will be installed.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for display cases as required by type and size of unit.

3.3 INSTALLATION

A. General: Install units in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Recessed Display Cases: Attach units to wall framing with fasteners at not more than 16 inches o.c. Attach aluminum trim over edges of recessed display cases and conceal grounds and clips. Attach trim with fasteners at not more than 24 inches o.c.

C. Surface-Mounted Display Cases: Attach units to wall surfaces with concealed clips, hangers, or grounds fastened at not more than 16 inches o.c. Secure both top and bottom of display cases to walls.

D. Freestanding Display Cases: Install display cases in locations indicated. Adjust floor glides so display cases are level and plumb.

E. Comply with requirements in Division 16 for connecting illuminated display cases.

1. After installation is complete, install new fluorescent lamps.

F. Install display case shelving level and straight.

3.4 ADJUSTING AND CLEANING

A. Adjust doors to operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 10125

SECTION 10155 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes solid-polymer units as follows:

1. Toilet Enclosures: Floor-anchored and overhead braced.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of cutouts for compartment-mounted toilet accessories.
2. Show locations of reinforcements for compartment-mounted grab bars.

C. Samples for Initial Selection: For each type of unit indicated.

D. Samples for Verification: Of each type of color and finish required for units, prepared on 6-inch square Samples of same thickness and material indicated for Work.

1.4 QUALITY ASSURANCE

A. Comply with requirements in CID-A-A-60003, "Partitions, Toilets, Complete."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 METAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Comtec Industries, Inc.
2. Santa Ana Products Co., Inc.
3. Sanymetal; a Crane Plumbing Company.
4. Sanymetal Products Corp.

2.2 SOLID-POLYMER UNITS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Comtec Industries.
2. Santana Products, Inc.
3. Sanymetal; a Crane Plumbing Company.
4. Sanatec Industries, Inc.

C. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges ¼" radius and with homogenous color and pattern throughout thickness of material.

1. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range of colors and patterns.

D. Pilaster Shoes: Manufacturer's standard design; polymer.

1. Polymer Color and Pattern: Matching pilaster.

E. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.
2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

a. Polymer Color and Pattern: Matching pilaster.

F. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip fastened to exposed bottom edges of solid-polymer components to prevent burning.

2.3 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Stainless steel.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Support Posts for Urinal Screens: Manufacturer's standard aluminum post with floor shoe for anchoring to floor construction.

D. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.4 FABRICATION

A. Toilet stalls for disabled persons shall have slide bolt door latch, U-shape or wire pulls both sides of the door located directly beneath the latch, and self closing hinges.
   1. Door hardware shall be mounted at 30" to 44" above finish floor.
   2. Provide coat hook, mounted at 48 inches A.F.F.

B. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.

C. Doors: Unless otherwise indicated, provide 24-inch- wide in-swinging doors for standard toilet compartments and 36-inch- wide doors with minimum clear openings for compartments as indicated at accessible stalls.
   1. Slide Latch and U-shaped Keeper: Surface-mounted latch unit with coated slide bolt and button. Provide units that comply with accessibility requirements of CBC at compartments indicated to be accessible.
      a. Mount at 30" to 44" above finished floor at disabled persons stall.
   2. Doors at front entry stalls shall have 32 inches minimum clear width when door is open 90 degrees.
   3. Doors at side entry stalls shall have 34 inches minimum clear width when door is open 90 degrees.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

   1. Maximum Clearances:

      a. Pilasters and Panels: 1/2 inch.
      b. Panels and Walls: 1 inch.

2. Stirrup Brackets: Secure panels to walls and to pilasters with not less than three brackets attached at midpoint and near top and bottom of panel.

   a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
   b. Align brackets at pilasters with brackets at walls.

B. Floor-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors[and doors in entrance screens] to return doors to fully closed position.

END OF SECTION 10155

SECTION 10350 - FLAGPOLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Aluminum ground mounted flagpole.
2. Truck, halyards, and accessories.
3. Concrete flagpole foundation base.

B. Related Documents: The Contract Documents, as defined in Section 01110 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:
1. Section 03300 – Cast-in-Place Concrete: Concrete base.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM B 241 - Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements:
1. Pole With Flag Flying: Resistant without permanent deformation, 100 miles per hour wind velocity, non-resonant, safety design factor of 1.0.
2. Flag Dimension: 5 foot x 8 foot.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Procedures for submittals.
1. Product Data: Data on pole, accessories, and configurations.
2. Shop Drawings: Detailed dimensions, anchor requirements, imposed loads, and foundation system.
3. Assurance/Control Submittals:
   a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Design flagpole foundation under direct supervision of a Professional Structural Engineer licensed in the State where Project is located, experienced in the design of flagpole supports.

1.6 DELIVERY, STORAGE AND HANDLING

A. Section 01600 - Product Requirements: Transport, handle, store, and protect products.

B. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

C. Protect flagpole and accessories on site from damage or moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
1. American Flagpole, Division of Kearney-National Incorporated, Abingdon, VA (800) 368-7171.
2. Eder Flag Manufacturing Company, Incorporated, Oak Creek, WI (800) 558-6044.
3. Concord Industries, Incorporated, Addison, TX (800) 527-3902.

B. Section 01600 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

A. Pole Type: Commercial internal halyard cone tapered aluminum with ground sleeve.

B. Flagpole: ASTM B 241; 6063-T6 wrought alloy aluminum, cone tapered.
1. Outside Butt Diameter: 5-1/2 inches.
2. Outside Tip Diameter: 3-1/2 inches.
3. Nominal Wall Thickness: 0.188 inches.
4. Nominal Height: 25 foot 0 inches, measured from top of flagpole base.
5. Mounting: Ground mounted to concrete foundation and base.

C. Truck Assembly: Aluminum; revolving; stainless steel ball-bearings, non-fouling.

D. Halyard: Stainless steel aircraft cable with four chrome plated bronze swivel snaphooks, plastic covered counterweight, and beaded sling.

E. Hand Crank: Removable type with automatic brake system to permit locking of flag in any position.

F. Collar: Spun aluminum to match pole.

G. Foundation Sleeve: 16 gauge steel, galvanized corrugated tube with 3/16 inch thick steel base plate and support plate, 3/4 inch diameter x 18 inch long ground spike, and steel centering wedges.

H. Concrete: Specified in Section 03300.

I. Flags: Furnished and installed by District.

2.3 FINISHES

A. Metal Surfaces in Contact with Concrete: Asphaltic paint.

B. Aluminum: AA M32-C22-A41 Clear anodized.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01700 - Execution Requirements: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the District.

3.2 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.3 INSTALLATION

A. Install flagpole base assembly, and accessories in accordance with manufacturer's published instructions.

B. Electrically ground flagpole installation.

C. Install foundation plate and centering wedges for flagpole base set in concrete base and fasten. Fill foundation tube sleeve with sand and compact.

3.4 CONSTRUCTION

A. Site Tolerances:
1. Maximum Variation From Plumb: One inch.

3.6 ADJUSTING AND CLEANING

A. Clean flagpole surfaces immediately prior to installation.

B. Adjust operating devices for smooth halyard and flag function.

END OF SECTION 10350

SECTION 10431 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of signs:

1. Tactile Plaques

B. SUBMITTALS

1. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
2. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
3. Shop drawings showing fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.

   a. Provide message list for each sign required, including large-scale details of wording and lettering layout.
   b. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
   c. Templates: Furnish full-size spacing templates for individually mounted dimensional letters and numbers.

4. Samples: Submit samples of each sign form and material showing finishes, colors, surface textures and qualities of manufacturer and design of each sign component including graphics.

   a. Submit full-size sample units. Acceptable units may be installed as part of the work.

1.2 QUALITY ASSURANCE

A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

C. Design Criteria: The drawings indicate size, profiles, and dimensional requirements of some signs and some are based on the specific type and model indicated. Signs by other manufacturers may be considered provided that deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the manufacturer.

1. All signage shall comply with CBC Sections 1117B and 1103.2.4. Nothing in this specification shall be construed to relieve the Contractor of complying with all applicable codes.
2. Color of symbol: The international symbol of accessibility shall consist of blue equal to Color No. 15090 in Federal Standard 595B.
3. Signage and Graphics:

   a. **Character type**: Characters on signs shall be raised 1/32" inch minimum and shall be sans serif uppercase characters accompanied by California Contracted Grade 2 Braille.

   b. **Character size**: On Tactile Signs, raised characters shall be a minimum of 5/8 inchand a maximum of 2 inches high.

   c. **Finish and contrast**: Contrast between character, symbols and their background must be 70% minimum and have a non-glare finish. 1117B.5.2.

   d. **Proportions**: Characters on signs shall have a width-to-height ratio of between 3:5 and 1:1 and a stroke width-to-height ratio of between 1:5 and 1:10. 1117B.5.3.

   e. **All letters measured must be uppercase**. After choosing a typestyle to test, begin by printing the letters, I, X, and O at 1 inch. Place the template's 1:1 square over the X or O, whichever is narrower. If the character is not wider than 1 inch, nor narrower than the 3:5 rectangle, the proportions are correct. Use the 1:5 rectangle to determine if the stroke of the I is too broad, and the 1:10 rectangle to see if it is too narrow. If all the tests are passed, the typestyle is compliant with proportion code.

   f. **Braille**: California Contracted Grade 2 Braille shall be used wherever Braille is required in other portions of these standards. Dots shall be 1/10 inch on centers in each cell with 2/10 inch space between cells, measured from the second column of dots in the first cell to the first column of dots in the second cell. Dots shall be raised a minimum of 1/40 inch above the background. Utilize rounded or domed California Braille dots.

1.3 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include the following:

   1. Basis-of-Design: ASI Sign Systems, Inc., Infinity series.
   2. Architect and District approved equal.

B. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.

C. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.2 TACTILE PLAQUES

A. Manufacturer's standard embossed one-piece sign face construction to comply with relevant ADA regulations and requirements indicated for materials, thickness, finish colors, shapes, sizes and details of construction.

1. Sign Face: One-piece embossed
2. Laminating Base: .125 inch thick acrylic.
3. Fastener: screw mount (4 screws each)
4. Colors: As selected from manufacturer's high contrast standards.

2.3 DIMENSIONAL LETTERS

a. **Letter type**: Letters shall be italic Ariel uppercase.

b. **Letter size**: Letters shall be a minimum of 10 inches high.

c. **Finish**: Brush stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
2. Tactile Plaques - Room Number: ADA Compliance.
3. Background Size: 8" x 8".
4. Typography: Helvetica Medium.
5. Room Number: 1 line, 1-1/2" high.
6. Room Name: 2 lines, 5/8" high.
7. Braille Lines: 2, California Contracted Grade 2 Braille directly below number or name.
8. Mounting Location and Height: Signs shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting height shall be per plans. Mounting location for such signage shall be so that a person may approach within 3 inches (76 mm) of signage without encountering protruding objects or standing within the swing of a door. Mounting locations shall be per DSA Approved Plans. Allow for a variety of mounting types.
9. Tactile Plaques - Toilet Room Door: California Building Code Compliance.

   a. Size: Doorways leading to men's sanitary facilities shall be identified by an equilateral triangle 1/4 inch thick with edges 12 inches long and a vertex pointing upward.

Women's sanitary facilities shall be identified by a circle 1/4 inch thick and 12 inches in diameter.

b. Mounting Location, Height and Color: These geometric symbols shall be centered on the door at a height of 60 inches and their color and contrast shall be distinctly different from the color and contrast of the door.

10. Tactile Plaques - Toilet Room Identification: ADA Compliance.

    a. Size: 8" x 8".
    b. Typography: Helvetica Medium.
    c. Pictogram: Man or woman or both as applicable plus International Symbol of Accessibility. ¼" raised finish.
    d. Text: Men, Women, as applicable.
    e. Braille: California Contracted Grade 2 braille directly below text.
    f. Mounting Location and Height: Signs shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting height shall be 60 inches (1525 mm) above the finish floor to the centerline of the sign. Mounting location for such signage shall be so that a person may approach within 3 inches (76 mm) of signage without encountering protruding objects or standing within the swing of a door. Allow for a variety of mounting types.

11. Tactile Plaques - Accessible Entrance: California State Building Code Compliance.

    a. Size: 8" x 8".
    b. Pictogram: International symbol of accessibility, 5/8" thick, 5" high, white paint.
    c. Mounting Location and Height; Directly below room identification signs.

12. Cleaning and Protection: At completion of the installation, clean soiled sign surfaces. Protect from damage until Owner's acceptance.

END OF SECTION 10431

SECTION 10520 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers.

2. Recessed cabinets for fire extinguishers.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.

1. Fire Extinguishers: Include rating and classification.

2. Fire Extinguisher Cabinets.

B. Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. CFC Standard, Section 10-1, Fire Protection and Equipment

C. CFC, Title 19, CCR, Public Safety, State Fire Marshal Regulations

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to CFC Standard, Section 10-1.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 PORTABLE FIRE EXTINGUISHERS

A. Manufacturers:
1. Larsen's Manufacturing Company.
2. Potter Roemer; Div. of Smith Industries, Inc.
3. JL Industries, Inc.

B. General: Provide fire extinguishers of type, size, and capacity for each mounting bracket indicated.
1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B .

C. Regular Dry-Chemical Type UL-rated 2A-10BC minimum rating, with sodium bicarbonate-based dry chemical in manufacturer's standard enameled container.

D. Carbon Dioxide Type: UL-rated 10-B:C, 10-lb nominal capacity, with carbon dioxide in manufacturer's standard enameled-metal container.

E. Finishes:

1. Manufacturer's standard baked-enamel paint.

2.3 RECESSED FIRE EXTINGUISHER CABINETS

A. Available Manufacturers:
1. Larsen's Manufacturing Company.
2. Potter Roemer; Div. of Smith Industries, Inc.
3. JL Industries, Inc.

B. Identify fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

C. Cabinet:
   1. Models:
      a. Larsen's: Vista Series No. V-2709.
      b. Potter-Roemer: Buena Series No. 7121-A-16-VR.
      c. J.L. Industries: Clear VU Series No. 1515F25.

   2. Description:
      a. Metal: Formed sheet steel.
      b. Mounting: Recessed.
      c. Trim: Trimless.
      d. Door: Steel with clear acrylic glazing.
      e. Finish: Manufacturer's standard white finish.
      f. Lettering: Vertical red 1-inch letters; "Fire Extinguisher."
      g. Door Hardware: "U" pull or lever.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

   1. Remove and replace damaged, defective, or undercharged units.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
   1. Mounting Brackets: 48 inches above finished floor to top of fire extinguisher.
   2. Install clear of latch side of door.
   3. Maintain 30" x 48" clear floor area at fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

C. Identification: Apply decals at locations indicated.

END OF SECTION 10520

SECTION 10650 - OPERABLE PARTITIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single panel partitions, 3 inch (76 mm) thick panels.

B. Continuously hinged panel partitions, manual operation.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete; concrete tolerances required.

B. Section 05500 - Metal Fabrications; primary structural support, including pre-punching of support members by steel supplier in accordance with template supplied by operable partition supplier's template.

C. Section 09260 - Gypsum Board Assemblies; metal framing and gypsum board wall systems adjacent to operable partitions, including blocking and insulation.

D. Section 09260 - Gypsum Board Assemblies; wall and ceiling framing at head and jambs.

1.3 REFERENCES

A. ASTM E 90 - Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

B. ASTM E 557 - Standard Practice for the Installation of Operable Partitions.

1.4 SUBMITTALS

A. Submit under provisions of Section 01330.

B. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.

C. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

D. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.

E. Samples: Color samples demonstrating full range of finishes available to Architect. Verification samples shall be available in same thickness and material indicated for the work.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Acoustical Performance: Test operable partitions in accordance with ASTM E 90 test procedure to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

C. Preparation of Opening: Conform to ASTM E 557.

D. Fire Performance Characteristics: Provide vinyl-fabric-faced tackboards with surface burning characteristics indicated below, as determined by testing assembled materials composed of facings and backings identical to those required in this section, in accordance with ASTM E 84, by a testing organization acceptable to authorities having jurisdiction.

a) Flame Spread: 25 or less.
b) Smoke Developed: 10 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.

B. Protect panels during delivery, storage, and handling to comply with manufacturer's instructions and as required to prevent damage.

1.7 WARRANTY

A. Provide operable partition manufacturer's written warranty agreeing to repair or replace components with manufacturing defects for a period of two years from the date of shipment to the Project.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design: Modernfold, Inc., which is located at: 215 W. New Rd. ; Greenfield, IN 46140; Toll Free Tel: 800-869-9685; Tel: 317-468-6700; Fax: 866-410-5016; Email: info@modernfold.com; Web: www.modernfold.com

1. Product: Acousti-Seal 933 Operable Partition by Modernfold, Inc., manually operated series of continuously hinged flat panels, top supported with operable floor seals.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 SINGLE PANEL PARTITIONS, THREE INCH (76 MM) THICK PANELS

A. Panel Construction and STC Rating: Nominal 3 inch (76 mm) thick in manufacturer's

standard 48 inch (1220 mm) width by height required, with horizontal and vertical framing elements fabricated from 18 gage formed steel with overlapped and welded corners; reinforced top channel to support suspension system components; frame with concealed formed steel at vertical edges.

1. Panel Trim: No vertical trim required or allowed on vertical edges of panels; minimal groove appearance at panel joints.
2. Panel Weight: As standard with manufacturer for STC of 47, 6 to 11 pounds per sq ft.

B. Panel Finish and Exposed Trim: Factory applied, Class A rated material and as follows:
1. Panel Finish: Full height tackboard.
   a. Covering: Fabric.
   b. Substrate: 0.25 inch (6 mm) fiberboard tackbase.
2. Exposed Panel Trim Color: Smoke gray.

C. Sound Seals and Bottom Seals:
1. Vertical Interlocking Sound Seals Between Panels: Roll-formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation. Rigid plastic or aluminum astragals or astragals in only one panel edge are not acceptable.
2. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.
3. Horizontal Bottom Floor Seals: Modernfold IA2 Bottom Seal. Automatic operable seals providing nominal 2 inches (51 mm) operating clearance with an operating range of plus 0.50 inches (13 mm) to minus 1.50 inches (38 mm) which automatically drop as panels are positioned without the need for tools or cranks.

D. Suspension System and Soffits:
1. Suspension System: Modernfold No. 14 "Smart Track" Suspension System:
   a. Track: Nominal 7 gage formed steel track with adjustable steel hanger brackets supporting the load bearing surface of the track, connected to structural support by pairs of 0.50 inches (13 mm) diameter threaded rods; no failure of track or brackets at 5,000 lb. (2268 kg) static point loading at mid-span with brackets at 48 inch (1220 mm) centers.
   b. Exposed Track Soffit: Steel, removable for service and maintenance, attached to track bracket without exposed fasteners and pre-painted off-white. Wood or aluminum soffits are not acceptable.
   c. Carriers: Two all-steel trolleys with steel tired ball-bearing wheels for each panel except closure panels, with automatic indexing of panels into stack area using pre-programmed switches and trolley's without electrical, pneumatic, or mechanical activation. Non-steel tires are not acceptable.

2.3 CONTINUOUSLY HINGED PANEL PARTITIONS, MANUAL OPERATION

A. Panel Construction and STC Rating: Nominal 3 inch (76 mm) thick in manufacturer's standard 48 inch (1220 mm) width by height required, with horizontal and vertical framing elements fabricated from 18 gage formed steel with overlapped and welded corners; reinforced top channel to support suspension system components; frame with concealed formed steel at vertical edges.
1. Panel Skin: Nominal 21 gage formed steel wrapping around panel edge, with panel skins lock-formed and welded directly to the frame for unitized construction with minimum STC as follows:
   a. STC 47.

2. Hinges for Closure Panels for Steel Panels: SOSS invisible laminated hinge with anti-friction segments mounted between each heat treated link. Attach hinge directly to panel frame, with welded internal hinge bracket to support hinge and allow for adjustment of hinge plates. Concealed hinges mounted into panel edge or vertical astragal are not acceptable.
3. Panel Trim: No vertical trim required or allowed on vertical edges of panels; minimal groove appearance at panel joints.
4. Panel Weight: As standard with manufacturer for STC 47, 6.5 to 11 pounds per sq ft.

B. Panel Finish and Exposed Trim: Factory applied, Class A rated material and as follows:
1. Panel Finish: Full height tackboard.
2. Exposed Panel Trim Color: Smoke gray.

C. Sound Seals and Bottom Seals:
1. Vertical Interlocking Sound Seals Between Panels: Roll-formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation. Rigid plastic or aluminum astragals or astragals in only one panel edge are not acceptable.
2. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.
3. Horizontal Bottom Floor Seals: Modernfold IA2 Bottom Seal. Automatic operable seals providing nominal 2 inches (51 mm) operating clearance with an operating range of plus 0.50 inches (13 mm) to minus 1.50 inches (38 mm) which automatically drop as panels are positioned without the need for tools or cranks.

D. Suspension System and Soffits:
1. Suspension System: Modernfold No. 14 Suspension System:
   a. Track: Nominal 7 gage formed steel track with adjustable steel hanger brackets supporting the load bearing surface of the track, connected to structural support by pairs of 0.50 inches (13 mm) diameter threaded rods; no failure of track or brackets at 5,000 lb. (2268 kg) static point loading at mid-span with brackets at 48 inch (1220 mm) centers.
   b. Exposed Track Soffit: Steel, removable for service and maintenance, attached to track bracket without exposed fasteners and pre-painted off-white. Wood or aluminum soffits are not acceptable.
   c. Carriers: All-steel with four or eight steel tired ball-bearing wheels. Non-steel tires are not acceptable.

E. Pocket Doors: Acousti-Seal 900 Series Pocket Door by Modernfold, Inc., with the same general construction as the adjacent panels with the following characteristics:
1. Manual Operation: Type IV bi-fold door hinged to a jamb on one side as required.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until supports and substrates have been properly prepared.

B. Notify Architect in writing of unsatisfactory preparation prior to installation. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and ASTM E 557 installation procedures. Test for proper operation and make necessary adjustments until satisfactory results are obtained.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 10650

SECTION 10801 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Public-use washroom accessories.
2. Warm-air dryers.
3. Custodial accessories.

B. Related Sections include the following:

1. Division 9 Section "Ceramic Tile" for ceramic toilet and bath accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

D. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

C. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

D. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Bobrick Washroom Equipment, Inc.
2. Bradley Corporation.
3. American Specialties, Inc.

D. Toilet Tissue (Roll) Dispenser:

1. Basis-of-Design Product: Bobrick B-2888.
2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset .
3. Mounting: Recessed.
4. Operation: Noncontrol delivery with theft-resistant spindle.
5. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
6. Material and Finish: Stainless steel, No. 4 finish (satin) .

E. Paper Towel (Folded) Dispenser:

1. Basis-of-Design Product: Bobrick" B-262.
2. Mounting: Recessed.
3. Minimum Capacity: 400 C-fold or 525 multifold towels.
4. Material and Finish: Stainless steel, No. 4 finish (satin.
5. Lockset: Tumbler type.
6. Refill Indicators: Pierced slots at sides or front.

F. Liquid-Soap Dispenser:

1. Basis-of-Design Product: "Bobrick" B-4112.
2. Description: Designed for dispensing soap in liquid form.
3. Mounting: surface mounted.
4. Capacity: 40 oz.
5. Materials: Stainless Steel.
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

G. Grab Bar:

1. Basis-of-Design Product: "Bobrick" B-6806.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

   a. Finish: Smooth, No. 4, satin finish.

4. Outside Diameter: 1-1/2 inches (38 mm).
5. Configuration and Length: As indicated on Drawings.

H. Recessed Napkin/Tampon Vendor :

1. Basis-of-Design Product: "Bobrick" B-3500 50.
2. Type: Sanitary napkin and tampon.
3. Mounting: Fully recessed, designed for 4-inch (100-mm) wall depth.

4. Capacity: 30 napkins & 27 tampons.
5. Operation: Coin operated (25 cents).
6. Exposed Material and Finish: Stainless steel, No. 4 finish (satin.
7. Lockset: Tumbler type with separate lock and key for coin box.

I. Seat-Cover Dispenser :

1. Basis-of-Design Product: Bobrick B-3013 Trim Line Series Seat-Cover.
2. Mounting: recessed.
3. Minimum Capacity: 500 seat covers.
4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin.
5. Lockset: Tumbler type.

J. Mirror Unit:

1. Basis-of-Design Product: "Bobrick" B-165 Series Frame Mirror.
2. Frame: Stainless-steel channel.

   a. Corners: Manufacturer's standard.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
   a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

4. Size: As indicated on Drawings.

K. Recessed Combination Paper Towel Dispenser and Waste Receptacle:

1. Basis-of-Design Product: "Bobrick" B-3944.
2. Description: 4 inch wall depth. Minimum 22 gage Type 304 stainless steel. Drawn and beveled one-piece seamless flange. Full length stainless steel piano hinge and concealed tumbler lock at towel dispenser door. No. 4 satin finish. Capacity minimum 600 C-fold or 800 multi-fold paper towels. Waste receptacle with all edges with hemmed construction. Removable waste receptacle secured to cabinet with tumbler lock. Minimum 12 gallon capacity.

L. Recessed Toilet Seat Cover Dispenser, Sanitary Napkin Disposal, and Toilet Tissue Dispenser

1. Basis-of-Design Product: "Bobrick" B-3574, Classic Series, recessed.
2. Type: Sanitary napkin disposal, seat cover dispenser, toilet tissue dispenser.
3. Mounting: Fully recessed, designed for 4-inch (100-mm) wall depth.
4. Capacity: (2) 51/4" toilet tissue rolls, 1000 toilet seat covers, .08 gal disposal capacity.
5. Exposed Material and Finish: Stainless steel, No. 4 finish (satin finish).
6. Lockset: Tumbler type.

M. Partition mounted Toilet Seat Cover Dispenser, Sanitary Napkin Disposal, and Toilet Tissue Dispenser

1. Basis-of-Design Product: "Bobrick" B-357, Classic Series, partition mounted.
2. Type: Sanitary napkin disposal, seat cover dispenser, toilet tissue dispenser.
3. Mounting: Partition mount, designed for 1 ½ to2" thick-inch partition depth.

4. Capacity: (2) 51/4" toilet tissue rolls, 1000 toilet seat covers, .08 gal disposal capacity.
5. Exposed Material and Finish: Stainless steel, No. 4 finish (satin finish).
6. Lockset: Tumbler type.

N. Recessed Toilet Seat Cover Dispenser, and Toilet Tissue Dispenser

1. Basis-of-Design Product: "Bobrick" B-3474, Classic Series, recessed.
2. Type: Seat cover dispenser, and toilet tissue dispenser.
3. Mounting: Fully recessed, designed for 4-inch (100-mm) wall depth.
4. Capacity: (2) 51/4" toilet tissue rolls, 1000 toilet seat covers.
5. Exposed Material and Finish: Stainless steel, No. 4 finish (satin finish).
6. Lockset: Tumbler type.

O. Partition mounted Toilet Seat Cover Dispenser, Sanitary Napkin Disposal, and Toilet Tissue Dispenser

1. Basis-of-Design Product: "Bobrick" B-3571, Classic Series, partition mounted.
2. Type: Seat cover dispenser, and toilet tissue dispenser.
3. Mounting: Partition mount, designed for 1 ½ to2" thick-inch partition depth.
4. Capacity: (2) 51/4" toilet tissue rolls, 1000 toilet seat covers.
5. Exposed Material and Finish: Stainless steel, No. 4 finish (satin finish).
6. Lockset: Tumbler type.

2.3 WARM-AIR DRYERS

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Bobrick Washroom Equipment, Inc.
2. Bradley Corporation.
3. American Specialties, Inc.

B. Warm-Air Dryer:

1. Basis-of-Design Product: "Bobrick" B-7507 ADA/Barrier-Free compliant aircraft hand dryer.
2. Mounting: Surface mounted.
3. Operation: Electronic-sensor activated with timed power cut-off switch.

   a. Operation Time: 30 to 40 seconds.

4. Cover Material and Finish: Steel, with white enamel finish.
5. Electrical Requirements: 115 V, 13 A, 1500 W.

2.4 UNDERLAVATORY GUARDS

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Plumberex Specialty Products, Inc.
2. TCI Products.
3. Truebro, Inc.

B. Underlavatory Guard :

1. Basis-of-Design Product: "Truebro".
2. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded-plastic, white.

2.5 CUSTODIAL ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Bobrick Washroom Equipment, Inc.
2. Bradley Corporation.
3. American Specialties, Inc.

B. Utility Shelf: Provide one (1) at each Janitor's Closet.

1. Basis-of-Design Product: Bobrick.
2. Description: With exposed edges turned down not less than 1/2 inch (12.7 mm) and supported by two triangular brackets welded to shelf underside.
3. Size: 16 inches (406 mm) long by 6 inches (152 mm) deep.
4. Material and Finish: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel, No. 4 finish (satin).

C. Mop and Broom Holder: Provide one (1) at each Janitor's Closet.

1. Basis-of-Design Product: "Bobrick"
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf] .
3. Length: 36 inches (914 mm).
4. Hooks: Three.
5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

    a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
    b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Toilet accessories required to be accessible shall be mounted at heights according to CBC Section 1118B.

B. Toilet paper and feminine napkin dispensers located on the grab bar side of an accessible toilet room or stall shall not project more than 3 inches from the finished wall surface nor be closer than 1 ½ inch clear of the tangent point of the grab bar. Policy 99-07.

C. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

D. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10801

SECTION 10801 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Public-use washroom accessories.
2. Warm-air dryers.
3. Custodial accessories.

B. Related Sections include the following:

1. Division 9 Section "Ceramic Tile" for ceramic toilet and bath accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

D. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

C. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

D. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Bobrick Washroom Equipment, Inc.
2. Bradley Corporation.
3. American Specialties, Inc.

D. Toilet Tissue (Roll) Dispenser:

1. Basis-of-Design Product: Bobrick B-2888.
2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset .
3. Mounting: Recessed.
4. Operation: Noncontrol delivery with theft-resistant spindle.
5. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
6. Material and Finish: Stainless steel, No. 4 finish (satin) .

E. Paper Towel (Folded) Dispenser:

1. Basis-of-Design Product: Bobrick" B-262.
2. Mounting: Recessed.
3. Minimum Capacity: 400 C-fold or 525 multifold towels.
4. Material and Finish: Stainless steel, No. 4 finish (satin.
5. Lockset: Tumbler type.
6. Refill Indicators: Pierced slots at sides or front.

F. Liquid-Soap Dispenser:

1. Basis-of-Design Product: "Bobrick" B-4112.
2. Description: Designed for dispensing soap in liquid form.
3. Mounting: surface mounted.
4. Capacity: 40 oz.
5. Materials: Stainless Steel.
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

G. Grab Bar:

1. Basis-of-Design Product: "Bobrick".
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

   a. Finish: Smooth, No. 4, satin finish.

4. Outside Diameter: 1-1/2 inches (38 mm).
5. Configuration and Length: As indicated on Drawings.

H. Vendor :

1. Basis-of-Design Product: "Bobrick" B-3552 25.
2. Type: Sanitary napkin and tampon.
3. Mounting: Fully recessed, designed for 4-inch (100-mm) wall depth.

4. Capacity: 30 mapkins & 27 tampons.
5. Operation: Single coin (25 cents).
6. Exposed Material and Finish: Stainless steel, No. 4 finish (satin.
7. Lockset: Tumbler type with separate lock and key for coin box.

I. Seat-Cover Dispenser :

1. Basis-of-Design Product: Bobrick B-3013 Trim Line Series Seat-Cover.
2. Mounting: recessed.
3. Minimum Capacity: 500 seat covers.
4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin.
5. Lockset: Tumbler type.

J. Mirror Unit:

1. Basis-of-Design Product: "Bobrick" B-165 Series Frame Mirror.
2. Frame: Stainless-steel channel.

   a. Corners: Manufacturer's standard.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
   a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

4. Size: As indicated on Drawings.

K. Recessed Combination Paper Towel Dispenser and Waste Receptacle:

1. Basis-of-Design Product: "Bobrick" B-3944.
2. Description: 4 inch wall depth. Minimum 22 gage Type 304 stainless steel. Drawn and beveled one-piece seamless flange. Full length stainless steel piano hinge and concealed tumbler lock at towel dispenser door. No. 4 satin finish. Capacity minimum 600 C-fold or 800 multi-fold paper towels. Waste receptacle with all edges with hemmed construction. Removable waste receptacle secured to cabinet with tumbler lock. Minimum 12 gallon capacity.

L. Recessed Toilet Seat Cover Dispenser, Sanitary Napkin Disposal, and Toilet Tissue Dispenser

1. Basis-of-Design Product: "Bobrick" B-3574, Classic Series, recessed.
2. Type: Sanitary napkin disposal, seat cover dispenser, toilet tissue dispenser.
3. Mounting: Fully recessed, designed for 4-inch (100-mm) wall depth.
4. Capacity: (2) 51/4" toilet tissue rolls, 1000 toilet seat covers, .08 gal disposal capacity.
5. Exposed Material and Finish: Stainless steel, No. 4 finish (satin finish).
6. Lockset: Tumbler type.

M. Partition mounted Toilet Seat Cover Dispenser, Sanitary Napkin Disposal, and Toilet Tissue Dispenser

1. Basis-of-Design Product: "Bobrick" B-357, Classic Series, partition mounted.
2. Type: Sanitary napkin disposal, seat cover dispenser, toilet tissue dispenser.
3. Mounting: Partition mount, designed for 1 ½ to2" thick-inch partition depth.

4. Capacity: (2) 51/4" toilet tissue rolls, 1000 toilet seat covers, .08 gal disposal capacity.
5. Exposed Material and Finish: Stainless steel, No. 4 finish (satin finish).
6. Lockset: Tumbler type.

N. Recessed Toilet Seat Cover Dispenser, and Toilet Tissue Dispenser

1. Basis-of-Design Product: "Bobrick" B-3474, Classic Series, recessed.
2. Type: Seat cover dispenser, and toilet tissue dispenser.
3. Mounting: Fully recessed, designed for 4-inch (100-mm) wall depth.
4. Capacity: (2) 51/4" toilet tissue rolls, 1000 toilet seat covers.
5. Exposed Material and Finish: Stainless steel, No. 4 finish (satin finish).
6. Lockset: Tumbler type.

O. Partition mounted Toilet Seat Cover Dispenser, Sanitary Napkin Disposal, and Toilet Tissue Dispenser

1. Basis-of-Design Product: "Bobrick" B-3571, Classic Series, partition mounted.
2. Type: Seat cover dispenser, and toilet tissue dispenser.
3. Mounting: Partition mount, designed for 1 ½ to2" thick-inch partition depth.
4. Capacity: (2) 51/4" toilet tissue rolls, 1000 toilet seat covers.
5. Exposed Material and Finish: Stainless steel, No. 4 finish (satin finish).
6. Lockset: Tumbler type.

2.3 WARM-AIR DRYERS

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Bobrick Washroom Equipment, Inc.
2. Bradley Corporation.
3. American Specialties, Inc.

B. Warm-Air Dryer:

1. Basis-of-Design Product: "Bobrick" B-7507 ADA/Barrier-Free compliant aircraft hand dryer.
2. Mounting: Surface mounted.
3. Operation: Electronic-sensor activated with timed power cut-off switch.

   a. Operation Time: 30 to 40 seconds.

4. Cover Material and Finish: Steel, with white enamel finish.
5. Electrical Requirements: 115 V, 13 A, 1500 W.

2.4 UNDERLAVATORY GUARDS

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Plumberex Specialty Products, Inc.
2. TCI Products.
3. Truebro, Inc.

B. Underlavatory Guard :

1. Basis-of-Design Product: "Truebro".
2. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded-plastic, white.

2.5 CUSTODIAL ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Bobrick Washroom Equipment, Inc.
2. Bradley Corporation.
3. American Specialties, Inc.

B. Utility Shelf: Provide one (1) at each Janitor's Closet.

1. Basis-of-Design Product: Bobrick.
2. Description: With exposed edges turned down not less than 1/2 inch (12.7 mm) and supported by two triangular brackets welded to shelf underside.
3. Size: 16 inches (406 mm) long by 6 inches (152 mm) deep.
4. Material and Finish: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel, No. 4 finish (satin).

C. Mop and Broom Holder: Provide one (1) at each Janitor's Closet.

1. Basis-of-Design Product: "Bobrick"
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf] .
3. Length: 36 inches (914 mm).
4. Hooks: Three.
5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

   a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
   b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Toilet accessories required to be accessible shall be mounted at heights according to CBC Section 1118B.

B. Toilet paper and feminine napkin dispensers located on the grab bar side of an accessible toilet room or stall shall not project more than 3 inches from the finished wall surface nor be closer than 1 ½ inch clear of the tangent point of the grab bar. Policy 99-07.

C. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

D. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10801

SECTION 11051 - BOOK THEFT PROTECTION EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section Includes: Complete book theft detection system with alarm, detection targets/strips, and target de-tuners/deactivators as indicated on Drawings.

C. Related Sections:

1. Division 16: Electrical.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Library book detection system, by means of exit antennas and radio signals, detects library materials marked with pressure sensitive detection targets/strips. When items pass between the installed antenna system and have not been checked out correctly, the system emits an alarm signal notifying library personnel of an unauthorized removal of items.
2. An exit aisle shall be formed by a minimum of 2 sensing antennas, with exiting be tween the antennas. Aisles shall be not greater than 6-feet wide.

B. Installation Requirements:

1. Sensing antennas and peripherals shall be bolted directly to concrete floor with cement lag bolts and anchors.
2. Power is provided to antennas by installer through conduit installed in floor as part of the Work of Division 16.

1.3 SUBMITTALS

A. Shop Drawings: Indicate installation and interface with related Work, including details of assembly and wiring diagrams.

B. Product Data: Manufacturer's specifications and other data needed to provide com pliance with specified requirements.

C. Samples: Detection Target Strips.

D. Maintenance Data: For projection screens to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Qualifications of Installer: Work of this section shall be performed by installers trained by the equipment manufacturer.

B. Regulatory Requirements:

1. Entire system, including gates, shall be designed to be in compliance with ADA, CBC and ANSI accessibility requirements and recommendations.
2. Systems shall be UL listed.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver specified components to the Project site in unopened cartons, crates or suitable packaging bearing manufacturer's label.

B. Store components in a location safe from weather and damage by construction operations.

1.6 CLOSEOUT REQUIREMENTS

A. Staff Instruction: Before Substantial Completion, provide Owner personnel a 4 hour instruction period. Representative of book detection system manufacturer shall instruct library staff members in operation and installation of detection targets/strips in library materials. Coordinate and arrange the time of staff instruction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Radio Frequency System, by Checkpoint System Inc., or equal.

2.2 BOOK DETECTION SYSTEM, GENERAL

A. STRATA Series Theft Detection Antenna System:

1. Overall dimensions: 70 inches high by 22 inches wide by 4 inches deep.
2. High-impact gray and white ABS thermoplastic.
3. Weight: 24 pounds.
4. Floor-mounted with at least 2 cement lag bolts per antenna, minimum ½ inch diameter.
5. Maximum distance between antennas: 72 inches (center to center).

B. Operator Control Module:

1. Electric Power Requirement: Electronics in system shall be solid-state and operate from a standard 120 volt, 50/60 Hz AC 3-wire grounded outlet.
2. Location Requirement: Must be within 10 feet of nearest sensing antenna.
3. Specifications:

a. Housing: 9 inches long by 5.38 inches wide by 3.5 inches high.
b. Weight: 6 pounds
c. Key-controlled on/off switch.
d. Power-on indicator light (DC).

2.3 DETECTION TARGET/STRIPS

A. Radio Frequency Targets:

1. Series 320 target, 2 inches by 2 inches, with adhesive coating.
2. Quantity: Provide **20,000** targets.
2. Flexible programmed tag laminated on one side with paper stock pres sure-sensitive adhesive coating or reversed side with siliconized release paper.
3. Installed on/in library materials:

a. Inside front or back covers.
b. On any page.
c. Under book jacket.
d. Printed bookplate.
e. Under bookplate.
f. Inside book pocket.
g. Under book pocket.
h. Inside or in A/V materials or their containers or jackets.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Examine areas and conditions under which Work will be performed to determine best location for sensing unit, and to insure prerequisite Work has been installed, including:

1. Electrical convenience outlet (120 VAC, 50/60 Hz, AC 3-wire with ground) for connecting system power supply box to be mounted on wall adjacent to outlet.
2. Conduit (3/4-inch) and pull-wire in floor from power-supply box to antenna locations. Stub up in first antenna, then stub down and up to second antenna.
3. Electrical convenience outlet (120 VAC, 50/60 Hz, AC 3-wire with ground) for operator control module to be installed within 10 feet of nearest radio frequency sensing antenna, usually located behind circulation desk.

B. Assure no metal is installed above the floor within 18 inches of antenna locations.

C. Coordinate with related Work for drilling proper holes through charging desk for access to power outlet at circulation desk for hook-up of sensing unit. Holes shall be concealed and shall not interfere with functioning of desk storage spaces and other equipment to be installed in desk.

3.3 DETECTION SYSTEM INSTALLATION

A. Base Plate-Mounted Components: Install antennas on top of final finish flooring and anchor to concrete base flooring.

B. Install wiring and other components, make final connections and adjustments.

C. Provide all means necessary to eliminate electrical and magnetic interference affecting operation of detection system.

D. Connect electronic devices to power source and place system in operating condition.

3.5 OPERATOR CONTROL MODULE INSTALLATION

A. Control Module: Install module within circulation desk as indicated on Drawings and/or as required for operation at the Circulation Desk.

B. Provide all means necessary to eliminate electrical and magnetic interference affecting operation of detection system.

C. Connect electronic devices to power source and place system in operating condition.

3.6 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.7 PROTECTION

A. After installation, protect projection screens from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

1. Provide temporary covering of rear-projection screens until time of Substantial Completion. Use type of covering approved by screen manufacturer that will effectively protect screen from abrasion, breakage, or other damage.

END OF SECTION 11051

SECTION 11132 - PROJECTION SCREENS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Front-projection screens.

1.3 DEFINITIONS

A. Gain of Front-Projection Screens: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.

B. Gain of Rear-Projection Screens: Ratio of light refracted by screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94, except that for measuring luminance of test screen, projection lamp shall be placed behind screen same distance as it was placed in front of magnesium carbonate surface for measuring luminance of reference standard.

C. Half-Gain Angle: The angle, measured from the axis of the screen surface, to the most central position on a perpendicular plane through the horizontal centerline of the screen where the gain is half of the peak gain.

1.4 SUBMITTALS

A. Product Data: For each type of screen indicated.

B. Shop Drawings: Show layouts and types of projection screens. Include the following:

1. Location of screen centerline relative to ends of screen case.
2. Location of seams in viewing surfaces.
3. Drop length.
4. Connections to supporting structure for pendant- and recess-mounted screens.
5. Anchorage details.
6. Details of juncture of exposed surfaces with adjacent finishes.
7. Frame details.
8. Accessories.

C. Samples for Initial Selection: For finishes of surface-mounted screen cases.

D. Maintenance Data: For projection screens to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain projection screens through one source from a single manufacturer. Obtain each screen as a complete unit, including necessary mounting hardware and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver projection screens until building is enclosed and other construction within spaces where screens will be installed is substantially complete and ready for screen installation.

B. Store rear-projection screens in manufacturer's protective packaging and according to manufacturer's written instructions.

1.7 COORDINATION

A. Coordinate layout and installation of projection screens with adjacent construction, including ceiling framing, light fixtures, HVAC equipment, fire-suppression system, and partitions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 FRONT-PROJECTION SCREENS

A. Manually Operated Screens, General: Manufacturer's standard spring-roller-operated units, consisting of case, screen, mounting accessories, and other components necessary for a complete installation.

1. Screen Mounting: Top edge securely anchored to a 3-inch- diameter, rigid steel roller; bottom edge formed into a pocket holding a tubular metal slat, with ends of slat protected by plastic caps, and with a saddle and pull attached to slat by screws.

B. Surface-Mounted, Metal Encased, Manually Operated Screens: Units designed and fabricated for surface mounting on wall or ceiling, fabricated from formed steel sheet not less than 0.027 inch thick or aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish. Provide end caps and universal mounting brackets, finished to match end caps.

1. Available Products:

a. Bretford Manufacturing, Inc.; Series 500.
b. Da-Lite Screen Co., Inc.; Model C.
c. Draper Inc.; Luma 2, Silhouette/Series M.
d. District approved equal

C. Screen Material and Viewing Surface:

1. Matte-White Viewing Surface: Peak gain of 0.9 to 1.0, and gain of not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.

a. Available Products:

1) Bretford Manufacturing, Inc.; Matte White.
2) Da-Lite Screen Co., Inc.; Da-Mat, Matte White.
3) Draper Inc. Fiberglass Matte White, Panamax, T1000.
4) District approved equal

2. Material: Vinyl-coated glass-fiber fabric.
3. Mildew Resistance: Rating of 0 or 1 when tested according to ASTM G 21.
4. Flame Resistance: Passes NFPA 701.
5. Flame-Spread Index: Not greater than 75 when tested according to ASTM E 84.
6. Seamless Construction: Provide screens, in sizes indicated, without seams.
7. Edge Treatment: Black masking borders.
8. Size of Viewing Surface: 84 by 84 inches, unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.

3.2 PROTECTING AND CLEANING

A. After installation, protect projection screens from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

1. Provide temporary covering of rear-projection screens until time of Substantial Completion. Use type of covering approved by screen manufacturer that will effectively protect screen from abrasion, breakage, or other damage.

END OF SECTION 11132

SECTION 12552 - MANUAL CHAIN OPERATED SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manually operated sunscreen roller shades.

1.2 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories.

B. Section 09260 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.

C. Section 09511 - Acoustical Panel Ceilings: Coordination with acoustical ceiling systems for installation of shade pockets, closures and related accessories.

1.3 REFERENCES

A. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.

1.4 SUBMITTALS

A. Submit under provisions of Section 01330.

B. Submit Environmental Certification and Third Party Evaluation per Section 1.5 Qualifications.

C. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
   3. Storage and handling requirements and recommendations.
   4. Mounting details and installation methods.

D. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
   1. Prepare shop drawings on Autocad format using base sheets provided electronically by the Architect.

E. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

F. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

G. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shadecloth sample and aluminum finish sample as selected. Mark face of material to indicate interior faces.

H. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.

B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.

C. Fire-Test-Response Characteristics: Passes NFPA 701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

D. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.

E. Environmental Certification: Submit written certification from the manufacturer, including third party evaluation, recycling characteristics, and perpetual use certification as specified below. Initial submittals, which do not include the Environmental Certification, below will be rejected. Materials that are simply 'PVC free' without identifying their inputs shall not qualify as meeting the intent of this specification and shall be rejected.

F. Third Party Evaluation: Provide documentation stating the shade cloth has undergone third party evaluation for all chemical inputs, down to a scale of 100 parts per million, that have been evaluated for human and environmental safety. Identify any and all inputs, which are known to be carcinogenic, mutagenic, teratogenic, reproductively toxic, or endocrine disrupting. Also identify items that are toxic to aquatic systems, contain heavy metals, or organohalogens. The material shall contain no inputs that are known problems to human or environmental health per the above major criteria, except for an input that is required to meet local fire codes.

G. Recycling Characteristics: Provide documentation that the shade cloth can and is part of a closed loop of perpetual use and not be required to be down cycled, incinerated or otherwise thrown away. Scrap material can be sent back to the mill for reprocessing and recycling into the same quality yarn and woven into new material, without down cycling. Certify that this process is currently underway and will be utilized for this project.

H. Perpetual Use Certification: Certify that at the end of the useful life of the shade cloth, that the material can be sent back to the manufacturer for recapture as part of a closed loop of perpetual use and that the material can and will be reconstituted into new yarn, for weaving into new shade cloth. Provide information on each shade band indicating that the shade band can be sent back to the manufacturer for this purpose.

I. Mock-Up: Provide a mock-up (manual shades only) of one roller shade assembly for evaluation of mounting, appearance and accessories.
   1. Locate mock-up in window designated by Architect.

2. Do not proceed with remaining work until, mock-up is accepted by Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 WARRANTY

A. Roller Shade Hardware, Chain and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.

B. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design:

1. Acceptable Manufacturer: MechoShade Systems, Inc.; 42-03 35th Street, Long Island City, NY 11101. ASD. Tel: (718) 729-2020. Fax: (718) 729-2941. Email: info@mechoshade.com, www.mechoshade.com.

B. Substitutions: Permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 SHADE CLOTH

A. Basis-of-Design: Visually Transparent Single-Fabric Shadecloth: MechoShade Systems, Inc., ThermoVeil group, single thickness non-raveling 0.030-inch (0.762 mm) thick vinyl fabric, woven from 0.018-inch (0.457 mm) diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl, in colors selected from manufacturer's available range.

a. Dense "3000 Satin Texture", visually translucent, reversible, twill-weave pattern all at 2 percent open.

2. Color: As indicated on Drawings.

2.3 SHADE BAND

A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
   1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.
   2. Shade band and Shade Roller Attachment:
      a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch (39.37 mm) in diameter for manual shades, and less than 2.55 inches (64.77 mm) for motorize shades are not acceptable.
      b. Provide for positive mechanical engagement with drive / brake mechanism.
      c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
      d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
      e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.4 SHADE FABRICATION

A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.

B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 10 feet of shade height due to warp distortion or weave design. Fabricate hem as follows:
   1. Bottom hem weights.
   2. Concealed hemtube.
   3. Exposed hemtube.
   4. Exposed blackout hembar with light seal.
   5. Exposed blackout hembar with polybond seal.

C. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

2.5 COMPONENTS

A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
3. Use only Delrin engineered plastics by DuPont (Basis-of-Design) for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

B. Manual Operated Chain Drive Hardware and Brackets:
1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable
7. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
8. Drive Bracket / Brake Assembly (Basis-of-Design items):
   a. MechoShade Drive Bracket model M5 shall be fully integrated with all MechoShade accessories, including, but not limited to: SnapLoc fascia, room darkening side / sill channels, center supports and connectors for multi-banded shades.
   b. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.525 mm) steel pin.
   c. The brake shall be an over -unning clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position.
   d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.
   e. The entire M5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.

C. Drive Chain: #10 qualified stainless steel chain rated to 90 lb. (41 kg) minimum breaking strength. Nickel plate chain shall not be accepted.

2.6 ACCESSORIES

A. Roller Shade Pocket for recessed mounting in acoustical tile, or drywall ceilings as indicated on the Drawings.
   1. Provide either extruded aluminum and or formed steel shade pocket, sized to accommodate roller shades, with exposed extruded aluminum closure mount, tile support and removable closure panel to provide access to shades.

B. Fascia:
   1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
   2. Fascia shall be able to be installed across two or more shade bands in one piece.
   3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
   4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
   5. Notching of Fascia for manual chain shall not be acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow proper clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

D. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 12552

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser Industries, Inc.; DMD Div.
c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
d. JCM Industries.
e. Smith-Blair, Inc.
f. Viking Johnson.

2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Eslon Thermoplastics.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Thompson Plastics, Inc.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

a. NIBCO INC.
b. NIBCO, Inc.; Chemtrol Div.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc.
c. Mission Rubber Company.
d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Perfection Corp.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.
d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type with spring clips.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   g. Bare Piping in Unfinished Service Spaces and Equipment Rooms: One-piece, cast-brass type with polished chrome-plated finish.
   h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

   a. PVC Pipe Sleeves: For pipes smaller than NPS 6.
   b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
   c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

      1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

S. Methane Membrane Penetrations: All penetrations through the methane membrane shall be sealed/treated as indicated in the Methane Mitigation drawings. This includes all piping and conduit penetrating the slab.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Painting of mechanical systems, ductwork, piping, equipment, and components is specified in Division 9.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 15050

SECTION 15060 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for mechanical system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 13 Section "Fire-Suppression Piping" for pipe hangers for fire-protection piping.
3. Division 15 Section "Mechanical Vibration and Seismic Controls" for vibration isolation devices.
4. Division 15 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Pipe positioning systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Pipe stands. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. Tolco Inc.
2. B-Line Systems, Inc.; a division of Cooper Industries.
3. Grinnell Corp.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Tolco Inc.
3. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Carpenter & Paterson, Inc.

2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Mason Industries Type SAB

2.7 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Mfg. Corp.
2. HOLDRITE Corp.; Hubbard Enterprises.
3. Samco Stamping, Inc.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
4. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
5. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
4. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
5. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
6. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

   a. Horizontal (MSS Type 54): Mounted horizontally.
   b. Vertical (MSS Type 55): Mounted vertically.
   c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 15 Section "Plumbing Fixtures" for plumbing fixtures.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

N. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

a. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
b. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports, duct supports, and piping supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

SECTION 15071 - MECHANICAL VIBRATION AND SEISMIC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Elastomeric isolation pads.
2. Restrained spring isolators.
3. Spring hangers with vertical-limit stops.
4. Pipe riser resilient supports.
5. Resilient pipe guides.
6. Restrained vibration isolation roof-curb rails.
7. Restraining cables.

1.3 DEFINITIONS

A. A_v: Effective peak velocity related acceleration coefficient.

B. OSHPD: Office of Statewide Health Planning & Development for the State of California. OSHPD assigns a unique anchorage preapproval "OPA" number to each seismic restraint it tests. The number describes a specific device applied as tested.

1.4 PERFORMANCE REQUIREMENTS

A. Refer to structural drawings for seismic forces specific to this project.

1.5 SUBMITTALS

A. Product Data: Include load deflection curves for each vibration isolation device.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:

1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring

deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.

3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
4. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
5. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y, and z planes.

C. Welding certificates.

D. Manufacturer Seismic Qualification Certification: Submit certification that all specified equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to OSHPD and shall bear anchorage preapproval "OPA" number, from OSHPD or another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Seismic Snubber Units: Furnish replacement neoprene inserts for all snubbers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VIBRATION ISOLATORS

A. Manufacturers:

1. Mason Industries, Inc.
2. B-Line Systems, Inc.
3. Amber/Booth Company, Inc.

B. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Standard neoprene.
2. Number of Layers: 1.

C. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

D. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

E. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

F. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch- thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.3 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

A. Manufacturers:

1. Mason Industries, Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corp.

B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand 125-mph wind impinging laterally against side of equipment.

C. Lower Support Assembly: Sheet-metal "Z" section containing adjustable and removable steel springs that support upper floating frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist wind and seismic forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.

D. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch- thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
d. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

E. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

2.4 SEISMIC-RESTRAINT DEVICES

A. Manufacturers:

1. Mason Industries, Inc.
2. TOLCO Incorporated.
3. B-Line Systems, Inc.

B. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 40, plus or minus 5, with a flat washer face.

C. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement.

D. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

2.5 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.

2. All hardware shall be electrogalvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install roof curbs, equipment supports, and roof penetrations as specified in Division 7 Section "Roof Accessories."

B. Install seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

C. Install restraining cables at each trapeze and individual pipe hanger. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

D. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

E. Install resilient bolt isolation washers on equipment anchor bolts.

3.3 EQUIPMENT BASES

A. Fill concrete inertia bases, after installing base frame, with 3000-psi concrete; trowel to a smooth finish.

1. Cast-in-place concrete materials and placement requirements are specified in Division 3.

B. Concrete Bases: Anchor equipment to concrete base according to supported equipment manufacturer's written instructions for seismic codes at Project site.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
6. Cast-in-place concrete materials and placement requirements are specified in Division 3.

3.4 FIELD QUALITY CONTROL

A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

B. Testing: Perform the following field quality-control testing:

1. Isolator seismic-restraint clearance.
2. Isolator deflection.

3.5 ADJUSTING

A. Adjust isolators after piping systems have been filled and equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

E. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

3.6 CLEANING

A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems.

END OF SECTION 15071

SECTION 15075 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Equipment signs.
4. Access panel and door markers.
5. Pipe markers.
6. Duct markers.
7. Valve tags.
8. Valve schedules.
9. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equiprnent.

1. Data:

a. Manufacturer, product name, model number, and serial number.
b. Capacity, operating and power characteristics, and essential data.
c. Labels of tested compliances.

2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

1. Terminology: Match schedules as closely as possible.
2. Data:

a. Name and plan number.
b. Equipment service.
c. Design capacity.
d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Data: Instructions for operation of equipment and for safety procedures.
2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.

3. Thickness: 1/8 inch, unless otherwise indicated.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

D. Access Panel and Door Markers: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

2.3 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme matching submittal information. Provide 5/32-inch hole for fastener.

1. Material: 0.032-inch- thick brass.

2. Valve-Tag Fasteners: Brass wire-link chain.

2.5 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.

4. Fans, blowers, primary balancing dampers, and mixing boxes.
5. Packaged HVAC central-station and zone-type units.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:

   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Fire department hose valves and hose stations.
   c. Meters, gages, thermometers, and similar units.
   d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
   e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
   f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
   g. Fans, blowers, primary balancing dampers, and mixing boxes.
   h. Packaged HVAC central-station and zone-type units.
   i. Tanks and pressure vessels.
   j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.

1. Identify mechanical equipment with equipment markers in the following color codes:

   a. Green: For cooling equipment and components.
   b. Yellow: For heating equipment and components.

2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
4. Include signs for the following general categories of equipment:

   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.

b. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
e. Fans, blowers, primary balancing dampers, and mixing boxes.
f. Packaged HVAC central-station and zone-type units.
g. Tanks and pressure vessels.
h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

D. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
1. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, 1-1/2 inches wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
2. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 DUCT IDENTIFICATION

A. Install duct markers with permanent adhesive on air ducts in the following color codes:

1. Green: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

5. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape:

   a. Cold Water: 1-1/2 inches, round.
   b. Hot Water: 1-1/2 inches, round.
   c. Fire Protection: 1-1/2 inches, round.
   d. Gas: 1-1/2 inches, square.

2. Valve-Tag Color:

   a. Cold Water: Blue.
   b. Hot Water: Red.
   c. Fire Protection: Orange.
   d. Gas: Green.

3. Letter Color:

   a. Cold Water: White.
   b. Hot Water: White.
   c. Fire Protection: White.
   d. Gas: White.

3.6 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.7 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.8 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.9 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 15075

SECTION 15080 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes mechanical insulation for boiler breeching, duct, equipment, and pipe, including the following:

1. Insulation Materials:
   a. Flexible elastomeric.
   b. Mineral fiber.
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied cloths.
10. Field-applied jackets.
11. Tapes.
12. Securements.
13. Corner angles.

B. Related Sections include the following:

1. Division 15 Section "Metal Ducts" for duct liners.

1.3 DEFINITIONS

A. ASJ: All-service jacket.

B. FSK: Foil, scrim, kraft paper.

C. FSP: Foil, scrim, polyethylene.

D. PVDC: Polyvinylidene chloride.

E. SSL: Self-sealing lap.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Attachment and covering of heat tracing inside insulation.
3. Insulation application at pipe expansion joints for each type of insulation.
4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Removable insulation at piping specialties, equipment connections, and access panels.
6. Application of field-applied jackets.
7. Application at linkages of control devices.
8. Field application for each equipment type.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Sheet Form Insulation Materials: 12 inches square.
3. Jacket Materials for Pipe: 12 inches long by NPS 2.
4. Sheet Jacket Materials: 12 inches square.
5. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

D. Installer Certificates: Signed by Contractor certifying that installers comply with requirements.

E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

F. Field quality-control inspection reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction.

Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

D. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products:

a. CertainTeed Corp.; Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Duct Wrap.
d. Owens Corning; All-Service Duct Wrap.

E. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products:

a. CertainTeed Corp.; Commercial Board.
b. Johns Manville; 800 Series Spin-Glas.
c. Knauf Insulation; Insulation Board.
d. Owens Corning; Fiberglas 700 Series.

F. Mineral-Fiber, Preformed Pipe Insulation:

1. Products:
a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000(Pipe Insulation.
c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

G. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612,

Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products:

   a. CertainTeed Corp.; CrimpWrap.
   b. Johns Manville; MicroFlex.
   c. Knauf Insulation; Pipe and Tank Insulation.
   d. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.3 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products:

   a. Insulco, Division of MFS, Inc.; Triple I.
   b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products:

   a. Insulco, Division of MFS, Inc.; SmoothKote.
   b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
   c. Rock Wool Manufacturing Company; Delta One Shot.

2.4 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products:

   a. Childers Products, Division of ITW; CP-82.
   b. Foster Products Corporation, H. B. Fuller Company; 85-20.
   c. ITW TACC, Division of Illinois Tool Works; S-90/80.
   d. Marathon Industries, Inc.; 225.
   e. Mon-Eco Industries, Inc.; 22-25.

C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.
f.

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products:

a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Red Devil, Inc.; Celulon Ultra Clear.
e. Speedline Corporation; Speedline Vinyl Adhesive.
f.

2.5 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.
g.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

2.6 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products:

a. Childers Products, Division of ITW; CP-52.
b. Foster Products Corporation, H. B. Fuller Company; 81-42.
c. Marathon Industries, Inc.; 130.
d. Mon-Eco Industries, Inc.; 11-30.
e. Vimasco Corporation; 136.
f. Insert manufacturer's name; product name or designation.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F.
4. Color: White.

2.7 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Products:

a. Childers Products, Division of ITW; CP-76-8.
b. Foster Products Corporation, H. B. Fuller Company; 95-44.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products:

a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.8 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto PVC Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.
e.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

5. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:

1. Products:

a. Childers Products, Division of ITW; Metal Jacketing Systems.
b. PABCO Metals Corporation; Surefit.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

   a. Factory cut and rolled to size.
   b. Finish and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
   d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
   e. Factory-Fabricated Fitting Covers:

      1) Same material, finish, and thickness as jacket.
      2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      3) Tee covers.
      4) Flange and union covers.
      5) End caps.
      6) Beveled collars.
      7) Valve covers.
      8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

   1. Products:

      a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
      b. Compac Corp.; 104 and 105.
      c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
      d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

   2. Width: 3 inches.
   3. Thickness: 11.5 mils.
   4. Adhesion: 90 ounces force/inch in width.
   5. Elongation: 2 percent.
   6. Tensile Strength: 40 lbf/inch in width.
   7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.

   1. Products:

      a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
      b. Compac Corp.; 110 and 111.
      c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.

d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
b. Compac Corp.; 130.
c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
d. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.

1. Products:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
b. Compac Corp.; 120.
c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.11 SECUREMENTS

A. Bands:

1. Products:

a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

   a. Products:

      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; CD.
      3) Midwest Fasteners, Inc.; CD.
      4) Nelson Stud Welding; TPA, TPC, and TPS.
      5)

2. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products:

      1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
      2) GEMCO; Press and Peel.
      3) Midwest Fasteners, Inc.; Self Stick.

   b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
   d. Adhesive-backed base with a peel-off protective cover.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

   a. Products:

      1) AGM Industries, Inc.; RC-150.
      2) GEMCO; R-150.
      3) Midwest Fasteners, Inc.; WA-150.
      4) Nelson Stud Welding; Speed Clips.

   b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy.

1. Manufacturers:

a. ACS Industries, Inc.
b. C & F Wire.
c. Childers Products.
d. PABCO Metals Corporation.
e. RPR Products, Inc.

2.12 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

B. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

   a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Through-Penetration Firestop Systems."

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies according to Division 7 Section "Through-Penetration Firestop Systems."

3.5 DUCT AND PLENUM INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

3.6 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch

prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.

7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

C. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from galvanized steel, at least 0.040 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.7 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union

cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.8 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.10 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.11 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent inspecting agency to perform field inspections and prepare inspection reports.

B. Perform the following field tests and inspections and prepare test reports:
1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe,

three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements. Remove defective Work.

D. Install new insulation and jackets to replace insulation and jackets removed for inspection. Repeat inspection procedures after new materials are installed.

3.13 BOILER BREECHING INSULATION SCHEDULE

A. Round, exposed breeching and connector insulation shall be the following:
   1. High-Temperature Mineral-Fiber Blanket: 3 inches thick and 3-lb/cu. ft. nominal density.

3.14 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

   1. Indoor, concealed supply and outdoor air.
   2. Indoor, exposed supply and outdoor air.
   3. Indoor, concealed return located in nonconditioned space.
   4. Indoor, exposed return located in nonconditioned space.
   5. Outdoor, concealed supply and return.
   6. Outdoor, exposed supply and return.

B. Items Not Insulated:
   1. Metal ducts with duct liner as shown on the drawings and general project notes. All supply air ductwork exposed to view shall be lined. All ductwork (supply, return, exhaust, outside air) on the exterior of the building, exposed to weather, shall be lined.
   2. Factory-insulated flexible ducts.
   3. Factory-insulated plenums and casings.
   4. Flexible connectors.
   5. Vibration-control devices.
   6. Factory-insulated access panels and doors.

3.15 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Indoor Concealed, round or rectangular, supply-air, return-air, and outdoor air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
   2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

B. Indoor Exposed, round and rectangular, supply-air ductwork shall be lined. Refer to section 15815 "Metal Ducts".

C. Indoor Exposed, round and rectangular, return-air and exhaust-air duct does not require insulation unless specifically shown on the drawings.

3.16 OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Outdoor, round and rectangular, return-air, supply air, and outside air ductwork shall be lined. Refer to section 15815 "Metal Ducts".

B. Outdoor round and rectangular, exhaust-air duct does not require insulation unless specifically shown on the drawings.

3.17 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Heating-hot-water pump insulation shall be the following:
1. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

D. Expansion/compression tank insulation shall be the following:
1. Mineral-Fiber Board: 1 inch thick and 2-lb/cu. ft. nominal density.

E. Air-separator insulation shall be the following:
1. Mineral-Fiber Board: 1 inch thick and 2-lb/cu. ft. nominal density.

3.18 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Fire-suppression piping.
2. Drainage piping located in crawl spaces.
3. Below-grade piping.
4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.19 PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1-1/2 inch thick.

C. Roof Drain and Overflow Drain Bodies:

1. Insulation shall be the following:
   a. Flexible Elastomeric: 1 inch thick.

D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:
   a. McGuire Pro-Wrap.

E. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1 inch thick.

F. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1 inch thick.

3.20 FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None.

D. Ducts and Plenums, Exposed:

1. None.
2. PVC: 20 mils thick.

E. Equipment, Concealed:
1. PVC: 20 mils thick.

F. Piping:

1. PVC: 20 mils thick on indoor piping
2. Aluminum, Corrugated: 0.020 inch thick on outdoor piping..

END OF SECTION 15080

SECTION 15127 - METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Thermometers.
2. Gages.
3. Test plugs.
4. Flowmeters.

B. Related Sections:

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Product Certificates: For each type of thermometer and gage, signed by product manufacturer.

PART 2 - PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Trerice, H. O. Co.
2. Weiss Instruments, Inc.
3. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Case: Brass, 7 inches long.

C. Tube: Red or blue reading, mercury filled, with magnifying lens.

D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

E. Window: Glass.

F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.3 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Trerice, H. O. Co.
2. Weiss Instruments, Inc.
3. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red metal.
7. Window: Glass.
8. Ring: Brass.
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.

2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.4 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Peterson Equipment Co., Inc.
2. Trerice, H. O. Co.
3. Watts Industries, Inc.; Water Products Div.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be CR.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install liquid-in-glass thermometers in the following locations:
1. Inlet and outlet of each hydronic boiler.

B. Install liquid-filled-case-type, vapor-actuated dial thermometers at suction and discharge of each pump.

C. Provide the following temperature ranges for thermometers:

1. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

A. Install liquid-filled-case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.

C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

D. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).

E. Install needle-valve and syphon fitting in piping for each pressure gage for steam.

F. Install test plugs in tees in piping.

3.4 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

3.5 ADJUSTING

A. Calibrate meters according to manufacturer's written instructions, after installation.

B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 15127

SECTION 15140 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes domestic water.

B. Related Sections include the following:
1. Section 15430 "Plumbing Specialties" for water distribution piping specialties.
2. Section 15110 "Valves".

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Distribution Piping: 80 psig.

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Water Samples: Specified in "Cleaning" Article in Part 3.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with "Drinking Water System Components-Health Effects; Sections 1 through 9."

C. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

C. Transition Couplings for Underground Pressure Piping: AWWA C219, metal, sleeve-type coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 COPPER TUBING

A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

2.3 ENCASEMENT

A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105 PE film, 0.008-inch minimum thickness, tube or sheet.

2.4 VALVES

A. Refer to Section 15110 "Valves" for bronze and cast-iron, general-duty valves.

B. Refer to Section "15430" for balancing and drain valves.

C. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Grooved joints may be used on aboveground grooved-end piping.

D. Fitting Option: Mechanically formed tee-branch outlets and brazed joints may be used on aboveground copper tubing.

E. Underground Domestic Water Service Piping: Use the following piping materials for each size range:

1. NPS 2 and Smaller: Soft copper tube, Type Kcopper pressure fittings; and soldered joints.
2. NPS 2-1/2 to NPS 3-1/2: Soft copper tube, Type K copper pressure fittings and brazed joint.

F. Aboveground Domestic Water Piping: Use the following piping materials for each size range:

1. NPS 1-1/2 and Smaller: Hard copper tube, Type K; copper pressure fittings; and soldered joints.
2. NPS 2: Hard copper tube, Type K; copper pressure fittings; and soldered joints.

3. NPS 2-1/2 to NPS 3-1/2: Hard copper tube, Type K copper pressure fittings; and soldered joints.

G. Placement and Type
1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod..

I. Install unistrut with C-clamp supports for vertical steel piping every 15 feet and per CPC. In addition provide unistrut with C-clamp supports at top, middle and bottom of pipe drops serving all plumbing fixtures.

J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

K. Install supports for vertical copper tubing every 10 feet.

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.3 PIPING INSTALLATION

A. Refer to Division 2 Section "Water Distribution" for site water distribution and service piping.

B. Refer to Section 15000 "Basic Mechanical Materials and Methods" for basic piping installation.

C. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.

D. Install underground copper tubing according to CDA's "Copper Tube Handbook."

E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.

F. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight.

G. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each domestic water service.

H. Install water-pressure regulators downstream from shutoff valves. Refer to Section 15430 "Plumbing Specialties" for water-pressure regulators.

I. Install aboveground domestic water piping level with 0.125 percent slope downward toward drain.

J. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

K. Perform the following steps before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

L. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

M. Check plumbing specialties and verify proper settings, adjustments, and operation.

1. Water-Pressure Regulators: Set outlet pressure at 80 psig maximum, unless otherwise indicated.

N. Energize pumps and verify proper operation.

3.4 JOINT CONSTRUCTION

A. Refer to Section 15050 for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C. Grooved Joints: Assemble joints with keyed-coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

D. Mechanically Formed Outlets: Form tee in copper tube according to equipment manufacturer's written instructions. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

3.5 VALVE INSTALLATION

A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Refer to Section 15430 "Plumbing Specialties" for balancing valves.

E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Refer to Section 15430 "Plumbing Specialties" for calibrated balancing valves.

3.6 HANGER AND SUPPORT INSTALLATION

A. Refer to Section "15242 "Vibration Isolation" for seismic-restraint devices.

B. Refer to Section 15060 for pipe hanger and support devices. Install the following:

C. Install supports according to Section 15060.

D. Support vertical piping and tubing at base and at each floor.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to service piping with shutoff valve, and extend and connect to the following:
   1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
   3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

   1. Do not enclose, cover, or put piping into operation until it is inspected by the inspector of record (I.O.R.).
   2. During installation, notify the inspector of record at least 24 hours before inspection must be made. Perform tests specified below in presence of the inspector of record:

      a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
      b. Final Inspection: Arrange for final inspection by inspector of record to observe tests specified below and to ensure compliance with requirements.

   3. Reinspection: If the inspector of record finds that piping will not pass test or inspection, make required corrections and arrange for reinspection.

4. Reports: Prepare inspection reports and have them signed by the inspector of record.

B. Test domestic water piping as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.9 ADJUSTING

A. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

1. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
2. Adjust calibrated balancing valves to flows indicated.

3.10 CLEANING

B. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities.

END OF SECTION 15140

SECTION 15145 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated water mixing valves.
6. Strainers.
7. Hose bibbs.
8. Wall hydrants.
9. Post hydrants.
10. Drain valves.
11. Water hammer arresters.
12. Air vents.
13. Trap-seal primer valves.
14. Trap-seal primer systems.

B. Related Sections include the following:

1. Division 15 Section "Meters and Gages" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Division 15 Section "Domestic Water Piping" for water meters.
3. Division 15 Section "Emergency Plumbing Fixtures" for water tempering equipment.
4. Division 15 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Mifab
b. Conbraco
c. Watts Industries, Inc.; Water Products Div.
d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. MIFAB, Inc.
b. Prier Products, Inc.
c. Woodford Manufacturing Company.
d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers P-0.2:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Wilkins.
b. Watts Industries, Inc.; Water Products Div.
c. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Size: per plans
6. Design Flow Rate: 130
7. Selected Unit Flow Range Limits: 150
8. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
9. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
10. Configuration: Designed for horizontal, straight through flow.
11. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet ofNPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Wilkins
b. Watts Industries, Inc.; Water Products Div.
c. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Size: per plans
5. Design Flow Rate: 120
6. Design Inlet Pressure: 90
7. Design Outlet Pressure Setting: 75
8. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
9. Valves for Booster Heater Water Supply: Include integral bypass.
10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.4 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. NIBCO INC.
   b. Kitz
   c. Apollo
   d. Watts Industries, Inc.; Water Products Div.

2. Type: Globe valve with two readout ports and memory setting indicator.
3. Body: Brass,
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.5 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves P-0.2:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Lawler Manufacturing Company, Inc.
   b. Leonard Valve Company.
   c. Powers; a Watts Industries Co.
   d. Symmons Industries, Inc.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
9. Tempered-Water Setting: 90

10. Tempered-Water Design Flow Rate: 40
11. Selected Valve Flow Rate at 45-psig Pressure Drop: 30
12. Pressure Drop at Design Flow Rate: 5
13. Valve Finish: Polished, chrome plated.
14. Piping Finish: Copper.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller;flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:

    a. StrainersNPS 2 and Smaller: 0.020 inch.
    b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
    c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Pipe plug.

B. Icemaker Outlet Boxes P-0.1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. IPS Corporation.
    b. LSP Products Group, Inc.
    c. Plastic Oddities; a division of Diverse Corporate Technologies.

2. Mounting: Recessed.
3. Material and Finish: Plastic box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.7 HOSE BIBBS

A. Hose Bibbs P-0.1:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.

7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: or operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.8 WALL HYDRANTS

A. Moderate-Climate Wall Hydrants P-0.1:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Acorn
   b. MIFAB, Inc.
   c. Prier Products, Inc.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Woodford Manufacturing Company.
2. Standard: ASME A112.21.3M for concealed -outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet: Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounting with cover.
8. Box and Cover Finish: Chrome plated.
9. Outlet: Exposed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): Two with each wall hydrant.

2.9 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:
1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.

7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.10 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company.
   b. MIFAB, Inc.
   c. PPP Inc.
   d. Sioux Chief Manufacturing Company, Inc.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.11 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves P-0.1.:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. MIFAB, Inc.
   b. PPP Inc.
   c. Sioux Chief Manufacturing Company, Inc.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

D. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

E. Install balancing valves in locations where they can easily be adjusted.

F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

G. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 6 Section "Rough Carpentry."

H. Install water hammer arresters in water piping according to PDI-WH 201.

I. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 16 Section "Grounding and Bonding."

C. Connect wiring according to Division 16 Section "Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.

2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Water pressure-reducing valves.
5. Calibrated balancing valves.
6. Primary, thermostatic, water mixing valves.
7. Supply-type, trap-seal primer valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 15 Section "Mechanical Identification."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 15145

SECTION 15150 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.

B. Related Sections include the following:
   1. Section 15430 "Plumbing Specialties" for soil, waste, and vent piping systems specialties.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

   1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

A. Product Data: For pipe, fittings, and couplings.

B. Shop Drawings: For sovent drainage system, include plans, elevations, sections, and details.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

C. Transition Couplings for Underground Pressure Piping: AWWA C219 metal, sleeve-type coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 CAST-IRON SOIL PIPING

A. Hubless Pipe and Fittings: Trademark of CISPI

1. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.
   a. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve.

      1) NPS 1-1/2 to NPS 4: 3-inch- wide shield with 4 bands.

2.3 ENCASEMENT

A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Section 02220 "Excavation and Backfill" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.

C. Aboveground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:

1. NPS 1-1/4 and NPS 1-1/2: Use NPS 1-1/2 hubless, cast-iron soil piping and one of the following:

   a. Couplings: Heavy-duty, Type 304, stainless steel.

2. NPS 1-1/4 and NPS 1-1/2: Steel pipe; cast-iron, threaded drainage fittings; and threaded joints.
3. NPS 2 to NPS 4: Hubless, cast-iron soil piping and one of the following:

   a. Couplings: Heavy-duty, Type 304, stainless steel.

D. Underground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:

1. NPS 1-1/2: Hubless, cast-iron soil piping and one of the following:

   a. Couplings: Heavy-duty, Type 304, stainless steel.

2. NPS 2 to NPS 4: Hubless, cast-iron soil piping and one of the following:

   a. Couplings: Heavy-duty, Type 304, stainless steel.

3.3 PIPING INSTALLATION

A. Refer to Section 15050 "Basic Mechanical Materials and Methods" for basic piping installation.

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.

D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight.

E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Encase underground piping with PE film according to ASTM A 674 or AWWA C105.

F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by

side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

3.4 JOINT CONSTRUCTION

A. Refer to Division 15050 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

3.5 HANGER AND SUPPORT INSTALLATION

A. Refer to Section 15242 "Vibration Isolation Controls" for seismic-restraint devices.

B. Refer Section 15060 "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Section 15060 "Hangers and Supports"

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.. In addition provide unistrut with C-clamp supports at top, middle and bottom of pipe drops serving all plumbing fixtures.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Specialties."
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 15150

SECTION 15155 - DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following drainage piping specialties:
1. Cleanouts.
2. Floor drains.
3. Roof flashing assemblies.
4. Through-penetration firestop assemblies.
5. Roof drains.
6. Miscellaneous drainage piping specialties.
7. Flashing materials.

B. Related Sections include the following:

1. Division 15 Section "Plumbing Fixtures" for hair interceptors.
2. Division 15 Section "Medical Plumbing Fixtures" for plaster sink interceptors.

1.3 SUBMITTALS

1. Wiring Diagrams: Power, signal, and control wiring.

B. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary and storm piping specialty components.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for adjustable housing cast-iron soil pipe with cast-iron ferrule cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Threaded.
8. Closure: Brass plug with tapered threads Cast-iron plug.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
8. Wall Access: Round, wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains P-0.1:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. MIFAB, Inc.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3.
3. Pattern: Sanitary drain.
4. Body Material: Per plans.
5. Outlet: Bottom.
6. Top or Strainer Material: Nickel bronze.
7. Top of Body and Strainer Finish: Nickel bronze.
8. Top Shape: Round.
9. Trap Material: Cast iron.
10. Trap Pattern: Standard P-trap.
11. Trap Features: Trap-seal primer valve drain connection.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Company; Elmdor/Stoneman Div.
b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
1. Low-Silhouette Vent Cap: With vandal-proof vent cap.
2. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

2.5 ROOF DRAINS

A. Metal Roof Drains P-0.01:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. MIFAB, Inc.
b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
c. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.21.2M.
3. Pattern: Roof drain.
4. Body Material: Cast iron.
5. Dimensions of Body: Per P-0.1.
6. Combination Flashing Ring and Gravel Stop: Required.
7. Outlet: Bottom.
8. Dome Material: Cast iron.
9. Extension Collars: Required.
10. Underdeck Clamp: Required.
11. Sump Receiver: Required.

2.6 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.7 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

   a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
   b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
   c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

H. Install through-penetration firestop assemblies in plastic conductors at floor penetrations.

I. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 7.

1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Position roof drains for easy access and maintenance.

J. Install deep-seal traps on floor drains and other waste outlets, if indicated.

K. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

L. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

M. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

N. Install vent caps on each vent pipe passing through roof.

O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

P. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Ground equipment according to Division 16 Section "Grounding and Bonding."

D. Connect wiring according to Division 16 Section "Conductors and Cables."

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

H. Provide "Mathane Barrier Boot" for all penetrations through slab. Refer to Mathane Medigation Plans for additional requirements.

3.4 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 15 Section "Mechanical Identification."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 15155

SECTION 15160 - STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes storm-drainage piping inside the building and to locations indicated.

B. Related Sections include the following:
   1. Section 15430 "Plumbing Specialties" for storm drainage piping system specialties.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

   1. Storm Drainage Piping: 10-foot head of water

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings: For controlled-flow storm drainage system, include calculations, plans, and details.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

C. Transition Couplings for Underground Pressure Piping: AWWA C219 metal, sleeve-type coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 CAST-IRON SOIL PIPING

A. Hubless Pipe and Fittings: Trademark of CISPI

1. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral center pipe stop.
   a. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve.
      1) NPS 1-1/2 to NPS 4: 3-inch- wide shield with 4 bands.
      2) NPS 5 to NPS 10: 4-inch- wide shield with 6 bands.

   b. Heavy-Duty, FM-Approved Couplings: ASTM A 666, Type 304, stainless-steel housing; stainless-steel bands; and sleeve.

      1) NPS 1-1/2 to NPS 4: 3-inch- wide housing with 2 bands.

   c. Heavy-Duty, Cast-Iron Couplings: ASTM A 48, 2-piece, cast-iron housing; stainless-steel bolts and nuts; and sleeve.
   d. Heavy-Duty, Type 301, Stainless-Steel Couplings: ASTM A 666, Type 301, stainless-steel shield; stainless-steel bands; and sleeve.

      1) NPS 1-1/2 to NPS 4: 3-inch- wide shield with 4 bands.

2.3 ENCASEMENT

A. PE Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105 PE film, 0.008-inch minimum thickness, tube or sheet.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.

C. Aboveground Storm Drainage Piping: Use the following piping materials for each size range:
   1. NPS 2 to NPS 4: Hubless, cast-iron soil piping and one of the following:
      a. Couplings: Heavy-duty, Type 304, stainless steel.

D. Underground Storm Drainage Piping: Use the following piping materials for each size range:
   1. NPS 3 and NPS 4: Extra-Heavy class, cast-iron soil piping; gaskets; and gasketed joints.

      a. Couplings: Heavy-duty, Type stainless steel.

3.3 PIPING INSTALLATION

A. Refer to Division 2 Section "Storm Drainage" for Project site storm sewer and drainage piping.

B. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers.

C. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.

   1. Encase piping with PE film according to ASTM A 674 or AWWA C105.

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.

E. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight.

F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

   1. Encase underground piping with PE film according to ASTM A 674 or AWWA C105.

G. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

H. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

I. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:

1. Horizontal Storm-Drainage Piping: 1.0 percent downward in direction of flow.

J. Install engineered controlled-flow storm drainage piping in locations indicated.

K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by the inspector of record.

3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

3.5 HANGER AND SUPPORT INSTALLATION

A. Refer to Section 15060 "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 15 Section "Hangers and Supports."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3: 60 inches with 1/2-inch rod.
2. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.

F. Install supports for vertical cast-iron soil piping every 15 feet.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of inspector of record.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by inspector of record to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If the inspector of record finds that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 15160

SECTION 15181 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot-water heating piping.
2. Chilled-water piping.
3. Makeup-water piping.
4. Condensate-drain piping.

1.3 DEFINITIONS

A. PTFE: Polytetrafluoroethylene.

1.4 SUBMITTALS

A. Product Data: For each type of the following:
1. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air control devices.
3. Hydronic specialties.

B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Welding certificates.

D. Qualification Data: For Installer.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1.6 EXTRA MATERIALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. DWV Copper Tubing: ASTM B 306, Type DWV.

C. Wrought-Copper Fittings: ASME B16.22.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Anvil International, Inc.
      b. S. P. Fittings; a division of Star Pipe Products.
      c. Victaulic Company of America.

D. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

C. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

   1. Material Group: 1.1.
   2. End Connections: Butt welding.
   3. Facings: Raised face.

D. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Hart Industries International, Inc.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.

2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Perfection Corporation; a subsidiary of American Meter Company.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Company, Inc.
d. Victaulic Company of America.

2. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.5 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 15 Section "Valves."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 15 Section "HVAC Instrumentation and Controls."

C. Automatic Flow-Control Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Belimo
b. Flow Design Inc.
c. Griswold Controls.

2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
4. Combination Assemblies: Include bonze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig.
9. Maximum Operating Temperature: 250 deg F.

2.6 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.

3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Taco.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

2.7 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

C. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.

4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

D. Expansion fittings are specified in Division 15 Section "Pipe Expansion Fittings and Loops."

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, NPS 2 and smaller, shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

B. Hot-water heating piping, NPS 2-1/2 and larger, shall be the following:
1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

C. Chilled-water piping, aboveground, NPS 2 and smaller, shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

D. Chilled-water piping, NPS 2-1/2 and larger, shall be the following:
1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

E. Makeup-water piping shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

F. Condensate-Drain Piping: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

G. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

H. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

C. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

D. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

R. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

S. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 15 Section "Pipe Expansion Fittings and Loops."

T. Identify piping as specified in Division 15 Section "Mechanical Identification."

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 15 Section "Hangers and Supports." Comply with the following requirements for maximum spacing of supports.

B. Seismic restraints are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Spring hangers to support vertical runs.
3. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
2. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
3. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
4. NPS 6: Maximum span, 17 feet; minimum rod size, 1/2 inch.

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.

F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 15 Section "Meters and Gages."

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Set makeup pressure-reducing valves for required system pressure.
3. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
4. Set temperature controls so all coils are calling for full flow.
5. Verify lubrication of motors and bearings.

END OF SECTION 15181

SECTION 15194 - FUEL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes fuel gas piping within the building. Products include the following:

1. Pipe, tube, fittings, and joining materials.
2. Protective pipe and fitting coating.
3. Piping specialties.
4. Specialty valves.
5. Service meters.

B. Related Sections include the following:

1. Division 2 Section "Natural Gas Distribution" for natural gas service piping, specialties, and accessories outside the building.

1.3 PROJECT CONDITIONS

A. Gas System Pressure: One pressure range. 0.5 psig or less.

B. Design values of fuel gas supplied for these systems are as follows:

1. Nominal Heating Value: 1000 Btu/cu. ft..
2. Nominal Specific Gravity: 0.6.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

B. Shop Drawings: For fuel gas piping. Include plans and attachments to other work.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For natural gas specialties and accessories to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NFPA Standard: Comply with NFPA 54, "National Fuel Gas Code."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition. Notify fuel gas supplier. Handle flammable liquids used by Installer with proper precautions and do not leave on premises from end of one day to beginning of next day.

1.7 COORDINATION

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 PIPES, TUBES, FITTINGS, AND JOINING MATERIALS

A. Steel Pipe: ASTM A 53/A 53M; Type E or S; Grade B; black. Wall thickness of wrought-steel pipe shall comply with ASME B36.10M.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
3. Joint Compound and Tape: Suitable for natural gas.
4. Steel Flanges and Flanged Fittings: ASME B16.5.

2.4 PROTECTIVE COATING

A. Furnish pipe and fittings with factory-applied, corrosion-resistant polyethylene coating for use in contact with materials that may corrode the pipe.

2.5 PIPING SPECIALTIES

A. Flexible Connectors: ANSI Z21.24, copper alloy.

2.6 SPECIALTY VALVES

A. Valves, NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves, NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

C. Appliance Connector Valves: ANSI Z21.15 and CSA International listed.

1. Manufacturers:
   a. Brass Craft Manufacturing Co.
   b. Conbraco Industries, Inc.; Apollo Div.
   c. JMF Company.
   d. Mueller Co.; Mueller Gas Products Div.
   e. Watts Industries, Inc.; Water Products Div.

D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.

E. Gas Valves, NPS 2 and Smaller: ASME B16.33 and CSA International-listed bronze body and 125-psig pressure rating.

1. Manufacturers:

a. Grinnell Corp.
b. Honeywell International Inc.
c. KITZ Corporation.
d. Milwaukee Valve Company.
e. Mueller Co.; Mueller Gas Products Div.
f. NIBCO INC.

2. Tamperproof Feature: Include design for locking.

F. Plug Valves, NPS 2-1/2 and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig pressure rating.

1. Manufacturers:

a. Milliken Valve Co., Inc.
b. Nordstrom Valves, Inc.
c. Olson Technologies, Inc.; Homestead Valve Div.
d. Walworth Co.

2. Tamperproof Feature: Include design for locking.

G. General-Duty Valves, NPS 2-1/2 and Larger: ASME B16.38, cast-iron body, suitable for fuel gas service, with "WOG" indicated on valve body, and 125-psig pressure rating.

1. Gate Valves: MSS SP-70, OS&Y type with solid wedge.

H. Electrically Operated Gas Valves: UL 429, bronze, aluminum, or cast-iron body solenoid valve; 120-V ac, 60 Hz, Class B, continuous-duty molded coil. Include NEMA ISC 6, Type 4, coil enclosure and electrically opened and closed dual coils. Valve position shall normally be closed.

1. Manufacturers:

a. ASCO General Controls.
b. ASCO Power Technologies, LP; Division of Emerson.
c. Eclipse Combustion, Inc.

I. Earthquake Valves: Listed in CSA International's "Certified Product Listing Directory: Components for Gas and Electrical Equipment" as complying with ASCE 25 and UL listed.

1. Earthquake-Valve, Type 1: Working-pressure rating is 125 psig. Cast-aluminum body with stainless-steel internal parts. Buna-N, reset-stem, O-ring seal. Threaded end connections.

   a. Manufacturers:

      1) Safe T Quake Corp.

2.7 SERVICE METERS

A. Service Meters: To be provided by local Gas Co. Location shown on plan is for coordination purposes only. Coordination with local Gas Co. is required prior to installation of new site gas piping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for fuel oil piping system to verify actual locations of piping connections before equipment installation.

   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.

3.3 SERVICE ENTRANCE PIPING

A. Extend fuel gas piping and connect to fuel gas distribution for service entrance to building.

   1. Exterior fuel gas distribution system piping, service pressure regulator, and service meter will be provided by gas utility.
   2. Natural gas distribution system piping, service pressure regulator, and service meter are specified in Division 2 Section "Natural Gas Distribution."

B. Install dielectric fitting downstream from and adjacent to each service meter unless meter is supported from service-meter bar with integral dielectric fitting. Install shutoff valve downstream from and adjacent to dielectric fitting. Dielectric fittings are specified in Division 15 Section "Basic Mechanical Materials and Methods."

C. Install strainer upstream from each earthquake valve. Strainers are specified in Division 15 Section "Plumbing Specialties."

3.4 PIPING APPLICATIONS

A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.

B. Fuel Gas Piping, 2 psig or Less:

1. NPS 1/2 and Smaller: NPS 3/4 steel pipe, malleable-iron threaded fittings, and threaded joints.

2. NPS 3/4 and NPS 1: Steel pipe, malleable-iron threaded fittings, and threaded joints.

3. NPS 1-1/4 to NPS 2: Steel pipe, malleable-iron threaded fittings, and threaded joints.
4. NPS 2-1/2 and Larger: Steel pipe, steel welding fittings, and welded joints.

C. Underground Fuel Gas Piping: Steel pipe, steel welding fittings, and welded joints. Encase in containment conduit.

D. Containment Conduits: Steel pipe, steel welding fittings, and welded joints.

E. Gas Service Piping at Meters and Regulators, More Than 5 psig: Steel pipe, steel welding fittings, and welded joints.

3.5 VALVE APPLICATIONS

A. Appliance Shutoff Valves for Pressure 0.5 psig or Less: Appliance connector valve or gas stop.

B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig: Gas stop or gas valve.

C. Piping Line Valves, NPS 2 and Smaller: Gas valve.

D. Piping Line Valves, NPS 2-1/2 and Larger: Plug valve or general-duty valve.

3.6 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.

1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.

2. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.

   a. Exception: Tubing passing through partitions or walls.

3. In Walls: Gas piping with welded joints and protective wrapping specified in Part 2 "Protective Coating" Article may be installed in masonry walls, subject to approval of authorities having jurisdiction.
4. Prohibited Locations: Do not install gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.

   a. Exception: Accessible above-ceiling space specified above.

C. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.

   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

D. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels, unless indicated to be exposed to view.

E. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.

F. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

G. Connect branch piping from top or side of horizontal piping.

H. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

I. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.

J. Install pressure gage downstream from each line pressure regulator. Pressure gages are specified in Division 15 Section "Meters and Gages."

K. Install flanges on valves, specialties, and equipment having NPS 2-1/2 and larger connections.

L. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

M. Install containment conduits for gas piping below slabs, within building, in gastight conduits extending minimum of 4 inches outside building, and vented to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal-tar, epoxy-polyamide paint according to SSPC-Paint 16.

3.7 JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Use materials suitable for fuel gas.

C. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.8 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support and equipment support materials and installation requirements are specified in Division 15 Section "Hangers and Supports."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.9 CONNECTIONS

A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.

B. Install piping adjacent to appliances to allow service and maintenance.

C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

E. Ground equipment according to Division 16 Section "Grounding and Bonding."

1. Do not use gas pipe as grounding electrode.

F. Connect wiring according to Division 16 Section "Conductors and Cables."

3.10 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator, and specialty valve.

1. Text: In addition to name of identified unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
2. Nameplates, pipe identification, and signs are specified in Division 15 Section "Mechanical Identification."

3.11 PAINTING

A. Use materials and procedures in Division 9 painting Sections.

B. Paint exterior service meters, pressure regulators, and specialty valves.

1. Color: Gray.

3.12 FIELD QUALITY CONTROL

A. Test, inspect, and purge piping according to NFPA 54 and requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Verify capacities and pressure ratings of service meters, pressure regulators, valves, and specialties.

D. Verify correct pressure settings for pressure regulators.

E. Verify that specified piping tests are complete.

END OF SECTION 15194

SECTION 15300 - FIRE PROTECTION SYSTEM

PART 1- GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, tools, services and miscellaneous and incidental work to complete the design engineering, and installation of a complete wet pipe sprinkler system throughout the building and Type II standpipe where shown, in accordance with this specification and NFPA 13. Sprinkler protection design shall be based on street main pressure. The sprinkler system hydraulic design point shall fall ten percent below the available supply curve.

B. The following documents, including others referenced therein, form part of this Section to the extent designated herein.

C. American Society of Mechanical Engineers (ASME)

D. American Welding Society (AWS)

D 1.1-90 Structural Welding Code – Steel

E. Factory Mutual System (FM)

1999 Edition Approval Guide

F. Federal Standards (FED STD)

FED-STD-595B Colors Used in Government Procurement

G. National Fire Protection Association (NFPA)

13 Installation of Sprinkler Systems, 2001 Edition

H. Underwriters Laboratories (UL)

I. California Building Code (CBC) 2001 "Installation of Automatic Sprinkler Systems".

1.2 SUBMITTALS

A See Division 1 for submittal procedures.

B Approval Required

1. Design/Fabricator drawings: Before fabrication, submit design, fabrication and installation drawings of the sprinkler systems. Prepare drawings under supervision of, and have submittal stamped by a licensed professional fire protection engineer.

2. The fire sprinkler system shall be DSA "Deferred Approval".

C Record drawings: Submit drawings of sprinkler systems as installed.

D NFPA test certificate: Submit completed Contractor's Material and Test Certificate in accordance with NFPA 13.

E Submit evidence of current California C-16 Contractor's license and list of comparable installations required by Section 1.03 herein.

F Submit multiple copies of catalog data sheets for all materials per Section 01300. Submittals shall include, but not be limited to, the following:

1. Sprinkler heads and accessories

2. Pipe and fittings.

3. Valves.

4. Gauges.

5. Alarm flow switches.

6. Hangers and supports.

7. Fire department connections.

8. Post indicator valves.

9. Valve supervisory switches.

10. Hose cabinets.

11. Identification signs.

12. Sprinkler head cabinets.

13. Underground piping plan.

G Submit shop drawings per Section 01300.

1. Detailed working drawings and hydraulic calculations shall be prepared and submitted for review before fabrication of the project. Working drawings shall be submitted in complete sets (partial submission will not be acceptable) and shall bear the Contractor's license stamp, identity of the system designer and computer program used in the calculation of hydraulic information.

2. Fire Marshal approval of submittals is for permission to proceed and does not authorize design, products or installation not conforming to referenced codes and standards and this specification.

3. Upon completion of the work, the contractor shall provide reproducible As-Built Drawings to the Owner's Representative as required by Section 01720 of the Project Specifications. Final approvals are subject to receipt of acceptable As-Built Drawings.

4. California State Fire Marshal (CSFM) listing numbers (alarm and supervisory devices).

H Submittals having any content which is incomplete or unclear will be returned without review.

I Discharge patterns and application data shall be included in submittals for sidewall, water curtain, and similar special purpose sprinklers.

J Operating instructions: Provide instruction charts describing operation and proper maintenance of system equipment per Section 01350.

1.3 COORDINATION WITH OTHER TRADES

A The Contractor shall coordinate work among the trades to avoid any interference with the effectiveness of the fire protection system. Shop drawings shall include elevations of equipment and piping for other trades to assure coordination. The fire protection system shall be coordinated with other trades to assure that conflicts will not arise with structural, mechanical, electrical or architectural features of the building. Any changes required by field coordination, shall be provided and installed at no cost to the Owner.

B The Contractor shall be specifically directed to coordinate with the fire sprinkler and alarm trades to ensure full awareness of the location of all control valves, flow switches, tamper switches, and alarm and signal switches.

1.4 SYSTEM DESCRIPTION

A Design the sprinkler systems in accordance with NFPA 13 for ordinary hazard group 2 occupancy classification.

B System shall include a 6-inch alarm check valve, supplied with standard trim, including retard chamber, fire department connection, flow alarm pressure switch, system main drain valve assembly, water motor alarm gong and electrical connections..

C Components of the system, if not designated in this Section and the Drawings by manufacturer's name and model/figure number, shall be current products and be UL listed in the Fire Protection Equipment Directory or Fire Resistance Directory, or FM approved in the Approval Guide for their intended use.

1.5 QUALITY ASSURANCE

A. Product Qualification: See Division 1 for additional requirements related to product qualification and Contractor/Supplier qualifications.

B. Deliverable Documentation: The following documents and records, required by this Section, shall be delivered in accordance with Section 01720.

Document	Paragraph
Flushing Verification	3.2.B.
Hydrostatic Test Record	3.2.C.

PART - 2 PRODUCTS

2.1 SUBSTITUTES

See Division 1 for substitution.

2.2 MATERIALS

A. Piping

1. Pipe and fittings: Meet the requirements of NFPA 13. Piping shall be schedule 40 steel, and with threaded or grooved type (rubber gasketed) fittings. Rubber gasketed fittings for use with plain end pipe shall not be used.
2. Flexible couplings: Bolted sleeve type for use with grooved-end pipe, with rubber rings for sealing.

B. Reducers: One piece concentric threaded reducers, reducing tees for straight run reduction in pipe sizes or grooved type, rubber gasketed reducing couplings. Hexagonal or face busings shall not be used.

C. Identification Labels: Approximately 2 –1/4 by 14 inches, bearing the words "FIRE PROTECTION WATER", and a direction arrow approximately 2-1/4 by 7 inches. Labels shall have adhesive backing and installed per "Mechanical Identification" section.

D. Expansion Anchors

1. For concrete: Wedge type anchors: Hilti Fastening Systems "Kwik-Bolt II," or ITW-Ramset "Trubolt Wedge Anchor."
2. For filled concrete blocks: Sleeve type anchors; Hilti Fastening Systems "Hol-Hugger," or ITW-Ramset "Dynabolt Sleeve Anchor." If open cells are contacted, use toggle bolts
3. Ceiling hangers at hi-volume ceiling (library) "Epic" metal deck hanging system. . ER3.5 "Wedge Nut" hanging devices shall be installable and relocatable along the length of the interior ribs of the ER3.5A Acoustical Roof Deck units. (at gym only). Manufacturer's product data shall be consulted for minimum spacing, load capacities and proper installation procedure of the ER3.5 "Wedge Nut" hanging devices.

E. Sealant: See Section 07900.

F. Paint: See Section 09900.

G. Signs: Provide permanent "CAUTION" signs worded in accordance with NFPA 13.

H. Hydraulic design information sign: Provide a permanently marked, weatherproof metal or plastic sign, with corrosion-resistant attachments, containing information required by NFPA 13.

I. Escutaheons – Primed, steel.

2.3 EQUIPMENT

A. Water Motor Alarm Gong: Weatherproof mechanical gong with hood, complete with drain and interconnecting piping. Viking Model F-2.

B. Switches

1. Flow alarm pressure switch for installation on wet pipe sprinkler system retard chamber: Pressure operated having built-in adjustable time retard feature which may be set from 0 seconds to 1 minute or more. Retard feature shall recycle instantly and automatically, and have no build-up. Potter Electric Switch #WFSRC.
2. Flow switches installed directly on sprinkler system piping for fire zone or alarm annunciation shall be flexible vane type, with normally open contacts and instantaneous recycling retard adjustable 15 to 60 seconds.
3. Provide position supervisory switches to supervise sprinkler system control valves. Switches shall be tamperproof, alarms when cover is removed, and alarm during first 2 revolutions of valve handwheel in closing direction. Switches shall be SPDT, 120 V ac, rated for pilot duty and provided with suitable mounting hardware.

C. Automatic Sprinklers: Nominal ½-inch diameter orifices, rated for ordinary temperature classification, unless other temperature ratings are required by NFPA 13. For Computer Lab sprinklers shall be rated for 200° F. The sprinklers shall be recessed automatic type. Reliable Model G with chrome finish.

1. Ceiling Mounted: Pendant type with natural chrome finish and adjustable chrome finish metal escutcheons.
2. Exposed Piping: Upright except where limited space requires pendant; natural brass finish.
3. Ceilings below 10'-0": Provide recessed type heads at all locations.

D. Sprinkler Head Guards: Formed wire or forged steel, suitable for use with upright or pendent sprinklers which can be attached or removed without disturbing sprinkler head, where heads are subject to damage or as directed by architect.

E. Sprinkler Cabinet: Provide with required number of sprinkler heads of ratings and types installed, sprinkler wrench, and mount on wall in the fire sprinkler riser room.

F. Fire Department Connection: Polished chrome finish and furnished with self-closing double clapper, plugs and chains, automatic balldrip valve, and escutcheon plate. Connection shall be 4-inch NPT by 2-1/2-inch hose thread by 1-1/2-inch hose thread. Hose threads shall be in accordance with NFPA 1963, 7-1/2 threads/in. Use Potter-Roemer Figure 5021 for vertical installation.

G. Alarm Check valve: 6-inch supplied with standard trim, including retard chamber. Grinnell Figure F2001 Alarm Valve with figure F211 Retard Chamber, Trim Type A.

H. Fire System Control Valves (PIV's, Wall PIV's, Butterfly Valves)

1. Each sprinkler system shall be provided sprinkler control valve to isolate the system from the water supply.
2. Valves provided for each sprinkler system shall be outside indicating. When there is more than one riser on the system each riser shall have separate outside indicating valve.
3. The installation height of the PIV shall be at 36" above the adjacent grade to the PIV handle's socket.
4. Wall PIV's and butterfly valves shall be readily accessible.
5. Protection of the control valves is required when the control valves are subject to impact from vehicular traffic.
6. Working clearance for control valves shall be an unobstructed 3-foot radius around the control valve.
7. When providing control in a multi-story building, indicating valves may be located within fire resistant stair shafts which provide access to fire department personnel from the exterior, provided: (1) the valve is monitored by the fire alarm system; (2) the valve is recessed into the wall, equipped with a access panel 3' x 3' (or large enough to allow for service of sprinkler riser) fire rated access panel and (3) access panel identified by a metal sign stating "sprinkler control valve 1st floor" etc. The sign's lettering shall white, no less than 2" in height, with a 3/8-inch stroke and with a red background. Stick-on type letters are not permitted.
8. Sectional control valves shall be aboveground indicating.

I. Fire Department Connections (FDC's):

1. FDC's shall be located on the street side of the building, close to curb facing the street.
2. FDC's shall not be installed where there is the possibility of injury from falling objects.
3. FDC's shall be installed so that the centerlines of the inlets are located at a minimum height of 24" and a maximum height of 36" above the adjacent finish grade.
4. FDC's shall be installed on the system side of the double detector check.
5. Protection of the FDC is required when the FDC is subject to impact from vehicular traffic.
6. For working clearance an unobstructed radius of 3-fee shall be maintained around the FDC.

J. Signage:

1. All indicating valves, including PIV's, and fire department connections, shall be identified.

PART - 3 EXECUTION

3.1 INSTALLATION

A. Install sprinkler systems in accordance with NFPA 13 for ordinary hazard occupancy classification.#2.

B. Coordinate requirements for interruption of existing services and Fire Department stand-by with the Construction Manager.

C. Protect new piping from damage by earthquake by proper clearance around penetration holes, flexible couplings, and sway bracing, in accordance with NFPA 13.

D. Sealing Floor and Wall Penetrations

1. Nonfire Rated.
   a. Cut minimum size hole for pipe passing through gypsum board walls. Seal both sides with polysulfide sealant.
   b. Pack pipe penetrations through concrete floors and walls with fiberglass or mineral wool packing and seal both sides with minimum 1-inch thick polysulfide sealant.
   c. Seal pipe penetrations through concrete block walls both sides to thickness of web with polysulfide sealant. Provide fiberglass or mineral wool packing as required to prevent filling void.

2. Fire Rated
   a. Cut minimum size hole for pipe passing through gypsum board walls. Seal both sides with fire rated sealant.
   b. Seal sprinkler pipe penetrations through concrete floors and walls, and filled concrete block walls with sealant to provide a 2 or 3 hour fire resistance rating in accordance with manufacturer's test data.
   c. Seal pipe penetrations through nonfilled concrete block walls with sealant in accordance with manufacturer's test data.

E. Pipe Escutcheons: Install on sides of wall penetrations exposed to view.

F. Repair damaged surfaces. Refinish repaired or defaced surfaces to match adjacent undisturbed areas.

G. Terminate exterior discharge, inspectors test, and auxiliary drain lines with 45 degree elbows, turned down, and extending no more than 4" from wall.

H. Provide suitable splash-pads, at exterior discharge locations, on other than paved surfaces.

I. Install sprinkler head guards where subject to mechanical damage from low elevation or exposure to normal building activities.

J. Paint new system piping exposed to view, with 1 coat of zinc chromate primer and 1 coat of semigloss enamel. Finish color shall be red (No. 21105) shown in FED STD 595. Surface preparation, including cleaning and primer, shall be in accordance with Section 09900.

K. Welding

1. Limit welding to fabrication of supports or braces, if necessary. No other on site welding will be permitted, except as specified in this Section or on the Drawings.
2. Perform welding of sprinkler system piping in accordance with NFPA 13. Welding acceptance criteria shall be in accordance with ASME B31.1, Paragraph 136.4.2.
3. Perform welding of steel structural elements in accordance with AWS D1.1. Perform visual weld examination in accordance with AWSD1.1 Paragraph 6.5.5.

4. Do not perform welding or flame cutting on or within building.
5. Perform dye penetrant weld examination on cover pass of tie-in welds, not to be hydrostatically tested, in accordance with ASME B31.1 Paragraph 136.4

L. Hangers and Supports

1. Hang, support and brace sprinkler system piping from building structural steel members, concrete surfaces, or to metal supports attached to building structure or concrete surfaces in accordance with NFPA 13.
2. Use clamping devices when attaching to structural steel. When clamping is impossible, obtain written authority to weld, punch, drill or cut structural steel members to provide attachment.
3. When required, deliver to the Construction Manager detailed mathematical analysis, by registered professional engineer, of structural integrity where questionable alteration of building structural components are proposed. Analysis may also be required where obvious deformation of structural members are caused by hanging sprinkler piping.

M. Identification Labels

1. Install labels after painting is completed.
2. Locate labels on pipe where they can be easily read. Place labels on bottom quadrant of overhead pipe and top quadrant of pipe lower than eye level.
3. Identify only feed mains, cross mains, and risers 3-inch nominal diameter and larger.
4. Locate line identification at intervals of approximately 40 feet on unobstructed runs, and on each side of partitions and floors.

N. Signs

1. Install "CAUTION" signs at control, drain, test, and alarm valves.
2. Install the hydraulic design information sign, placed in accordance with NFPA 13.
3. Electrical Connections – To be completed per 2001 CEC.

3.2 FIELD QUALITY

A. General

1. Furnish equipment and instruments required to perform flushing and testing operations described below.
2. Conduct flushing and testing operations while witnessed by the Inspector of Record. Manager.
3. Remove and replace pieces of apparatus, material, or work which falls in flushing or testing operations and retest.
4. Repair damage resulting from flushing or testing to satisfaction of the Construction Manager.

B. Flushing: Flush new sprinkler system piping as described below.

1. Flush sprinkler piping by feeding water into the system through the alarm valve in accordance with NFPA 13.
2. Discharge flushing water from end of cross mains.
3. Discharge flushing water to point designated by the Construction Manager. Flushing shall continue until effluent runs clear and free of foreign matter.
4. Provide documented evidence that flushing has been accomplished in accordance with this Section. Deliver to the Construction Manager before testing.

C. Hydrostatic Testing

1. Hydrostatically test the new sprinkler system in accordance with NFPA 13.
2. Use a hydrostatic test pressure of 200 ib/in ^{2} minimum.
3. Leaks in piping will not be acceptable.

D. Backflow prevention assembly test: Testing shall be at the time of installation, by a State of California, Department of Health Certified Backflow Assembly Tester.

E. Provide two NFPA certificates to the owner, local fire official, and DSA.

END OF SECTION 15300

SECTION 15410 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes plumbing fixtures and related components.

B. Related Sections include the following:

1. Division 15 Section "Drinking Fountains and Water Coolers."
2. Division 15 Section "Plumbing Specialties" for backflow preventers and specialty fixtures not in this Section.

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities, as per CBC Section 1115B.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated, as per CBC Table 1115b-1 and Section 1118B.

1.4 SUBMITTALS

A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.

B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; CBC and CPC about plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Hand Sinks: NSF 2 construction.
3. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
4. Slip-Resistant Bathing Surfaces: ASTM F 462.
5. Vitreous-China Fixtures: ASME A112.19.2M.
6. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.

H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
2. Faucet Hose: ASTM D 3901.
3. Faucets: ASME A112.18.1M.
4. Hose-Connection Vacuum Breakers: ASSE 1011.
5. Hose-Coupling Threads: ASME B1.20.7.
6. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
7. NSF Materials: NSF 61.
8. Pipe Threads: ASME B1.20.1.
9. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
10. Supply and Drain Fittings: ASME A112.18.1M.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1M.
3. Manual-Operation Flushometers: ASSE 1037.
4. Plastic Tubular Fittings and Piping: ASTM F 409.
5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
6. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Floor Drains: ASME A112.21.1M.
3. Grab Bars: ASTM F 446.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Hot-Water Dispensers: ASSE 1023 and UL 499.
6. Off-Floor Fixture Supports: ASME A112.6.1M.
7. Pipe Threads: ASME B1.20.1.
8. Plastic Shower Receptors: ANSI Z124.2.
9. Plastic Toilet Seats: ANSI Z124.5.
10. Supply and Drain Protective Shielding Guards: CBC 1115B.2.1.3.1.

1.6 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Faucet, Laminar-Flow Fittings: Equal to 10 percent of amount of each type and size installed, but not less than 2 of each type and size.
4. Faucet, Flow-Control Fittings: Equal to 10 percent of amount of each type and size installed.
5. Supply, Flow-Control Fittings: Equal to 5 percent of amount of each type and size installed.
6. Shower, Flow-Control Fittings: Equal to 5 percent of amount of each type and size installed.
7. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but not less than 12 of each type.

8. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
9. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. For fixture descriptions in other Part 2 articles where the subparagraph titles manufacturers introduce a list of manufacturers and their products or manufacturers only, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified in other Part 2 articles.

2.2 LAVATORY FAUCETS: See Fixture Schedule on Drawing P0.01

2.3 SINK FAUCETS: See Fixture Schedule on Drawing P0.01

2.4 FLUSHOMETERS: See Fixture Schedule on Drawing P0.01

2.5 TOILET SEATS: See Fixture Schedule on Drawing P0.01

2.6 PROTECTIVE SHIELDING GUARDS: See Fixture Schedule on Drawing P0.01

2.7 FIXTURE SUPPORTS: See Fixture Schedule on Drawing P0.01

2.8 WATER CLOSETS: See Fixture Schedule on Drawing P0.01

2.9 URINALS: See Fixture Schedule on Drawing P0.01

2.10 LAVATORIES: See Fixture Schedule on Drawing P0.01

2.11 SERVICE SINKS: See Fixture Schedule on Drawing P0.1

2.12 SHOWERS: See Fixture Schedule on Drawing P0.01.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION

A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-hanging fixtures with tubular waste piping attached to supports.

F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter-mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Refer to Division 15 Section "Valves" for general-duty valves.

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

M. Install toilet seats on water closets.

N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

P. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

Q. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

R. Install disposer in outlet of sinks indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

S. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for escutcheons.

T. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

F. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at **faucets and flushometer valves** to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 15410

SECTION 15415 - DRINKING FOUNTAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Drinking fountains.
   2. Fixture supports.

1.3 DEFINITIONS

A. Accessible Drinking Fountain: Fixture that can be approached and used by people with disabilities.

B. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.

C. Fitting: Device that controls flow of water into or out of fixture.

D. Fixture: Drinking fountain or water cooler, unless one is specifically indicated.

1.4 SUBMITTALS

A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each type of fixture indicated.

B. Shop Drawings: Diagram power,

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

D. Maintenance Data: For fixtures to be included in maintenance manuals as described in Division 1.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Regulatory Requirements: Comply with requirements in CBC 1117B.1.1, Public Law 101-336, "Americans with Disabilities Act"; about fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

1.6 COORDINATION

A. Coordinate roughing-in and final fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acorn Aqua, Haws or equal.

2.2 DRINKING FOUNTAINS: See Fixture Schedule on Drawing P-0.01

2.3 FIXTURE SUPPORTS

A. Off-Floor, Plumbing Fixture Supports: ASME A112.6.1M, carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.

1. Manufacturers:

   a. Smith, Jay R. Mfg. Co.
   b. Tyler Pipe; Wade Div.
   c. Watts Industries, Inc.; Enpoco, Inc. Div.
   d. Watts Industries, Inc.; Watts Drainage Products Div.
   e. Zurn Specifications Drainage Operation.

2. Type I: Hanger-type carrier with two vertical uprights.
3. Type II: Bilevel, hanger-type carrier with three vertical uprights.
4. Supports for Accessible Fixtures: Rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.

B. Examine walls and floors for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Use carrier off-floor supports for wall-hanging fixtures, unless otherwise indicated.

B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.3 INSTALLATION

A. Install off-floor supports affixed to building substrate and attach wall-hanging fixtures, unless otherwise indicated.

B. Install fixtures level and plumb.

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation.

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Install pipe escutcheons at wall penetrations in exposed, locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.

F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Section 15430 "Joint Sealants" for sealant and installation requirements.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

A. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

B. Report test results in writing.

3.6 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

3.7 CLEANING

A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 15415

SECTION 15486 - FUEL-FIRED, DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for domestic water systems:

1. Compression tanks.
2. Accessories.
3. Expansion tank

1.3 SUBMITTALS

A. Product Data: For each type and size of water heater. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

B. Shop Drawings: Detail water heater assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring.

C. Product Certificates: Signed by manufacturers of water heaters certifying that products furnished comply with requirements.

D. Maintenance Data: For water heaters to include in maintenance manuals specified in Division 1.

E. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on specific units indicated. Other manufacturers' products

complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ANSI Compliance: Provide gas water heaters that comply with ANSI standards for gas water heaters and related products and that bear AGA certification label.

E. ASME Compliance: Fabricate and label water heater, hot-water storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

F. ASHRAE Standards: Comply with performance efficiencies prescribed for the following:

1. ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," for commercial water heaters.
2. ASHRAE 90.2, "Energy Efficient Design of New Low-Rise Residential Buildings," for household water heaters.

1.5 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include storage tanks, circulators, and burner assemblies
2. Warranty Period: From date of Substantial Completion:
   a. Storage Tanks 3 years.
   b. Parts one year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Commercial, Gas Water Heaters:

   a. American Water Heater Co.
   b. A.O. Smith

c. Lochinvar

2. Expansion Tanks:

a. Amtrol, Inc.
b. Smith: A.O. Smith Aqua-Air Div.
c. American

2.2 COMMERCIAL, STORAGE, GAS WATER HEATERS

A. Description: Comply with ANSI Z21.10.3.

B. Storage Tank Construction ASME-code steel with 150-psig working-pressure rating.

1. Tappings: Factory fabricated of materials compatible with tank for piping connections, relief valve, pressure gage, thermometer, drain, anode rods, and controls as required. Attach tappings to tank shell before testing and labeling.

a. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1, pipe threads.
b. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

2. Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
3. Insulation: Comply with ASHRAE 90.1. Surround entire storage tank except connections and controls.
4. Jacket: Steel, with enameled finish.

C. Burner: For use with automatic vent water heaters for natural-gas fuel.

1. Temperature Control: Adjustable thermostat.
2. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
3. Automatic Ignition: ANSI Z21.20, automatic gas-ignition system and components.
4. Automatic Damper: ANSI Z21.66, gas-fired-appliance, automatic-vent-damper device.

D. Anode Rods: Factory installed, magnesium.

E. Dip Tube: Factory installed. Not required if cold-water inlet is near bottom of storage tank.

F. Drain Valve: ASSE 1005, corrosion-resistant metal, factory installed.

2.3 EXPANSION TANKS

A. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

B. Construction: 150-psig working-pressure rating.

C. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.

D. Tank Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.

E. Tank Exterior Finish: Manufacturer's standard, unless finish is indicated.

F. Air-Charging Valve: Factory installed.

2.4 WATER HEATER ACCESSORIES

A. Combination Temperature and Pressure Relief Valves: According to the following:

1. Gas Water Heaters: ANSI Z21.22, combination temperature and pressure relief valve.
2. Option: Separate temperature and pressure relief valves are acceptable instead of combination relief valve.

B. Pressure Relief Valves: According to the following:

1. Gas Water Heaters: ANSI Z21.22 pressure relief valve for storage tanks of 200,000 Btuh.

2. Gas Water Heaters: ANSI Z21.22.

C. Gas Shutoff Valves: ANSI Z21.15, manually operated. Furnish for installation in piping.

PART 3 - EXECUTION

3.1 CONCRETE BASES

A. Install concrete bases of dimensions indicated. Refer to Section 03300 "Cast-in-Place Concrete" and Section 15000 "Basic Mechanical Materials and Methods."

3.2 WATER HEATER INSTALLATION

A. Install commercial water heaters on concrete bases.

1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.

B. Install water heaters, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Anchor water heaters to substrate.

D. Install seismic restraints for water heaters. Anchor to substrate.

E. Install and connect gas water heaters according to NFPA 54.

1. Install appliance, gas pressure regulators on gas-burner inlets of water heaters without pressure regulators.
2. Install vent piping from gas-train pressure regulators and valves to outside of building where required. Terminate vent piping with brass-screened vent cap fitting. Do not combine vents except with approval of authorities having jurisdiction.

F. Install and connect oil-fired water heaters according to NFPA 31.

G. Install temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.

H. Install pressure relief valves in water piping for water heaters without storage. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.

I. Install vacuum relief valves in cold-water-inlet piping.

J. Install vacuum relief valves in water heater storage tanks that have copper lining.

K. Install water heater drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Section 15400 "Plumbing " for drain valves.

L. Install thermometers on water heater inlet and outlet piping. Refer to Division 15 Section "Meters and Gages" for thermometers.

1. Exception: Omit thermometers for the following:

a. Household, water heater inlet and outlet piping.
b. Commercial, point-of-use, water heater inlet piping.

M. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve, and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Section 15400 "Plumbing" for general-duty valves.

N. Arrange for insulation on equipment and piping not furnished with factory-applied insulation.

O. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

P. Fill water heaters with water.

Q. Charge expansion tanks with air.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Section 15140 "Domestic Water Piping".. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect hot- and cold-water piping with shutoff valves and unions. Connect hot-water-circulating piping with shutoff valve, check valve, and union.

D. Connect gas piping to gas burner with drip leg, tee, shutoff valve, and union; minimum size same as inlet connection.

E. Connect oil piping to oil burner with shutoff valve and union in supply, and check valve and union in return.

F. Make connections with dielectric fittings where piping is made of dissimilar metal.

G. Gas, Water Heater Vent Connections: Connect to vent system. Include draft hoods and diverters where required. Use vents same size as or larger than water heater outlets, but not smaller than indicated unless smaller vent size has been calculated according to NFPA 54. Comply with gas utility requirements for sizing.

H. Electrical Connections: Power wiring and disconnect switches are specified in Division 16 Sections. Arrange wiring to allow unit service.

I. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Engage a factory-authorized service representative to perform startup service.

B. In addition to manufacturer's written installation and startup checks, perform the following:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment and retest until satisfactory results are achieved.
2. Verify that piping system tests are complete.
3. Check for piping connection leaks.
4. Check for clear relief valve inlets, outlets, and drain piping.
5. Check operation of circulators.
6. Test operation of safety controls, relief valves, and devices.
7. Energize electric circuits.
8. Adjust operating controls.
9. Adjust hot-water-outlet temperature settings. Do not set above 140 deg F unless piping system application requires higher temperature.
10. Balance water flow through manifolds of multiple-unit installations.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water heaters.

1. Train Owner's maintenance personnel on procedures for starting and stopping troubleshooting, servicing, and maintaining equipment.
2. Review date in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 15486

SECTION 15725 - MODULAR INDOOR MULTIZONE AIR HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes modular indoor multizone air handling units.

1.2 REFERENCES

A. AMCA 99 - Standards Handbook.

B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

C. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

D. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.

E. AMCA 500 - Test Methods for Louver, Dampers, and Shutters.

F. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

G. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

H. ANSI/UL 900 - Test Performance of Air Filter Units.

I. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

J. ARI 430 - Standard for Central-Station Air-Handling Units.

K. ARI 435 - Standard for Application of Central-Station Air-Handling Units.

L. NFPA 70 - National Electrical Code.

M. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

1.3 QUALIFICATIONS

A. Air Handling Units: Product of manufacturer regularly engaged in production of industrial quality, custom-designed complete air handlers, with a minimum of five (5) years of documented experience.

1.4 QUALITY ASSURANCE

A. Conform to space and access requirements; units will not be accepted which do not conform to space and access requirements.

B. Obtain indoor air-handling units through one source from a single manufacturer.

C. Air-Handling unit assembly shall have UL 1995 certification for safety.

D. Products Requiring Electric Connection shall be listed and classified by ETL and CSA as suitable for the purpose specified and indicated.

E. Fan Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal

F. Sound Ratings: AMCA 301; tested to AMCA 300 and bear AMCA Certified Sound Rating Seal.

G. Air-Handling unit shall be ARI 430 listed and meet NFPA 90A requirements.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

I. Coil Performance shall be certified in accordance with ARI Standard 410.

1.5 SUBMITTALS

A. Product Data: indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, and gages and finishes of materials.

B. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, anchorage method between air handler and concrete pad with seismic overturning calculation stamped by structural engineer, and electrical characteristics and connection requirements.

C. Provide fan curves with specified operating point clearly plotted.

D. Submit sound power levels for air handling unit outlet, inlet, and casing radiation at rated capacity.

E. Submit product data of filter media, filter performance data, filter assembly, and filter frames.

F. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

G. Submit manufacturer's installation instructions.

H. Submit operation and maintenance data.

I. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

J. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Equipment to be furnished and delivered to the site. Reference the Mechanical Schedule for exact capacity and parameters.

B. Vendor shall state firm delivery date for delivery of equipment to job site or as directed by Owner. The delivery time shall not exceed 4 weeks from the date the order is issued. Date shall include stated allowance time for approval of shop drawings.

C. Transport equipment in sections only where field conditions and/or transportation requirements do not allow installation as a single unit.

D. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

E. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.7 WARRANTY

A. Provide five (5) year warranty on the air-handling units.

B. The warranty period shall not begin until the equipment is installed and start-up of equipment is performed.

1.8 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

B. Coordinate size and location of structural-steel support members.

1.9 ENVIRONMENTAL REQUIREMENTS:

A. Do not operate units for any purpose, temporary or permanent, until ductwork has been installed and cleaned, filters are in place, bearings lubricated, and fan has been test run under observation.

1.10 EXTRA MATERIALS

A. Provide one (1) set of fan belts and filters for each unit.

B. Provide one (1) set of gaskets for access doors for each unit

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers:

1. Temtrol
2. Energy Labs
3. Haakon

2.2 GENERAL

A. Unit shall be factory-supplied, central station modular-type air handler. The air-handling unit may consist of a fan with the following factory-installed components as indicated on the equipment schedule.
1. Cooling Coils
2. Filter Bank.
3. Supply Fan
4. Variable Speed Drive
5. Internal Vibration Isolation

B. Each unit shall be constructed on a fully welded 10-gauge, structural tubular steel base, minimum 2" Wide x 6" high. The base support shall include additional structural steel supports under fans, motors, coils, and filters.

C. Contractor shall provide and install all piping, fittings, couplings, unions, and associated components within air handler sections as required to connect to coil inlets and outlets.

D. Air Handler shall be provided with factory mounted lifting lugs at all demounts. Lugs shall be utilized for connection points to the equipment pad. Should additional lugs be required to prevent seismic overturning, provision shall be made by the Contractor to obtain additional lugs from the Manufacturer and field weld the additional lugs to the unit per the Manufacturer's recommendations.

E. All internal controls components shall be factory installed and wired by the air handler manufacturer. Air handling manufacturer shall factory install and wire all DDC Temperature Control related unit components including but not limited to temperature and pressure sensors, damper actuators and main DDC panel. Water coil valves and actuators shall be furnished and field installed and wired by the Controls Contractor.

F. Programming, start-up and commissioning of the DDC Temperature Control system shall be the responsibility of the Controls Control contractor and shall be done in the field.

G. Unit serial numbers shall be permanently welded into the base frame or engraved on a nameplate.

2.3 CONSTRUCTION FEATURES

A. Unit shall be constructed of a complete frame with easily removable panels. Removal of any panel shall not affect the structural integrity of the unit. Coil sections shall have removable frame sections to facilitate vertical coil extraction.

B. Panels and frames shall be thermally broken so as not to allow a clear conduction path from the inside of the casing to the outside.

C. Unit sections shall be supplied with 16-gage G90 galvanized pre-painted steel structural baserails. Bolt-on legs are NOT acceptable. Perimeter 10-gage lifting lugs for overhead rigging shall be provided on each section. Slinging of units in lieu of lifting lugs is not acceptable.

D. Casing panels (top, sides, and bottom) shall be constructed of galvanized steel, with pre-painted, baked enamel finish passing 500-hour salt spray test (ASTM B-117) for prepainted steel and 125-hour marine level 1 prohesion test (ASTM G-85.A5) for prepainted steel inside and out. Interior panels shall be coated with a silver zeolite antimicrobial material registered by the US EPA for use in HVAC (heating, ventilation and air conditioning) applications.

E. Casing panels shall have no exterior exposed raw edges that could lead to rust formation. All casing corners shall be radiused or chamfered.

F. Casing panels shall be solid doublewall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13.

G. Casing deflection shall not exceed a 1:200 ratio when subject to an internal pressure of ± 5-in. wg and shall exhibit no permanent deformation at ± 9-in. wg.

H. Side panels shall be easily removable for access to unit by $^1/_4$-turn cam-lock type fasteners. All panels shall seal against a full perimeter automotive style gasket to ensure a tight seal.

I. The panel retention system shall comply with UL 1995 which states that, all moving parts (for example, fan blades, blower wheels, pulleys, and belts) that, if accidentally contacted, could cause bodily injury, shall be guarded against accidental contact by an enclosure requiring tools for removal.

J. Fan supports, structural members, panels, or flooring shall not be welded, unless aluminum, stainless steel, or other corrosion-resistant material is used. Painted welds on unit exterior steel or galvanized steel are not acceptable.

K. The fan section shall have a pre-painted doublewall, insulated, galvanized steel floor. Accessibility options shall be hinged doublewall access door on hand side, hinged doublewall access doors on both sides, or removable doublewall access panels.
   1. Viewports shall be available as a factory-installed option on the access panel(s) or door(s) of this section.
   2. Marine lights shall be available as a factory-installed option with or without convenience outlets.

L. All coil sections shall be doublewall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13. Coil sections shall have removable frame sections to facilitate vertical coil extraction. Blow-thru sections

shall have a diffuser plate as an integral part of the fan section if used immediately downstream of the fan section.

M. Filter types as shown on the equipment schedule. Mixing Box sections shall be designed and constructed to house 2-in. angle filters.

N. Filter-mixing boxes and mixing boxes shall have pre-painted doublewall, insulated, galvanized steel floors. Accessibility options shall be hinged doublewall access door on hand side, hinged doublewall access doors on both sides, or removable doublewall access panels.
   1. Viewports shall be available as a factory-installed option on the access panel(s) or door(s) of mixing box sections only.
   2. Marine lights shall be available as a factory-installed option with or without convenience outlets.

O. Each section shall be factory insulated. Casing panels shall be solid doublewall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13.

P. Casing panels (top, sides, and bottom) shall be constructed of galvanized steel, with pre-painted, baked enamel finish passing 500-hour salt spray test (ASTM B-117) for prepainted steel and 125-hour marine level 1 prohesion test (ASTM G-85.A5) for prepainted steel inside and out. Interior panels shall be coated with a silver zeolite antimicrobial material registered by the US EPA for use in HVAC (heating, ventilation and air conditioning) applications.

Q. Access doors shall be solid doublewall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13. Latches shall be non-removable and operated with a simple tool.

R. Drain pans shall be insulated double wall galvanized or stainless steel construction. The pan shall be sloped in 4 directions toward the drain fitting. Drain pan shall have a recessed bottom drain design with $1^1/_2$-in. MPT connection exiting through the hand side or opposite side of the casing as specified. Drain connection shall be insulated from the drain pan to the point at which it exits the casing. One drain outlet shall be supplied for each cooling coil section. Drain pan shall allow no standing water and comply with ASHRAE Standard 62. Where 2 or more coils are stacked in a coil bank, intermediate drain pans shall be provided and the condensate shall be piped to the bottom drain pan. The bottom coil shall not serve as a drain path for the upper coil.

S. Casing deflection shall not exceed a 1:200 ratio when subject to an internal pressure of ±5-in. wg and shall exhibit no permanent deformation at ±9-in. wg.

T. Supply Fan Sections:
   1. Airfoil fan sections shall have one DWDI airfoil fan wheel and scroll. Airfoil blades shall be double thickness design constructed of heavy gage, high strength steel continuously welded to the backplate and the spun inlet flange. Entire fan assembly cleaned, primed and painted with alkyd enamel. Fans shall have an AMCA class rating corresponding to the static pressure at which the fan is designed to operate (Class I, II, or III). Completed fan assembly shall be dynamically balanced to minimum grade of G 6.3 per ANSI/AMCA 204-96 at design operating speed using contract drive and motor if ordered.

2. Wheels: Fan wheels shall be keyed to the shaft and shall be designed for continuous operation at maximum rated fan speed and motor horsepower. Fan wheels and shafts shall be selected with a maximum operating speed 25% below the first critical.

3. Fan shafts shall be solid steel, turned, ground, polished and coated with a rust inhibitor.

4. Motors: Fan motor shall be mounted within the fan section casing on slide rails equipped with adjusting screws. Motor shall be high efficiency, open drip-proof or totally enclosed fan cooled NEMA Design B with size and electrical characteristics as shown on the equipment schedule. Premium efficiency motors shall be available. Motor shall be mounted on a horizontal flat surface and shall not be supported by the fan or its structural members. All three-phase motors shall have a ± 10% voltage utilization range and a 1.15 minimum service factor. Motor shall be compliant with EPACT where applicable.

5. All fans shall be selected to operate at a point no higher than 90% of the peak static pressure rating as defined by the fan performance curve at the selected operating speed. The fan design point shall deliver the specified volume against the specified static pressure. Fan blades in all sizes shall be hollow airfoil, double skinned and welded to the center and wheel side plates.

6. Fan performance shall be rated and certified in accordance with ARI Standard 430.

7. Manufacturer shall submit first through eighth octave sound power for fan discharge and casing radiated sound.

8. Fan scroll, wheel, shaft, bearings, drives, and motor shall be mounted on a common base assembly. The base assembly is isolated from the outer casing with factory-installed isolators and rubber vibration absorbent fan discharge seal. A canvas style duct connection between fan discharge and cabinet is not acceptable. Sizes 03-61 shall use 2-in. deflection spring isolators.

9. Fan Accessories:
   a. Variable frequency drives.
   b. Magnetic motor starters.
   c. Motor disconnects.
   d. Belt guards.
   e. Inlet screen.

10. Flexible Connection: The base assembly is isolated from the outer casing with factory-installed isolators and rubber vibration absorbent fan discharge seal. A canvas style duct connection between fan discharge and cabinet is not acceptable.

11. Bearings: Self-aligning, grease lubricated, anti-friction with lubrication fittings extended to drive side of fan section. Optional grease fittings extended to the exterior of the casing are available. Heavy-duty pillow block type, self-aligning, regreasable ball or roller type bearings selected for a minimum average life (L_{50}) of 200,000 hours.

12. Shaft: Fan shafts shall be stainless steel, turned, ground, and polished.

13. V-Belt Drive: Drive shall be designed for a minimum 1.5 service factor as standard with a 2.0 service factor options and/or a factory-supplied extra set of belts. Drives shall be variable pitch, factory set for specified speed, for motors 20 hp and less and fixed-pitch for 25 hp and larger. All drives shall be factory mounted, with sheaves aligned and belts properly tensioned.

U. Cooling Coil Sections (General):

1. All water,coils shall be provided to meet the scheduled performance. All coil performance shall be certified in accordance with ARI Standard 410. All coils shall be tested at 450 psig air pressure. Direct expansion coils shall be designed and tested in accordance with ASHRAE/ANSI 15 Safety Code for Mechanical Refrigeration (latest edition).

2. Water coils shall have minimum $^5/_8$-in. OD copper tubes mechanically expanded into fins to ensure high thermal performance with lower total flow and pumping requirements. Minimum tube wall thickness shall be 0.035 inches.

3. Aluminum plate fin type with belled collars. Aluminum-finned coils shall be supplied with die-formed casing and tube sheets of mill galvanized steel or stainless steel as specified.

4. Hydronic Heating and Cooling Coils: Headers shall be constructed of steel with steel MPT connections. Headers shall have drain and vent connections accessible from the exterior of the unit. Non-ferrous headers and nipples shall be supplied. Coils shall be drainable, with non-trapping circuits. Coils will be suitable for a design working pressure of 300 psig at 200 F.

V. Filter Sections: Angle filter sections shall accept either 2-in. or 4-in. filters of standard sizes, arranged in a horizontal V formation.

W. Dampers: Leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 2 percent of air quantity at 2000-fpm (10-m/s) face velocity through damper and 4-inch wg (1000-Pa) pressure differential.

1. Mixing boxes, filter-mixing boxes, and exhaust boxes shall have parallel or opposed blades and interconnecting outside-air and return-air dampers. Damper blades shall be constructed of galvanized steel, with blade seals and stainless steel jamb seals. Blades shall be mechanically fastened to axle rods rotating in self-lubricating synthetic bearings. Maximum leakage rate shall be 4 cfm/ft^2 at 1 in. wg (0.25 kPa) differential pressure.

2. Face and Bypass Dampers: Shall be factory mounted in galvanized steel frame. Damper blades shall be constructed of galvanized steel, with high temperature blade and edge seals. Blades shall be mechanically fastened to axle rods rotating in self-lubricating synthetic bearings. To eliminate blade warping, face dampers shall be sectionalized to limit blade length to 60 in. maximum. Face damper blades shall be opposed and arranged to match coil face with top bypass, and internal linkage.

1.4 UNIT TESTING AND QUALITY CONTROL

A. The fans shall be factory run-tested to insure structural integrity and proper RPM. All electrical circuits shall be tested to ensure correct operation before shipment of unit. Units shall pass quality control and be thoroughly cleaned prior to shipment. A report, including all data and test methods, shall be shipped with the unit.

B. All air handling units shall be factory-tested for cabinet leakage. Leakage rate shall not exceed 1% of supply airflow at 1.5 times operating pressure. Positive sections shall be pressurized with positive pressure. Negative sections shall be pressurized with negative pressure. Leak testing shall be performed by measuring the airflow pumped into and out of the air handling unit. The Contractor along with the air handling unit manufacturer shall notify the Architect at least seven (7) days prior to the scheduled start of leakage tests to permit the witnessing, at the Owner's option.

C. Fan wheel and shaft assemblies shall be dynamically analyzed after the fan, motor and drive assemblies have been installed in the unit. The fan shall be analyzed with an electronic balance analyzer with a tunable filter. Vibration measurements are to be taken on each bearing housing in the horizontal, vertical, and axial positions with the filter tuned to the fan RPM. A field fan balance test shall be performed under the supervision of the manufacturer to insure that the factory balance has not been disturbed during installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of hydronic and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Arrange installation of units to provide access space around air-handling units for service and maintenance.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect condensate drain pans using NPS 1-1/4, Type M copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

D. Chilled-Water Piping: Comply with applicable requirements in Division 15 Section "Hydronic Piping." Connect to supply and return coil tappings with shutoff or balancing valve and union or flange at each connection.

E. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connections.

F. Electrical: Comply with applicable requirements in Division 16 Sections for power wiring, switches, and motor controls.

G. Ground equipment according to Division 16 Section "Grounding and Bonding."

H. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

1. Leak Test: After installation, fill water coils with water and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
2. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly trapped, piping connections verified and leak tested, belts aligned and tensioned, all shipping braces have been removed, and fan has been test run under observation.

C. Final Checks before Startup: Perform the following:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Perform cleaning and adjusting specified in this Section.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify free fan wheel rotation and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
6. Set outside- and return-air mixing dampers to minimum outside-air setting.
7. Comb coil fins for parallel orientation.

8. Install clean filters.
9. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

D. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

E. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for air-handling system testing, adjusting, and balancing.

3.6 ADJUSTING

Adjust damper linkages for proper damper operation.

3.7 CLEANING

A. Clean air-handling units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

B. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new filters.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION 15725

SECTION 15738 - SPLIT-SYSTEM AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

D. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

E. Units shall be designed to operate with HCFC-free refrigerants.

1.5 COORDINATION

A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."

B. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 7 Section "Roof Accessories."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Air Conditioning; Div. of Carrier Corporation.
2. Enviromaster
3. Mitsubishi Electronics America, Inc.; HVAC Division.

2.2 WALL-MOUNTING, EVAPORATOR-FAN COMPONENTS

A. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Direct drive, centrifugal fan.

D. Fan Motors: Comply with requirements in Division 15 Section "Motors."

1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

E. Filters: Permanent, cleanable.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Reciprocating.
2. Refrigerant Charge: R-22.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Fan: Aluminum-propeller type, directly connected to motor.

E. Motor: Permanently lubricated, with integral thermal-overload protection.

F. Low Ambient Kit: Permits operation down to 45 deg F.

G. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Control equipment and sequence of operation are specified in Division 15 Sections "HVAC Instrumentation and Controls".

B. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection, including auto setting.

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounting compressor-condenser components on equipment supports specified in Division 7 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Install compressor-condenser components on neoprene pads having a minimum deflection of 1/4 inch.

E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Duct Connections: Duct installation requirements are specified in Division 15 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply[**and return]** ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 15 Section "Duct Accessories."

D. Ground equipment according to Division 16 Section "Grounding and Bonding."

E. Electrical Connections: Comply with requirements in Division 16 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water heaters.

1. Train Owner's maintenance personnel on procedures for starting and stopping troubleshooting, servicing, and maintaining equipment.
2. Review date in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 15738

SECTION 15815 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg. Metal ducts include the following:

1. Rectangular ducts and fittings.
2. Single-wall, round spiral-seam ducts and formed fittings.
3. Duct liner.

B. Related Sections include the following:
1. Division 15 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and - distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.4 SUBMITTALS

A. Shop Drawings: CAD-generated and drawn to 1/4 inch equals 1 foot scale. Show fabrication and installation details for metal ducts.
1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Duct layout indicating sizes and pressure classes.
3. Elevations of top and bottom of ducts.
4. Dimensions of main duct runs from building grid lines.
5. Fittings.
6. Reinforcement and spacing.
7. Seam and joint construction.
8. Penetrations through fire-rated and other partitions.

9. Equipment installation based on equipment being used on Project.
10. Duct accessories, including access doors and panels.
11. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Other systems installed in same space as ducts.
3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

C. Welding certificates.

D. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports.

B. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards–Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G60 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.

D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 DUCT LINER

A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.

1. Manufacturers:

   a. CertainTeed Corp.; Insulation Group.
   b. Johns Manville International, Inc.
   c. Knauf Fiber Glass GmbH.
   d. Owens Corning.

2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.

   a. Thickness: 1 inch.
   b. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
   c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
   d. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
   e. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

      1) Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
      2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
      3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

2.4 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

C. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

D. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

2.6 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.

2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Nexus Inc.
c. Ward Industries, Inc.

C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Lockformer.

2. Duct Size: Maximum 30 inches wide and up to 2-inch wg pressure class.
3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

2.7 APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

F. Apply adhesive coating on longitudinal seams.

G. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

1. Fan discharges.
2. Intervals of lined duct preceding unlined duct.
3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 m/s) or where indicated.

I. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.8 ROUND DUCT AND FITTING FABRICATION

A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

B. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

1. Manufacturers:

a. McGill AirFlow Corporation.
b. SEMCO Incorporated.

C. Duct Joints:

1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

a. Manufacturers:

1) Ductmate Industries, Inc.
2) Lindab Inc.

D. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards–Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

E. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

F. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards–Metal and Flexible," unless otherwise indicated.

2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:

   a. Ducts 3 to 26 Inches in Diameter: 0.034 inch.
   b. Ducts 27 to 50 Inches in Diameter: 0.040 inch.
   c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
   d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.

3. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
4. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
5. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Supply Ducts: 2-inch wg.
2. Supply Ducts (before Air Terminal Units): 2-inch wg.
3. Supply Ducts (after Air Terminal Units): 1-inch wg.
4. Supply Ducts (in Mechanical Equipment Rooms): 3-inch wg.
5. Return Ducts (Negative Pressure): 1-inch wg.
6. Exhaust Ducts (Negative Pressure): 1-inch wg.

3.2 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 15 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Through-Penetration Firestop Systems."

O. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems. 2000 Supplement, Connection Level "AA"

P. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

Q. Paint interiors of metal ducts, that do not have duct liner, for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

3.3 SEAM AND JOINT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.

1. For pressure classes lower than 2-inch wg, seal transverse joints.

B. Seal ducts before external insulation is applied.

3.4 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

D. Install concrete inserts before placing concrete.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 15 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 CLEANING NEW SYSTEMS

A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

B. Use service openings, as required, for physical and mechanical entry and for inspection.

1. Create other openings to comply with duct standards.
2. Disconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling sections to gain access during the cleaning process.

C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

F. Cleanliness Verification:

1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

END OF SECTION 15815

SECTION 15820 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Volume dampers.
3. Combination fire and smoke dampers.
4. Turning vanes.
5. Duct-mounted access doors.
6. Flexible connectors.
7. Flexible ducts.
8. Duct accessory hardware.

B. Related Sections include the following:

1. Division 13 Section "Fire Alarm" for duct-mounting fire and smoke detectors.
2. Division 15 Section "HVAC Instrumentation and Controls" for electric and pneumatic damper actuators.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Combination fire and smoke dampers.
4. Turning vanes.
5. Duct-mounted access doors.
6. Flexible connectors.
7. Flexible ducts.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Special fittings.

2. Manual-volume damper installations.
3. Combination fire-and smoke-damper installations, including sleeves and duct-mounting access doors.
4. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed or a minimum of (5) whichever is greater..

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G60 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT DAMPERS

A. Manufacturers:
1. Greenheck.
2. Penn Ventilation Company, Inc.
3. Ruskin Company.

B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

C. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners and mounting flange.

D. Blades: 0.025-inch- thick, roll-formed aluminum.

E. Blade Seals: Felt.

F. Blade Axles: Nonferrous.

G. Tie Bars and Brackets: Galvanized steel.

H. Return Spring: Adjustable tension.

2.4 VOLUME DAMPERS

A. Manufacturers:
1. Titus
2. McGill AirFlow Corporation.
3. Nailor Industries Inc.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: U -shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
3. Aluminum Frames: U -shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
4. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
5. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
6. Blade Axles: Galvanized steel.
7. Bearings: Oil-impregnated bronze thrust or ball.
8. Blade Seals: Felt.
9. Tie Bars and Brackets: Galvanized steel.

D. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.5 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
1. Ruskin FSD-60 or equal Class 1 by manufacturer listed below.
2. Potorff
3. Ruskin Company.
4. Greenheck

B. General Description: Labeled according to UL 555S. Combination fire and smoke dampers shall be labeled according to UL 555 for 1-1/2-hour rating. Class 1 leakage rating.

C. Fusible Links: Replaceable, 165 deg F rated.

D. Frame and Blades: 0.064-inch- thick, galvanized sheet steel.

E. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application.

F. Damper Motors: Modulating and two-position action.
1. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.

2. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
3. Electrical Connection: 115 V, single phase, 60 Hz.

2.6 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- wide, single-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Duro Dyne Corp.
c. METALAIRE, Inc.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.7 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

1. Manufacturers:
a. Ductmate Industries, Inc.
b. McGill AirFlow Corporation.
c. Ventfabrics, Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:

a. Less Than 12 Inches Square: Secure with two sash locks.
b. Up to 18 Inches Square: Two hinges and two sash locks.
c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
d. Sizes 24 by 48 Inches and Larger: One additional hinge.

C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.

1. Manufacturers:

   a. Ductmate Industries, Inc.
   b. Flexmaster U.S.A., Inc.

2. Frame: Galvanized sheet steel, with spin-in notched frame.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

E. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.8 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Corp.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.9 FLEXIBLE DUCTS

A. Manufacturers:

1. Flexmaster U.S.A., Inc.
2. Hart & Cooley, Inc.
3. McGill AirFlow Corporation.

B. Insulated-Duct Connectors: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.

C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 through 18 inches to suit duct size.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.

E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

F. Provide test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.

H. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers, turning vanes, and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
5. On sides of ducts where adequate clearance is available.

I. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body Plus Ladder Access: 25 by 17 inches.

J. Install the following sizes for duct-mounting, round access doors:

1. One-Hand or Inspection Access: 8 inches in diameter.
2. Two-Hand Access: 10 inches in diameter.
3. Head and Hand Access: 12 inches in diameter.
4. Head and Shoulders Access: 18 inches in diameter.
5. Body Access: 24 inches in diameter.

K. Install the following sizes for duct-mounting, pressure relief access doors:

1. One-Hand or Inspection Access: 7 inches in diameter.
2. Two-Hand Access: 10 inches in diameter.
3. Head and Hand Access: 13 inches in diameter.
4. Head and Shoulders Access: 19 inches in diameter.

L. Label access doors according to Division 15 Section "Mechanical Identification."

M. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

N. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect diffusers or light troffer boots to low pressure ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.

P. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

Q. Install duct test holes where indicated and required for testing and balancing purposes.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 15 Section "Testing, Adjusting, and Balancing."

END OF SECTION 15820

SECTION 15838 - POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Centrifugal roof ventilators.
   2. Ceiling-mounting ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Roof curbs.
   7. Fan speed controllers.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

   1. Wiring Diagrams: Power, signal, and control wiring.
   2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
   3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Greenheck.
2. Loren Cook Company.
3. Penn Ventilation.

C. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

D. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

E. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

F. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Fan and motor isolated from exhaust airstream.

G. Accessories:
1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

H. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in raised cant and mounting flange.
2. Overall Height: 12 inches.
3. Pitch Mounting: Manufacture curb for roof slope.

2.2 CEILING-MOUNTING VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Greenheck.
2. Loren Cook Company.
3. Penn Ventilation.

C. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

D. Housing: Steel, lined with acoustical insulation.

E. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

F. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

G. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

H. Accessories:
1. Motion Sensor: Motion detector with adjustable shutoff timer.
2. Isolation: Rubber-in-shear vibration isolators.
3. Manufacturer's standard roof jack, pitched roof curb, or wall cap, and transition fittings.

2.3 MOTORS

A. Comply with requirements in Division 15 Section "Motors."

B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.

B. Support suspended units from structure using threaded steel rods and spring hangers with vertical-limit stops having a static deflection of 1 inch. Vibration-control devices are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Division 15 Section "Mechanical Identification."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 15 Section "Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 16 Section "Grounding and Bonding."

D. Connect wiring according to Division 16 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water heaters.

1. Train Owner's maintenance personnel on procedures for starting and stopping troubleshooting, servicing, and maintaining equipment.
2. Review date in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 15838

SECTION 15840 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Shutoff single-duct air terminal units.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

   1. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
   2. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

   1. Ceiling suspension assembly members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 include the following:

   1. Instructions for resetting minimum and maximum air volumes.
   2. Instructions for adjusting software set points.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.5 COORDINATION

A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 SHUTOFF SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers:

1. Titus.
2. Anemostat; a Mestek Company.
3. Krueger.

B. Configuration: Volume-damper assembly inside unit casing with control components located inside a protective metal shroud.

C. Casing: 0.034-inch steel.

1. Casing Lining: 1-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. Cover liner with nonporous foil.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket.

D. Regulator Assembly: Extruded-aluminum or galvanized-steel components; key damper blades onto shaft with nylon-fitted pivot points located inside unit casing.

1. Automatic Flow-Control Assembly: Combined spring rates shall be matched for each volume-regulator size with machined dashpot for stable operation.
2. Factory-calibrated and field-adjustable assembly with shaft extension for connection to externally mounted control actuator.

E. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
2. Damper Position: Normally open.

F. Attenuator Section: 0.034-inch steel sheet metal.

1. Lining: 1-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. Cover liner with nonporous foil.

G. Multioutlet Attenuator Section: With two, three, or four collars; each with locking butterfly balancing damper. Refer to plans for quantity and size of connections.

H. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig; and factory installed.

I. Electronic Controls: Bidirectional damper operator and microprocessor-based thermostat with integral airflow transducer and room sensor shall be compatible with temperature controls specified in other Division 15 Sections and shall have the following features:

1. Damper Actuator: 24 V, powered closed, spring return open.
2. Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 4-inch wg; and shall have a multipoint velocity sensor at air inlet.
3. Thermostat: Wall-mounting electronic type with the following features:

a. Proportional, plus integral control of room temperature.
b. Time-proportional reheat-coil control.
c. Temperature set-point display in Fahrenheit and Celsius.

J. DDC Controls: Single-package unitary controller and actuator specified in Division 15 Section "HVAC Instrumentation and Controls."

K. Control Sequence:

1. Suitable for operation with duct pressures between 0.25- and 3.0-inch wg inlet static pressure.
2. Factory-mounted and -piped, 5-micron filter; velocity-resetting, adjustable, high-limit control; and amplifying relay.
3. System-powered, wall-mounting thermostat.

2.2 SOURCE QUALITY CONTROL

A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

B. Verification of Performance: Rate air terminal units according to ARI 880.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air terminal units to allow service and maintenance.

C. Hot-Water Piping: In addition to requirements in Division 15 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

D. Connect ducts to air terminal units according to Division 15 Section "Metal Ducts."

E. Connect wiring according to Division 16 Section "Conductors and Cables."

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Refer to Division 1.

END OF SECTION 15840

SECTION 15855 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

B. Related Sections include the following:
   1. Division 15 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each product indicated, include the following:

   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

   1. Ceiling suspension assembly members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   5. Duct access panels.

C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GRILLES AND REGISTERS

A. Adjustable Bar Grille:

   1. Manufacturers:

      a. Titus 350 or 300 series (or Equal)
      b. Nailor Industries of Texas Inc.
      c. Tuttle & Bailey.

   2. Material: Steel.
   3. Finish: Baked enamel, white.
   4. Face Blade Arrangement: Adjustable horizontal spaced 3/4 inch apart.
   5. Rear Blade Arrangement: Adjustable vertical spaced 3/4 inch apart.
   6. Frame: 1-1/4 inches wide.
   7. Mounting: Countersunk screw.
   8. Damper Type: Adjustable opposed-blade assembly.

2.3 CEILING DIFFUSER OUTLETS

A. Round Ceiling Diffuser:

   1. Manufacturers:

      a. Titus TMR (or Equal).
      b. Nailor Industries of Texas Inc.
      c. Tuttle & Bailey.

   2. Material: Steel.
   3. Finish: Baked enamel, white.
   4. Face Style: Four cone.
   5. Pattern: Fully adjustable.
   6. Dampers: Radial opposed blade.
   7. Accessories:

      a. Equaling grid.
      b. Plaster ring.
      c. Safety chain.

d. Wire guard.
e. Sectorizing baffles.
f. Operating rod extension.
g. Square To Round Duct Transition on Diffuser Neck

B. Perforated Diffuser

1. Manufacturers:

a. Titus - PMC, PMR, PAR (or Equal)
b. Nailor Industries of Texas Inc.
c. Tuttle & Bailey.

2. Material: Steel backpan and pattern controllers, with steel face.
3. Finish: Baked enamel, white.
4. Face Size: 24 by 24 inches.
5. Duct Inlet: Square.
6. Face Style: Flush.
7. Pattern Controller: Adjustable with louvered pattern modules at inlet.
8. Mounting: T-bar.
9. Dampers: Opposed blade.
10. Accessories:

C. Louver Face Diffuser

1. Manufacturers:

a. Titus MCD (Or Equal).
b. Nailor Industries of Texas Inc.
c. Tuttle & Bailey.

2. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Size: Neck Size Plus 5".
5. Mounting: Surface.
6. Pattern: Four-way adjustable, modular core style.
7. Dampers: Opposed Blade.
8. Accessories:

a. Square to round neck adaptor.
b. Adjustable pattern vanes.
c. Equaling grid.
d. Plaster ring.
e. Jiffy Frame

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 15855

SECTION 15900 – HVAC INSTRUMENTATION AND CONTROLS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK TO BE PERFORMED

A. This section covers automatic temperature control systems and equipment.

Commissioning is specified in Section 15900, Automatic Temperature Control System Commissioning.

This project involves the installation of a new Computrols CBAS system including new TCP/IP Internet Ready DDC equipment, software, programming, controls, and field devices where needed. The new DDC panels shall be connected to the existing Workstation. The new DDC system shall include the following equipment as a minimum (see section 2.03 DDC SYSTEM for specifications):

The system shall handle overtime lighting and HVAC requests. Power monitoring and demand limiting are also to be included.

System must be nonproprietary with backwards capability for software and hardware.

1.2 INSTALLATION SCHEDULE

1.3 RELATED WORK

A. This section includes the furnishing and installation of controls and wiring for automatic controls, electric damper and valve actuators, air handling unit control, VAV controls, interlocks, and starting circuits.

1. The new control system shall control all points on the system.
2. The Owner shall provide the necessary ISP connection.
3. Contractor shall provide all necessary programming and graphics generation to ensure that all graphical user interface screens required to provide full floor plan views on a floor by floor basis are provided.
4. Scope of work shall include All interfaces with third party equipment (ie. Modbus drive interface, fire alarm, etc. Coordinate with Division 15 and 16 contractors for all alarm requirements.
5. Scope of work shall also include all necessary head end programming to incorporate the Library building controls graphics, programming and sequencing into the campus wide system at the maintenance office main console.

1.4 QUALITY ASSURANCE

A. Installation shall be by a certified Computrols dealer.

B. DDC system layout and performance: The DDC system shall be engineered and equipment selected by the controls contractor as required to meet the performance specified herein. The location and quantity of DDC panels shall be as determined by the DDC system contractor

1.5 COMPLIANCE ASSURANCE

Each contractor is responsible for submitting a written compliance statement to the Owner specifically acknowledging complete compliance with this specification. Systems that require exceptions to this specification will be disqualified from the bid.

1.6 PROJECT CONDITIONS

A. Contractor shall visit the Project prior to bidding, and make a survey of existing control instruments. The contractor is responsible for all equipment, devices, and labor required to accomplish the general intent of this specification.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Computrols, Inc. (Campus Standard, No Known Equal)

2.2 DDC SYSTEM

A. GENERAL

A building automation system shall be provided including all associated equipment and appurtenances.

The building automation system installed must control and manage HVAC control systems under one system computer and one software package. Systems which merely interface to other systems or use separate computers, software, and/or control equipment for the HVAC and lighting control systems are unacceptable.

The communication transmission network shall allow global sharing and exchange of information with other like controllers and field devices. The building automation system's control logic programs and its associated controller's logic programs shall be adjustable and changeable from the new building automation system head-end or any client connection via the World Wide Web. Systems that require a separate Internet gateway or separate utility program are not acceptable. All components of the total system shall be Internet ready and of the electronic DDC type.

B. INTERNET CONNECTIVITY

All new DDC controllers must have the ability to communicate to other controllers (peer-to-peer) and to the building automation software using standard TCP/IP communication.

C. REQUIRED SYSTEM EQUIPMENT

The building automation system head-end equipment shall include no less than the following:

1. DDC controllers

a. Points

Each DDC system panel shall provide a minimum of eight (8) 4-in-1 software configurable points such that every point on the board can be individually software configured for any of the following types:

- Analog Input – 10K ohm TYPE III thermistor, 0-10 VDC input, 4-20 mA input
- Analog Output – 0-10 VDC and 4-20 mA outputs
- Binary Input – contact open or close
- Binary Output – 24 VDC 100 mA output

b. Communication

- All controllers shall use Internet standard TCP/IP communications.
- All controllers shall have additional communication ports to interface with secondary communication devices such that additional hardware (i.e. Gateways, translators, routers, etc.) is not needed for common third party interfaces (Modbus-RTU, BACNet MS/TP, OPTO-22, N2, etc).

c. Communication Ports

Controllers shall have at a minimum the following ports:

- 10 MB CAT 5 TCP/IP port
- 1 MB multi-drop port for #18 twisted pair cabling
- RS-485 port non-polarity conscious up to 38.4 KBAUD
- Software selectable RS-485 / RS-232 port

d. Software

- Each controller shall be capable of networking with the building automation system without the use of separate utility software.

- Global points may be shared across the network (peer-to-peer). Global points, or any shared network information, shall not include scheduling functions.

- Closed loop control functions shall include automatic PID tuning for proportional, proportional plus integral, proportional plus integral plus derivative, incremental, and floating control.

e. Communication Wiring

Communications wiring for controllers shall utilize a category 5 type cable rated for plenum installation with appropriate jacket.

f. Hardware

- All DDC Controllers shall have a minimum 386 MHz 32 bit microprocessor.

- The controller shall be a separate entity such that it may be detached from its respective terminal strip without removing any field wiring from the terminal strip.

- All DDC Controllers shall be guaranteed under normal use for the life of the building.

g. Environmental

- Controllers and associated control panel devices shall function properly between 32 and 122 degrees Fahrenheit.

- Controllers and associated control panel devices shall function properly between 0 and 95 percent relative humidity (noncondensing).

- Storage conditions for the controller shall be between -4 and +140 degrees Fahrenheit.

- Storage conditions for the controller shall be between 0 and 95 percent relative humidity (noncondensing).

E. SYSTEM SOFTWARE

1. Software Platform:

a. The building automation software shall run on the Microsoft XP Professional operating system.

b. Interconnectivity between all workstations shall be achieved through the same protocol as the Internet, TCP/IP.

2. General features that must be provided:

a. The software shall provide a graphical user interface.

b. All points shall be programmable from a text view, hardware view, and graphics view.

c. English language point descriptors (systems which use point numbers with descriptors attached are not acceptable)

d. Event programming

e. English "IF/THEN" logic programming (systems which use ladder type logic, graphic programming languages, or programs which must be compiled are not acceptable)

f. User-defined calculations

g. Run-time calculations

h. Customized password protection for individual features (systems which use levels of passwords are not acceptable) Software must provide protection from and rights to specific features for every operator.

i. Continuous historical data logging and charting for all points. Historical data shall be recorded after a pre-specified time passes or in the event of a pre-specified change in value.

j. Field hardware troubleshooting utility

k. The downloading of any and all field panels shall be accomplished through the building automation system program at the head-end computer. Downloading of the field panels shall be accomplished while the building automation system program is running from the head-end computer. Systems which require exiting the building management program at the head-end computer to download DDC programs are unacceptable. Systems which require the use of separate utility programs to download DDC programs are unacceptable. Systems which require the use of laptop computers or other equipment other than the head-end computer to download DDC programs are unacceptable.

l. All DDC programs shall be stored in the individual controller's memory. Systems with HVAC controllers which rely on the use of one or more network control units to store control logic programs are not considered stand-alone, and are deemed unacceptable. Systems with HVAC controllers that rely on pre-configured or "canned" control logic programs to operate as stand-alone, are unacceptable.

m. Changes to existing setpoints or control logic shall be accomplished through the energy management system program at the head-end

F. ENERGY MANAGEMENT FEATURES

1. PID loop control

   a. Automatic PID loop tuning

      (i) Automatic PID loop tuning, to be initiated at any workstation. The tuning should be achieved through the use of sound mathematical principles, and not a rule-based inference engine.

      (ii) The automatic tuning must not require the supervision of an operator, and the software must be capable of tuning at least 10 PID loops simultaneously.

      (iii) The operation of the building automation software should not be in any way impeded when tuning PID loops automatically, and it must be possible for the operator to continue the use of the software as normal during automatic tuning.

      (iv) An operator can override the tuning at any point in time, in a well-defined and transparent manner.

      (v) Automatic PID tuning must not be the only means of setting the PID parameters. A manual tuning method must also be provided that provides a graphical real-time feedback of the system's response.

   b. All PID loops have the capacity for gain scheduling; i.e. the controller parameters change automatically based on measured operating conditions.

   c. PID loop performance tracking must be provided for at least one week, storing information pertinent to fault diagnosis, including standard deviation and average absolute error.

2. Time of day scheduling

3. Holiday scheduling

4. Overtime scheduling

5. Discharge/supply temperature reset

6. Night setback/morning warm-up

7. Automatic computer restart after power failure. Software shall provide equipment start-up queue with delay to minimize start-up electrical demand

G. GRAPHICS

1. All graphics must be dynamically updated

2. All point statuses, and graphic objects must be user-definable graphics

H. INFORMATION SORTING

The software must sort points by:

1. Units (degrees F, % Open, Dry, On, etc.) such that any point type with the selected unit type will populate the list
2. Alarms, Alarm Condition (in alarm, disabled, normal, etc.)
3. User-defined groups

I. REPORTS

1. System activity tracking-commands, edits, alarms, etc.
2. Historical data reports-recall past point statuses
3. Custom scheduled reports-user definable for weekly, monthly, and yearly averages, totals, degree-days, etc.
4. Current status report-sort groups of points for current status listings
5. All reports must have the capability to be routed to the screen for quick browsing, to a configured printer, or to a file
6. Reports must have the capability to be exported as ASCII delimited fields an for use with various other programs
7. It must be possible to export reports directly to:
   a. The World-Wide-Web (i.e. HTML)
   b. Microsoft Excel
   c. Microsoft Word

2.3 MATERIALS

A. New space mounted temperature sensors

Specifications:

- Sensing element – 10,000 ohm TYPE III thermistor
- Accuracy - ±0.36 ^{o}F
- Range - 35 ^{o}F to 140 ^{o}F
- Temperature response - Negative temperature coefficient
- Connections – Screw terminals

B. New duct mounted temperature sensors

Specifications:

- Sensing element - 10,000 ohm thermistor with 306 stainless steel probe
- Accuracy - ±0.36OF
- Range - 35 OF to 140 OF
- Temperature response - Negative temperature coefficient
- Stability - 0.24 OF over 5 years
- Connections - 8' OF 22 AWG pigtails pre-stripped inside of factory installed metallic handibox

C. New digital and analog current sensors

Specifications:

- Amperage rating - calibrate each unit to motor full load amp rating
- Isolation - 600 VAC rms
- Frequency range - 60 Hz nominal
- Accuracy - 2.0% all scales
- Temperature range - -15 OC to 60 OC
- Output – dry contact or 0 – 5 VDC

D. New control valves

General:

1. All control valves shall be fully proportioning of the ball type design.
2. Two way valves (1/2" to 3") and three way valves (1/2" to 2") shall be industrial quality with bronze bodies and female NPT threads. Valve bodies may also be stainless steel or carbon steel with operating pressures up to 1000 PSI (two way valves) or 800 PSI (three way valves).
3. All valves shall have blowout proof stem design, glass-reinforced Teflon thrust seal washer and stuffing box ring with minimum 600 PSI rating (two way valves) or 400 PSI rating (three way valves). The stem packing gland screw shall be adjustable for wear. Valves suitable for water or low-pressure steam shall incorporate an anti-condensation cap thermal break in the stem design.
4. Water valves shall have the standard chromium plated bronze ball and brass stem and shall be rated at a maximum of 600 PSI WOG* (two way valves) or 400 PSI WOG* (three way valves) valve body rating.

* WOG-(Water-Oil-Gas) This rating is based on paragraph UG101 of the ASME Boiler and Pressure Vessel Code.

5. Low pressure steam valves (0 to 15 PSI) shall have a three piece 316 Stainless Steel ball and stem and shall be rated at a maximum of 600 PSI valve body rating. Valves shall be installed in the piping at a 30 to 45 degree angle from vertical. Valve and linkage shall be insulated.

6. Medium and high-pressure steam valves (15 to 150 PSI) shall have a three-piece 316 Stainless Steel body, ball, and stem and shall be rated at a maximum of 1000 PSI valve body rating. Valves shall be provided with a heat detection bracket and shall be installed in the piping at a 30 to 45 degree angle from vertical. Valve and linkage shall be insulated.

7. Valves for corrosive environments shall have 316 Stainless Steel body, ball, and stem and shall be rated at a maximum of 1000 PSI (two way valves) or 800 PSI (three way valves) valve body rating.

8. Optional ball valve insulation casing available for all valve assemblies (except the three piece design for medium and high pressure steam). The casing shall be rated for -40 °F to 220 °F. The casing shall be installed inside the open area in the valve bracket and shall prevent condensation from reaching the actuator.

9. The two-way flanged ball valves shall have a cast iron body and a stainless steel ball and stem. The maximum working pressure shall be 200 PSI.

10. The three-way flanged ball valves shall have a carbon steel body and a stainless steel ball and stem. The maximum working pressure shall be 275 PSI.

11. Shall be sized by the control equipment contractor for a maximum pressure drop of 5 psi or as specified on the contract drawings. All sizing calculations must incorporate adjustments to the calculated Cv to reflect the Piping Geometry Factor (FP) and shall be listed on the valve schedule. All control valves shall be suitable for the pressure conditions as noted for the piping system in which installed and shall close against the differential pressures involved.

12. 2-way valve action - chilled water: normally closed, hot water: normally open, steam: normally closed

13. 3-way valve action – chilled water: piped to bypass the coil, hot water: piped to flow through the coil

E. Control valve actuator specifications:

1. Actuators shall be fully modulating, floating (tri-state), and two position, as indicated in the control sequence. Upon loss of power, fail-safe valve assemblies shall fail either Normally Open (N.O.) or Normally Closed (N.C.). Non-fail safe valve assemblies shall remain in last position upon loss of power.

2. Modulating valves shall be positive positioning, responding to a 2-10 VDC, 4-20 mA signal (with addition of a 500 ohm resistor), or pulse width signal. There shall be a visual valve position indicator Powering shall be 120 VAC, 24 VAC, or 24 VDC. Three-foot cables shall be provided for easy installation to an electrical junction box.

3. The actuator(s) shall provide minimum torque required for proper valve close off, with an approximate running time of 2 minutes for full rotation for non-industrial type actuators. The actuator shall be designed with current limiting motor protection (end of travel switches are not acceptable). A release button on the actuator shall be provided to allow for manual override, except with utilizing spring return actuators. Spring return actuators capable of manual override shall be provided with an override key. All actuators shall have an external direction of rotation switch.

4. All assemblies shall have a minimum resolution of 80 to 1 and a turndown exceeding 597 to 1. All actuators shall be UL listed. The manufacturer shall warranty all assemblies for a period of 2 years from the date of installation not exceeding 30 months from date of original shipment.

5. The valve manufacturer shall provide valve identification on the model number label. The tag may contain up to 30 characters. Tags shall be documented on the approved, submitted schedule.

6. Control valves shall be provided by Belimo Controls

F. New control damper actuators

1. Control damper actuators shall be electronic direct-coupled types, which require no crank arm and linkage.

2. Actuators shall be UL listed and CSA certified and be manufactured under ISO 9001 International Quality Control Standards.

3. Actuators shall have a reversing switch and gear disengagement button on the cover.

4. Actuators shall use a brushless DC motor and be protected from overload at all angles of rotation.

5. Run time shall be consistent and independent of torque.

6. The actuator must provide proportional damper control in response to a 2 to 10 VDC control input from the DDC controller for any outside air damper, return air damper, or exhaust air damper.

B. New differential pressure transmitters

1. The transmitter must have the capability to convert very low-pressure signals into a precise, drift-free and repeatable analog output.

2. The transmitter must incorporate a 100% solid-state piezoresistive-sensing element, which is immune to mounting orientation or vibration.

3. The unit must be fully temperature compensated and provide a stable output over a wide temperature band.

4. The output of the transmitter shall be 0-10 VDC, have a pressure range of 0-3" WCD, and accept a supply voltage of 24 VAC.

C. New DDC control cabinets

The control cabinets must be UL #E 130598. Cabinets shall have the following features:

1. Can be mounted with door hinged on left of right side.
2. Removable door.
3. Furnished with a key lock.
4. NEMA 1 rating.

D. New control transformers

Specifications:

1. Multi-tap primary connections for 120VAC, 208VAC, 240VAC, and 480VAC.
2. 24VAC secondary voltage output.
3. 100VA rating for DDC controller power
4. 40VA rating for field device power
5. Manual, resettable, current-limiting secondary circuit breaker.
6. Foot mounts provisions.
7. UL # E3210
8. Insulation class – 356 degrees F.
9. Temperature rise – 144 degrees F.

E. New thermostats: Room type shall have a blank cover and concealed means of adjustment. Remote element type shall have and accessible adjustment knob. Provide separable wells for elements in liquids and extended necks for wells in insulated pipe.

1. Low limit safeties: Elements shall respond to the lowest temperature to which any 12" segment is exposed; minimum length 8'.
2. Averaging switches: For use in coil discharge and mixed air locations.

F. New gradual switches: Potentiometer type with accessible means of adjustment.

G. New relays, transformers, and fusestats: Provide as needed.

H. New PE switches: Dust free sealed type, mercury or micro, with high and low limits independently adjustable over the entire range. Adjustability is not required for 2-position interlock for nonmodulating signals.

I. New air pressure gauges: Minimum 1.5" diameter, except minimum 2.5" diameter on control panels.

PART 3 – EXECUTION

3.1 GENERAL

A. Where control devices are installed on insulated piping or ductwork, provide standoff brackets or thermowells sized to clear insulation thickness. Provide extended sensing elements, actuator linkages, and other accessories as required.

3.2 THERMOSTATS

A. Mount room sensors or thermostats at the following height:

Type	Height
Adjustable	48" above the finished floor
Concealed adjustment	60" above the finished floor

1. Align vertically or horizontally with adjacent light switches or, if no light switch, with receptacles.

2. Coordinate final location with the furniture layout and the architectural layout.

B. Remote element type: Mount on a vibration free surface 5' above the finished floor, unless specified herein to be mounted in a control panel.

C. Averaging and low limit safety type elements: Install in a serpentine manner to sense temperatures across the entire face of the coil and support independently from the coil by the manufacturer's recommended capillary tube holder.

3.2 PANELS

A. Wiring and air piping connecting to apparatus on the front panel shall be concealed behind the front panel.

1. Wire electric switches and controls in the control panel to a terminal block. Line voltage and low voltage shall be separated on different terminal blocks with labels indicating voltage. Each electrical device shall be wired back to the terminal block in the control panel. Devices in series shall be individually terminated at the terminal block, such that each side of each device is available at the control panel for troubleshooting. In addition to the number markings on each wire, wire color shall be the same throughout each wire run. Wiring shall be neatly tied and routed in the control panel. Shielded wiring shall be terminated neatly, with heat shrink tubing placed over the bare end of the shield. Ground conductors over 4" long shall be insulated with tubing.

2. Adjustable relays.

3. Thermometers showing entering and leaving water temperatures for hydronic systems.

3.3 STATIC PRESSURE SENSORS

A. Install sensors in the associated air handling unit control panel and use extended sensing lines. Provide taps for calibration purposes. Mount static pressure tips in the duct before the farthest VAV box.

3.4 THERMOMETERS

A. Not applicable.

3.5 CONTROL DAMPERS

A. Install dampers in accordance with manufacturer's instruction to operate and to obtain leakage rates specified herein. Adjust the damper linkage such that the damper closes before the actuator is fully closed to assure tight shutoff of the damper.

B. For outdoor air damper assemblies, stage the opening of each section to prevent stratification and poor mixing of outside and return air.

C. Type:

1. Opposed blade: for balancing and modulating applications.

2. Parallel blade: for 2 position, and outside and return air mixing applications. For mixing applications, orient dampers to achieve maximum mixing at throttled conditions.

3.6 CONTROL VALVES

A. Install in accessible location, with room for actuator removal and service. Adjust the actuator to provide tight shutoff. Provide valve stem travel indicator.

3.7 WIRING

A. Materials and installation of wiring and electrical devices shall be in accordance with NFPA 70-1996, and Division 16.

B. Control and sensor wiring shall be installed in conduits separate from power wiring.

C. Provide transformers for operation controls from building power circuits.

D. Provide interlock wiring.

E. Provide power wiring to DDC terminal control units, and other power consuming control devices.

F. Branch circuit wiring and conduit furnished under this Section for control equipment power shall be separate from other power wiring. Each circuit shall be extended to a 120V branch circuit panel, and a 120V, 20 ampere, single pole branch circuit breaker shall be furnished in a breaker space in the panel. No more than 2 DDC panels shall operate from a single 120V branch circuit.

G. Low voltage control and sensor wiring shall be continuous without splicing.

3.09 ENVIRONMENTAL AIR-HANDLING SPACES

A. Electrical conductors installed in environmental air-handling spaces shall comply with NFPA 70-1996.

B. Communications, data, control, and signal cable provided in environmental air-handling spaces not in conduit or enclosed wire ways shall be classified as acceptable for installation in plenum areas, in accordance with NFPA 70-1996.

Control System Points

Description	BINARY INPUT								BINARY OUTPUT					ANALOG INPUT																ANALOG OUTPUT									CALCU	
	DIFFERENTIAL PRESSURE SWITCH	CURRENT SENSING RELAY	HIGH STATIC ALARM	VIBRATION ALARM	FILTER STATUS	VFD FAN RUN STATUS	VFD FAN FAULT	SMOKE DETECTOR	START/STOP VFD	PILOT RELAY	DAMPER OPEN/CLOSE	VALVE OPEN/CLOSE	PNEUMATIC EP SWITCH	OUTSIDE AIR TEMPERATURE	OUTSIDE AIR HUMIDITY	ANALOG CURRENT SENSOR 0-5 VDC	VFD CURRENT 4-20mA	STATIC PRESSURE SENSOR	FILTER DIFFERENTILA PRESSURE	SPACE TEMPERATURE	SUPPLY AIR TEMPERATURE	SUPPLY AIR FLOW - CFM	RETURN AIR TEMPERATURE	RETURN AIR HUMIDITY	MIXED AIR TEMPERATURE	SUPPLY WATER TEMPERATURE	RETURN WATER TEMPERATURE	BTU METER WATER SUPPLY TEMPERATURE	BTU METER WATER RETURN TEMPERATURE	SUPPLY WATER FLOW - GPM	SUPPLY WATER BTU	INLET VANES	INTAKE DAMPER	DISCHARGE DAMPER	OUTSIDE AIR DAMPER	RETURN AIR DAMPER	CHILLED WATER VALVE	HOT WATER VALVE	VFD SPEED		ENTHALPY	TONNAGE
AIR HANDLER w VFD			X			X	X	X	X					X			X	X	X		X		X													X		X			
AIR HANDLER			X					X	X					X		X			X		X		X													X	X				
COMMON HOT WATER LOOP																										X	X														
COMMON CHILLED WATER LOOP																										X	X														
BTU METER STATION																												X	X	X	X										X
EXHAUST FANS		X							X																																
SPLIT SYSTEM FAN COIL		X																		X	X																				
VAV BOXES																		X		X	X	X															X				

Points shown here are minimum. Refer to controls diagrams on the plans for additional controls points not necessarily depicted here.

END OF SECTION 15900

SECTION 15950 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes TAB to produce design objectives for the following:

1. Air Systems:
   a. Constant-volume air systems.

2. HVAC equipment quantitative-performance settings.
3. Verifying that automatic control devices are functioning properly.
4. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. NC: Noise criteria.

F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

G. RC: Room criteria.

H. Report Forms: Test data sheets for recording test data in logical order.

I. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

J. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

K. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

L. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

M. TAB: Testing, adjusting, and balancing.

N. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

O. Test: A procedure to determine quantitative performance of systems or equipment.

P. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

A. Qualification Data: Within 30 days from Contractor's Notice to Proceed, submit 6 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days from Contractor's Notice to Proceed, submit 6 copies of the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days from Contractor's Notice to Proceed, submit 6 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.

D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

E. Sample Report Forms: Submit two sets of sample TAB report forms.

F. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or an Independent NEBB contractor not affiliated with the mechanical contractor or its subsidiaries.

B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."

D. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."

E. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described in Division 1 Section "Project Record Documents."

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.

L. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine equipment for installation and for properly operating safety interlocks and controls.

O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

L. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

   a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
   b. Measure static pressure directly at the fan outlet or through the flexible connection.
   c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
   d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

   a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Refrigerant Coils: Measure the following data for each coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.9 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.10 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Check main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.11 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.

3.12 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.13 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to certified field report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB firm who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

a. Indicated versus final performance.
b. Notable characteristics of systems.
c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer, type size, and fittings.
14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fans and pump performance forms including the following:

a. Settings for outside-, return-, and exhaust-air dampers.
b. Conditions of filters.
c. Cooling coil, wet- and dry-bulb conditions.
d. Face and bypass damper settings at coils.
e. Fan drive settings including settings and percentage of maximum pitch diameter.
f. Inlet vane settings for variable-air-volume systems.
g. Settings for supply-air, static-pressure controller.
h. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Sheave dimensions, center-to-center, and amount of adjustments in inches.
j. Number of belts, make, and size.
k. Number of filters, type, and size.

2. Motor Data:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Sheave dimensions, center-to-center, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat coil static-pressure differential in inches wg.
g. Cooling coil static-pressure differential in inches wg.
h. Heating coil static-pressure differential in inches wg.
i. Outside airflow in cfm.
j. Return airflow in cfm.
k. Outside-air damper position.
l. Return-air damper position.
m. Vortex damper position.

G. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outside-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig.
j. Refrigerant suction temperature in deg F.

H. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Fuel type in input data.
   g. Output capacity in Btuh.
   h. Ignition type.
   i. Burner-control types.
   j. Motor horsepower and rpm.
   k. Motor volts, phase, and hertz.
   l. Motor full-load amperage and service factor.
   m. Sheave make, size in inches, and bore.
   n. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

   a. Total airflow rate in cfm.
   b. Entering-air temperature in deg F.
   c. Leaving-air temperature in deg F.
   d. Air temperature differential in deg F.
   e. Entering-air static pressure in inches wg.
   f. Leaving-air static pressure in inches wg.
   g. Air static-pressure differential in inches wg.
   h. Low-fire fuel input in Btuh.
   i. High-fire fuel input in Btuh.
   j. Manifold pressure in psig.
   k. High-temperature-limit setting in deg F.
   l. Operating set point in Btuh.
   m. Motor voltage at each connection.
   n. Motor amperage for each phase.
   o. Heating value of fuel in Btuh.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and size.
   e. Manufacturer's serial number.
   f. Arrangement and class.
   g. Sheave make, size in inches, and bore.
   h. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Motor Data:

   a. Make and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches, and bore.
   f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
   g. Number of belts, make, and size.

3. Test Data (Indicated and Actual Values):

   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Suction static pressure in inches wg.

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

   a. System and air-handling unit number.
   b. Location and zone.
   c. Traverse air temperature in deg F.
   d. Duct static pressure in inches wg.
   e. Duct size in inches.
   f. Duct area in sq. ft..
   g. Indicated airflow rate in cfm.
   h. Indicated velocity in fpm.
   i. Actual airflow rate in cfm.
   j. Actual average velocity in fpm.
   k. Barometric pressure in psig.

K. Air-Terminal-Device Reports:

1. Unit Data:

   a. System and air-handling unit identification.
   b. Location and zone.
   c. Test apparatus used.
   d. Area served.
   e. Air-terminal-device make.
   f. Air-terminal-device number from system diagram.
   g. Air-terminal-device type and model number.
   h. Air-terminal-device size.
   i. Air-terminal-device effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

L. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Unit make and model number.
d. Compressor make.
e. Compressor model and serial numbers.
f. Refrigerant weight in lb.
g. Low ambient temperature cutoff in deg F.

2. Test Data (Indicated and Actual Values):

a. Inlet-duct static pressure in inches wg.
b. Outlet-duct static pressure in inches wg.
c. Entering-air, dry-bulb temperature in deg F.
d. Leaving-air, dry-bulb temperature in deg F.
e. Condenser entering-water temperature in deg F.
f. Condenser leaving-water temperature in deg F.
g. Condenser-water temperature differential in deg F.
h. Condenser entering-water pressure in feet of head or psig.
i. Condenser leaving-water pressure in feet of head or psig.
j. Condenser-water pressure differential in feet of head or psig.
k. Control settings.
l. Unloader set points.
m. Low-pressure-cutout set point in psig.
n. High-pressure-cutout set point in psig.
o. Suction pressure in psig.
p. Suction temperature in deg F.
q. Condenser refrigerant pressure in psig.
r. Condenser refrigerant temperature in deg F.
s. Oil pressure in psig.
t. Oil temperature in deg F.
u. Voltage at each connection.
v. Amperage for each phase.
w. Kilowatt input.
x. Crankcase heater kilowatt.
y. Number of fans.
z. Condenser fan rpm.
aa. Condenser fan airflow rate in cfm.

bb. Condenser fan motor make, frame size, rpm, and horsepower.
cc. Condenser fan motor voltage at each connection.
dd. Condenser fan motor amperage for each phase.

M. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.14 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
2. Randomly check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Measure sound levels at two locations.
e. Measure space pressure of at least 10 percent of locations.
f. Verify that balancing devices are marked with final balance position.
g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.15 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 15950

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Common electrical installation requirements.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

1.6 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8.

D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7.

2.3 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Plastic. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items. Heights to comply with Americans with Disabilities Act (ADA) standards.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7.

C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

E. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

F. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

G. Cut sleeves to length for mounting flush with both surfaces of walls.

H. Extend sleeves installed in floors 2 inches above finished floor level.

I. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require a different clearance.

J. Seal space outside of sleeves with grout for penetrations of concrete and masonry.

K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 for materials and installation.

L. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with Division 7.

M. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

O. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7.

3.5 FIELD QUALITY CONTROL

A. Inspect installed sleeve and sleeve-seal installations and associated firestopping for damage and faulty work.

END OF SECTION 16050

SECTION 16055 - OVERCURRENT PROTECTIVE DEVICE COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.

1. Coordination of series-rated devices is permitted where indicated on Drawings.

1.3 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

C. Qualification Data: For coordination-study specialist.

D. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and Equipment Evaluation Reports.
3. Coordination-Study Report.

1.4 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

2.2 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in other Division 16 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Impedance of utility service entrance.
3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:

   a. Circuit-breaker and fuse-current ratings and types.
   b. Relays and associated power and current transformer ratings and ratios.
   c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
   d. Generator kilovolt amperes, size, voltage, and source impedance.
   e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
   f. Busway ampacity and impedance.
   g. Motor horsepower and code letter designation according to NEMA MG 1.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

   a. Special load considerations, including starting inrush currents and frequent starting and stopping.

b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
d. Generator thermal-damage curve.
e. Ratings, types, and settings of utility company's overcurrent protective devices.
f. Special overcurrent protective device settings or types stipulated by utility company.
g. Time-current-characteristic curves of devices indicated to be coordinated.
h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

2.3 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:

1. Switchgear and switchboard bus.
2. Medium-voltage controller.
3. Motor-control center.
4. Distribution panelboard.
5. Branch circuit panelboard.

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 141 and IEEE 242.

1. Transformers:

a. ANSI C57.12.10.
b. ANSI C57.12.22.
c. ANSI C57.12.40.
d. IEEE C57.12.00.
e. IEEE C57.96.

2. Medium-Voltage Circuit Breakers: IEEE C37.010.

3. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
4. Low-Voltage Fuses: IEEE C37.46.

E. Study Report:

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
2. Show interrupting (5-cycle) and time-delayed currents (6 cycles and above) on medium-voltage breakers as needed to set relays and assess the sensitivity of overcurrent relays.

F. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

2.4 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
3. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 141 IEEE 242 recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

   a. Inrush current when first energized.
   b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
   c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Motors served by voltages more than 600 V shall be protected according to IEEE 620.

E. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

F. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:

   a. Device tag.
   b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
   c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
   d. Fuse-current rating and type.
   e. Ground-fault relay-pickup and time-delay settings.

2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

   a. Device tag.
   b. Voltage and current ratio for curves.
   c. Three-phase and single-phase damage points for each transformer.
   d. No damage, melting, and clearing curves for fuses.
   e. Cable damage curves.
   f. Transformer inrush points.
   g. Maximum fault-current cutoff point.

G. Completed data sheets for setting of overcurrent protective devices.

END OF SECTION 16055

SECTION 16060 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1. Overhead-lines grounding.
2. Underground distribution grounding.
3. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.
5. Grounding for sensitive electronic equipment.

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at ground rings grounding connections for separately derived systems based on NFPA 70B.

   a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
   b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch ~~(6 mm)~~ in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches ~~(41 mm)~~ wide and 1/16 inch ~~(1.6 mm)~~ thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches ~~(41 mm)~~ wide and 1/16 inch ~~(1.6 mm)~~ thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.

D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches ~~(6 by 50 mm)~~ in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad Zinc-coated Stainless steel; 5/8 by 96 inches ~~(16 by 2400 mm)~~ in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install barecopper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches ~~(600 mm)~~ below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches ~~(300 mm)~~ above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch ~~(25 mm)~~, minimum, from wall 6 inches ~~(150 mm)~~ above finished floor, unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING OVERHEAD LINES

A. Comply with IEEE C2 grounding requirements.

B. Install 2 parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.

C. Drive ground rods until tops are 12 inches ~~(300 mm)~~ below finished grade in undisturbed earth.

D. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.

E. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.

F. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.

G. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches ~~(150 mm)~~ from the foundation.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.

4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch ~~(6-by-50-by-300-mm)~~ grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches ~~(50 mm)~~ below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet ~~(18 m)~~ apart.

H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches ~~(600 mm)~~ from building foundation.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet ~~(6 m)~~ of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet ~~(6 m)~~ long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

C. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

   a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.

4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 16060

SECTION 16074 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Elastomeric isolation pads.
2. Restrained spring isolators.
3. Spring hangers with vertical-limit stops.
4. Pipe riser resilient supports.
5. Resilient pipe guides.
6. Restrained vibration isolation roof-curb rails.
7. Restraining cables.

1.3 DEFINITIONS

A. Effective peak velocity related acceleration coefficient.

B. The IBC: International Building Code.

C. ICC-ES: ICC-Evaluation Service.

1.4 PERFORMANCE REQUIREMENTS

A. Comply with 2001 California Building Code, Title 24.

B. Refer to structural drawings for seismic forces specific to this project.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear.
b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.

a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other Division 16 Sections for equipment mounted outdoors.

2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
3. Field-fabricated supports.
4. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Division 16 Sections for equipment mounted outdoors.
d. Preapproval and Evaluation Documentation: Showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and testing agency.

F. Manufacturer Seismic Qualification Certification: Submit certification that all specified equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.

B. Comply with seismic-restraint requirements in the California Building Code unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

D. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Seismic Snubber Units: Furnish replacement neoprene inserts for all snubbers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VIBRATION ISOLATORS

A. Manufacturers:

1. Mason Industries, Inc.
2. Kinetics Noise Control, Inc.
3. M. W. Sausse

B. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Standard neoprene.
2. Number of Layers: 1.

C. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

D. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

E. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

F. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch- thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.3 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

A. Manufacturers:

1. Mason Industries, Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corp.

B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand 125-mph wind impinging laterally against side of equipment.

C. Lower Support Assembly: Sheet-metal "Z" section containing adjustable and removable steel springs that support upper floating frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist wind and seismic forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.

D. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch- thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

   a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.

b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
d. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

E. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

2.4 SEISMIC-RESTRAINT DEVICES

A. Available Manufacturers:

B. Manufacturers:

1. Mason Industries, Inc.
2. TOLCO Incorporated.
3. International Seismic Applications Technology

C. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face. Based on Mason Industries Type HG.

D. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement. Based on Mason Industries Type SCB.

E. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

2.5 FACTORY FINISHES

A. Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be electro-galvanized. Hot-dip galvanized metal components for exterior use.
3. Baked enamel for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install roof curbs, equipment supports, and roof penetrations as specified in Division 7 Section "Roof Accessories."

B. Install seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

C. Install restraining cables at each trapeze and individual pipe hanger. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

D. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

E. Install resilient bolt isolation washers on equipment anchor bolts.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.4 EQUIPMENT BASES

A. Fill concrete inertia bases, after installing base frame, with 5000-psi concrete; trowel to a smooth finish.

1. Cast-in-place concrete materials and placement requirements are specified in Division 3.

B. Concrete Bases: Anchor equipment to concrete base according to supported equipment manufacturer's written instructions for seismic codes at Project site.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
6. Cast-in-place concrete materials and placement requirements are specified in Division 3.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.7 CLEANING

A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train University maintenance personnel to adjust, operate, and maintain air-mounting systems.

END OF SECTION 16074

SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Identification for raceway and metal-clad cable.
2. Identification for conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the

Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power Circuits: Black letters on an orange field.
2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.

E. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch.
2. Tensile Strength: 50 lb, minimum.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.

1. Exterior Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):

a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Exterior concrete and masonry primer.
2) Finish Coats: Exterior semigloss acrylic enamel.

2. Exterior Concrete Unit Masonry:

a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a block filler.

1) Block Filler: Concrete unit masonry block filler.
2) Finish Coats: Exterior semigloss acrylic enamel.

3. Exterior Ferrous Metal:

a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Exterior ferrous-metal primer.
2) Finish Coats: Exterior semigloss alkyd enamel.

4. Exterior Zinc-Coated Metal (except Raceways):

a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Exterior zinc-coated metal primer.
2) Finish Coats: Exterior semigloss alkyd enamel.

5. Interior Concrete and Masonry (Other Than Concrete Unit Masonry):

a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Interior concrete and masonry primer.
2) Finish Coats: Interior semigloss alkyd enamel.

6. Interior Concrete Unit Masonry:

a. Semigloss Acrylic-Enamel Finish: One Insert number finish coat(s) over a block filler.

1) Block Filler: Concrete unit masonry block filler.
2) Finish Coats: Interior semigloss acrylic enamel.

7. Interior Gypsum Board:

a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Interior gypsum board primer.
2) Finish Coats: Interior semigloss acrylic enamel.

8. Interior Ferrous Metal:

a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Interior ferrous-metal primer.
2) Finish Coats: Interior semigloss acrylic enamel.

9. Interior Zinc-Coated Metal (except Raceways):

a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Interior zinc-coated metal primer.
2) Finish Coats: Interior semigloss acrylic enamel.

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Raceways and Duct Banks More Than 600 V Concealed within Buildings: 4-inch- wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways and Metal-Clad Cables More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches high, with self-adhesive vinyl labels. Repeat legend at 10-foot maximum intervals.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label.

D. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:

1. Fire Alarm System: Red.
2. Fire-Suppression Supervisory and Control System: Red and yellow.
3. Combined Fire Alarm and Security System: Red and blue.
4. Security System: Blue and yellow.
5. Mechanical and Electrical Supervisory System: Green and blue.
6. Telecommunication System: Green and yellow.
7. Control Wiring: Green and red.
8. Insert system name and identifying colors.

E. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use marker tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

F. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number.

G. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source and circuit number.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Limit use of underground-line warning tape to direct-buried cables.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

   a. Power transfer switches.
   b. Controls with external control power connections.

2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

K. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Adhesive film label with clear protective overlay. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.
b. Access doors and panels for concealed electrical items.
c. Electrical switchgear and switchboards.
d. Transformers.
e. Electrical substations.
f. Emergency system boxes and enclosures.
g. Motor-control centers.
h. Disconnect switches.
i. Enclosed circuit breakers.
j. Motor starters.
k. Push-button stations.
l. Power transfer equipment.
m. Contactors.
n. Remote-controlled switches, dimmer modules, and control devices.
o. Battery inverter units.
p. Battery racks.
q. Voice and data cable terminal equipment.
r. Master clock and program equipment.
s. Intercommunication and call system master and staff stations.
t. Television/audio components, racks, and controls.
u. Fire-alarm control panel and annunciators.
v. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
w. Monitoring and control equipment.
x. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service feeder branch-circuit service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
2. Colors for 208/120-V Circuits:

   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.

3. Colors for 480/277-V Circuits:

   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow.

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trenchexceeds 16 inches overall.

J. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.

END OF SECTION 16075

SECTION 16120 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

B. Related Sections include the following:

1. Division 16 Section 16715 for cabling used for voice and data circuits.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

C. Copper Conductors: Comply with NEMA WC 70.

D. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN, and XHHW.

E. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC metal-clad cable, Type MC nonmetallic-sheathed cable, and Type NM with ground wire.

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7.

2.4 SLEEVE SEALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

2. Pressure Plates: Plastic, Carbon steel, Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

F. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

I. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

K. Class 1 Control Circuits: Type THHN-THWN, in raceway.

L. Class 2 Control Circuits: Type THHN-THWN, in raceway Power-limited cable, concealed in building finishes.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Identify and color-code conductors and cables according to Division 16 Section 16075.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least ~~[6 inches]~~ 12 inches of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 7 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 7 Section "Through-Penetration Firestop Systems."

K. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 7.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 16120

SECTION 16130 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 2 Section "Underground Ducts and Utility Structures" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch ~~(1 mm)~~, minimum.

F. EMT: ANSI C80.3.

G. FMC: Zinc-coated steel.

H. LFMC: Flexible steel conduit with PVC jacket.

I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel Die-cast Steel or die-cast, type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch ~~(1 mm),~~ with overlapping sleeves protecting threaded joints.

J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arnco Corporation.
2. Endot Industries Inc.
3. IPEX Inc.
4. Lamson & Sessions; Carlon Electrical Products.

B. Description: Comply with UL 2024; flexible type, approved for plenum riser installation.

2.4 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type.

E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by ~~one of the following~~:

~~1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.~~
~~2. EGS/Appleton Electric.~~
~~3. Erickson Electrical Equipment Company.~~
4. Hoffman.
~~5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.~~
~~6. O-Z/Gedney; a unit of General Signal.~~
~~7. RACO; a Hubbell Company.~~
~~8. Robroy Industries, Inc.; Enclosure Division.~~
~~9. Scott Fetzer Co.; Adalet Division.~~
~~10. Spring City Electrical Manufacturing Company.~~
~~11. Thomas & Betts Corporation.~~
~~12. Walker Systems, Inc.; Wiremold Company (The).~~
13. ~~Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.~~

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Metal Floor Boxes: Cast metal, rectangular.

F. Nonmetallic Floor Boxes: Nonadjustable, round.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

J. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: Rigid steel conduit, EMT.
3. Underground Conduit: RNC, Type EPC-80-PVC, direct buried.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:

   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT ENT or RNC, Type EPC-40-PVC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit.
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway.
8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway.
9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway Riser-type, optical fiber/communications cable raceway Plenum-type, optical fiber/communications cable raceway EMT.
10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel nonmetallic in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch ~~(21-mm)~~ trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches ~~(150 mm)~~ away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 16 Section "Electrical Supports and Seismic Restraints."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch ~~(27 mm)~~ trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb ~~(90 kg)~~ tensile strength. Leave at least 12 inches ~~(300 mm)~~ of slack at each end of pull wire.

K. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch ~~(19 mm)~~ Trade Size and Smaller: Install raceways in maximum lengths of 50 feet ~~(15 m)~~.
2. 1-Inch ~~(25 mm)~~ Trade Size and Larger: Install raceways in maximum lengths of 75 feet ~~(23 m)~~.

3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F ~~(17 deg C)~~, and that has straight-run length that exceeds 25 feet ~~(7.6 m)~~.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F ~~(70 deg C)~~

   b. temperature change.
   c. Outdoor Locations Exposed to Direct Sunlight: 155 deg F ~~(86 deg C)~~ temperature change.
   d. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F ~~(70 deg C)~~ temperature change.
   e. Attics: 135 deg F ~~(75 deg C)~~ temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F ~~(0.06 mm per meter of length of straight run per deg C)~~ of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

N. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

O. Set metal floor boxes level and flush with finished floor surface.

P. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 2 Section "Earthwork" for pipe less than 6 inches ~~(150 mm)~~ in nominal diameter.
2. Install backfill as specified in Division 2 Section "Earthwork."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches ~~(300 mm)~~ of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches ~~(75 mm)~~ of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches ~~(1500 mm)~~ from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

5. Warning Planks: Bury warning planks approximately 12 inches ~~(300 mm)~~ above direct-buried conduits, placing them 24 inches ~~(600 mm)~~\ o.c. Align planks along the width and along the centerline of conduit.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches ~~(1270 mm)~~ and no side greater than 16 inches ~~(400 mm)~~, thickness shall be 0.052 inch ~~(1.3 mm)~~.
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches ~~(1270 mm)~~ and 1 or more sides equal to, or greater than, 16 inches ~~(400 mm)~~, thickness shall be 0.138 inch ~~(3.5 mm)~~.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Extend sleeves installed in floors 2 inches ~~(50 mm)~~ above finished floor level.

G. Size pipe sleeves to provide 1/4-inch ~~(6.4-mm)~~ annular clear space between sleeve and raceway unless sleeve seal is to be installed.

H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."

J. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch ~~(25-mm)~~ annular clear space between pipe and sleeve for installing mechanical sleeve seals.

L. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch ~~(25-mm)~~ annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.7 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 16130

SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Single and duplex receptacles, ground-fault circuit interrupters, integral surge suppression units, and isolated-ground receptacles.
2. Single- and double-pole snap switches and dimmer switches.
3. Device wall plates.
4. Pin and sleeve connectors and receptacles.
5. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. PVC: Polyvinyl chloride.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:

a. Pass & Seymour/Legrand; Wiring Devices Div or engineer approved equal.

~~b. General Electric.~~
~~c. General Electric Co., Inc.~~
~~d. Hubbell Incorporated; Wiring Device-Kellems.~~
~~e. Leviton Mfg. Company Inc.~~
~~f. Pass & Seymour/Legrand; Wiring Devices Div.~~

2. Wiring Devices for Hazardous (Classified) Locations:

a. Crouse-Hinds/Cooper Industries, Inc.; Arrow Hart Wiring Devices.
b. EGS/Appleton Electric Company.
c. Killark Electric Manufacturing Co./Hubbell Incorporated.

3. Multioutlet Assemblies:

~~Hubbell Incorporated; Wiring Device-Kellems.~~
a. Wiremold Company (The) or approved equal.

4. Poke-Through, Floor Service Outlets and Telephone/Power Poles:

   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Pass & Seymour/Legrand; Wiring Devices Div.
   c. Square D/Groupe Schneider NA.
   d. Thomas & Betts Corporation.
   e. Wiremold Company (The).

2.2 RECEPTACLES

A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498. Shall be Pass & Seymour model PT5360 with PTRA6STR plugtails.

B. Straight-Blade and Locking Receptacles: Heavy-Duty grade.

C. GFCI Receptacles: Straight blade, Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- ~~(70-mm-)~~ deep outlet box without an adapter.

D. Isolated-Ground Receptacles: Straight blade, Heavy-Duty grade, duplex receptacle, with equipment grounding contacts connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap.

   1. Devices: Listed and labeled as isolated-ground receptacles.
   2. Isolation Method: Integral to receptacle construction and not dependent on removable parts.

E. Industrial Heavy-Duty Pin and Sleeve Devices: Comply with IEC 309-1.

F. Hazardous (Classified) Location Receptacles: Comply with NEMA FB 11.

2.3 PENDANT CORD/CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector, NEMA WD 6, Configurations L5-20P and L5-20R, Heavy-Duty grade.

   1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
   2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.4 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.5 SWITCHES

A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.

B. Snap Switches: Heavy-Duty grade, quiet type.

C. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.

1. Switch: 20 A, 120/277-V ac.
2. Receptacle: NEMA WD 6, Configuration 5-15R.

D. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.

1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.
2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable rotary knob, toggle switch, or slider; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; and 5-inch ~~(130-mm)~~ wire connecting leads.
3. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.6 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- ~~(1-mm-)~~ thick, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Wet Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2.7 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Round, solid brass with satin finish.

D. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Blank cover with bushed cable opening.

2.8 POKE-THROUGH ASSEMBLIES

A. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.

1. Service Outlet Assembly: Flush type with four simplex receptacles and space for four RJ-45 jacks.
2. Size: Selected to fit nominal 4-inch ~~(100-mm)~~ cored holes in floor and matched to floor thickness.
3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
4. Closure Plug: Arranged to close unused 4-inch ~~(100-mm)~~ cored openings and reestablish fire rating of floor.
5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors; and a minimum of four, 4-pair, Category 3 and 5E voice and data communication cables.

2.9 MULTIOUTLET ASSEMBLIES

A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

B. Raceway Material: Metal, with manufacturer's standard finish.

C. Wire: No. 12 AWG.

2.10 SERVICE POLES

A. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.

1. Poles: Nominal 2.5-inch- ~~(65-mm-)~~ square cross section, with height adequate to extend from floor to at least 6 inches ~~(150-mm)~~ above ceiling, and with separate channels for power wiring and voice and data communication cabling.
2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
3. Finishes: Satin anodized-aluminum.
4. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors; and a minimum of four, 4-pair, Category 3 or 5 voice and data communication cables.
5. Power Receptacles: Two duplex, 20-A, heavy-duty, NEMA WD 6, Configuration 5-20R units.
6. Voice and Data Communication Outlets: Four RJ-45 Category 5 jacks.

2.11 FINISHES

A. Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect , unless otherwise indicated or required by NFPA 70.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.
4. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines. Install at heights specified on plans.

B. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.

C. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.

D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

E. Remove wall plates and protect devices and assemblies during painting.

F. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 16140

SECTION 16145 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following lighting control devices:

1. Time switches.
2. Outdoor and indoor photoelectric switches.
3. Indoor occupancy sensors.
4. Lighting contactors.

B. Related Sections include the following:
1. Division 16 Section 16140 for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.
2. Division 16 Section 16570 for architectural dimming system equipment.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Area Lighting Research, Inc.; Tyco Electronics.
2. Grasslin Controls Corporation; a GE Industrial Systems Company.
3. Intermatic, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls; a Genlyte Company.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Paragon Electric Co.; Invensys Climate Controls.
8. Square D; Schneider Electric.
9. TORK.
10. Touch-Plate, Inc.
11. Watt Stopper (The).

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Area Lighting Research, Inc.; Tyco Electronics.
2. Grasslin Controls Corporation; a GE Industrial Systems Company.
3. Intermatic, Inc.
4. Lithonia Lighting; Acuity Lighting Group, Inc.

5. Novitas, Inc.
6. Paragon Electric Co.; Invensys Climate Controls.
7. Square D; Schneider Electric.
8. TORK.
9. Touch-Plate, Inc.
10. Watt Stopper (The).

D. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc ~~(16.14 to 108 lx)~~, with an adjustment for turn-on and turn-off levels within that range.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 INDOOR PHOTOELECTRIC SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. Area Lighting Research, Inc.; Tyco Electronics.
3. Eaton Electrical Inc; Cutler-Hammer Products.
4. Grasslin Controls Corporation; a GE Industrial Systems Company.
5. Intermatic, Inc.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. MicroLite Lighting Control Systems.
8. Novitas, Inc.
9. Paragon Electric Co.; Invensys Climate Controls.
10. Square D; Schneider Electric.
11. TORK.
12. Touch-Plate, Inc.
13. Watt Stopper (The).

B. Ceiling-Mounted Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.

1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
2. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13 Insert amperage-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
3. Light-Level Monitoring Range: 100 to 1000 fc ~~(1080 to 10 800 lx)~~, with an adjustment for turn-on and turn-off levels within that range.

4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

C. Skylight Photoelectric Sensors: Solid-state, light-level sensor; housed in a threaded, plastic fitting for mounting under skylight, facing up at skylight; with separate relay unit, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.

1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
2. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
3. Light-Level Monitoring Range: 1000 to 10,000 fc ~~(10 800 to 108 000 lx)~~, with an adjustment for turn-on and turn-off levels within that range.
4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

2.4 INDOOR OCCUPANCY SENSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Hubbell Lighting.
2. Leviton Mfg. Company Inc.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Novitas, Inc.
5. RAB Lighting, Inc.
6. Sensor Switch, Inc.
7. TORK.
8. Watt Stopper (The).

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:

   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch ~~(13-mm)~~ knockout in a standard electrical enclosure.

c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc ~~(21.5 to 2152 lx)~~; keep lighting off when selected lighting level is present.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch- ~~(150-mm-)~~ minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. ~~(232-sq. cm)~~.
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. ~~(93-sq.-m)~~ when mounted on a 96-inch- ~~(2440-mm-)~~ high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet ~~(27.4-m)~~ when mounted on a 10-foot- ~~(3-m-)~~ high ceiling.

D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches ~~(305-mm)~~ in either a horizontal or a vertical manner at an approximate speed of 12 inches/s ~~(305-mm/s)~~.
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. ~~(56-sq.-m)~~ when mounted on a 96-inch- ~~(2440-mm-)~~ high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. ~~(93-sq.-m)~~ when mounted on a 96-inch- ~~(2440-mm-)~~ high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. ~~(186-sq.-m)~~ when mounted on a 96-inch- ~~(2440-mm-)~~ high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet ~~(27.4-m)~~ when mounted on a 10-foot- ~~(3-m-)~~ high ceiling in a corridor not wider than 14 feet ~~(4.3-m)~~.

E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- ~~(150-mm-)~~ minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. ~~(232-sq. cm)~~, and detect a person of average size and weight moving not less than 12 inches ~~(305-mm)~~ in either a horizontal or a vertical manner at an approximate speed of 12 inches/s ~~(305-mm/s)~~.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. ~~(93-sq.-m)~~ when mounted on a 96-inch- ~~(2440-mm-)~~ high ceiling.

2.5 LIGHTING CONTACTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Electrical Inc.; Cutler-Hammer Products.
4. GE Industrial Systems; Total Lighting Control.
5. Grasslin Controls Corporation; a GE Industrial Systems Company.
6. Hubbell Lighting.
7. Lithonia Lighting; Acuity Lighting Group, Inc.
8. MicroLite Lighting Control Systems.
9. Square D; Schneider Electric.
10. TORK.
11. Touch-Plate, Inc.
12. Watt Stopper (The).

B. Description: Electrically operated and electrically held, combination type with nonfused disconnect, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.6 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 16 Section 16120.

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 16 Section "Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Division 16 Section "Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 16 Section 16120. Minimum conduit size shall be 1/2 inch ~~(13 mm)~~.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 16 Section 16075.

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 16145

SECTION 16269 - VARIABLE FREQUENCY CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes solid-state, PWM, VFCs for speed control of three-phase, squirrel-cage induction motors.

B. Related Sections include the following:

1. Division 16 Section "Electrical Power Monitoring and Control" for monitoring and control of motor circuits.
2. Division 16 Section "Transient Voltage Suppression" for low-voltage power, control, and communication surge suppressors.

1.3 DEFINITIONS

A. BMS: Building management system.

B. IGBT: Integrated gate bipolar transistor.

C. LAN: Local area network.

D. PID: Control action, proportional plus integral plus derivative.

E. PWM: Pulse-width modulated.

F. VFC: Variable frequency controller.

1.4 SUBMITTALS

A. Product Data: For each type of VFC. Include dimensions, mounting arrangements, location for conduit entries, shipping and operating weights, and manufacturer's technical data on features, performance, electrical ratings, characteristics, and finishes.

B. Shop Drawings: For each VFC.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Each installed unit's type and details.
b. Nameplate legends.
c. Short-circuit current rating of integrated unit.
d. Listed and labeled for series rating of overcurrent protective devices in combination controllers by an NRTL acceptable to authorities having jurisdiction.
e. Features, characteristics, ratings, and factory settings of each motor-control center unit.

2. Wiring Diagrams: Power, signal, and control wiring for VFCs. Provide schematic wiring diagram for each type of VFC.

C. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around VFCs where pipe and ducts are prohibited. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

D. Manufacturer Seismic Qualification Certification: Submit certification that VFCs, accessories, and components will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Qualification Data: For ~~[manufacturer] [testing agency]~~ [manufacturer and testing agency].

F. Field quality-control test reports.

G. Operation and Maintenance Data: For VFCs, all installed devices, and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for VFCs and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

H. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

I. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that dip switch settings for motor running overload protection suit actual motor to be protected.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles ~~(160 km)~~ of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Source Limitations: Obtain VFCs of a single type through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NFPA 70.

F. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, minimum clearances between VFCs, and adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver VFCs in shipping splits of lengths that can be moved past obstructions in delivery path as indicated.

B. Store VFCs indoors in clean, dry space with uniform temperature to prevent condensation. Protect VFCs from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. If stored in areas subject to weather, cover VFCs to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions, unless otherwise indicated:

1. Ambient Temperature: 0 to 40 deg C.
2. Humidity: Less than 90 percent (noncondensing).
3. Altitude: Not exceeding 3300 feet ~~(1005 m)~~.
4. ~~**<Insert unusual service conditions.>**~~

B. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify ~~[Architect] [Construction Manager]~~ [Owner]~~-~~ no fewer than ~~**[two] <Insert number>** days~~two weeks in advance of proposed interruption of electrical service.
2. Indicate method of providing temporary electrical service.
3. Do not proceed with interruption of electrical service without ~~[Architect's] [Construction Manager's]~~ [Owner's] written permission.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.8 COORDINATION

A. Coordinate layout and installation of VFCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

D. Coordinate features of VFCs, installed units, and accessory devices with pilot devices and control circuits to which they connect.

E. Coordinate features, accessories, and functions of each VFC and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spare Fuses: Furnish one spare for every [five] ~~<Insert number>~~ installed, but no fewer than one set of [three] ~~<Insert number>~~ of each type and rating.
2. Indicating Lights: [Two] ~~<Insert number>~~ of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary.
2. Baldor Electric Company (Graham).
3. Danfoss Inc.; Danfoss Electronic Drives Div.
4. Eaton Corporation; Cutler-Hammer Products.
5. General Electric Company; GE Industrial Systems.
6. Rockwell Automation; Allen-Bradley Co.; Industrial Control Group.
7. Siemens Energy and Automation; Industrial Products Division.
8. Square D.
9. Toshiba International Corporation.
~~10. <Insert manufacturer's name.>~~

2.2 VARIABLE FREQUENCY CONTROLLERS

A. Description: NEMA ICS 2, IGBT, PWM, VFC; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.

1. Provide unit suitable for operation of [standard and] ~~[premium]~~ efficiency motor as defined by NEMA MG 1.

B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

C. Output Rating: 3-phase; 6 to [60 Hz, with voltage proportional to frequency throughout voltage range.] ~~[66 Hz, with torque constant as speed changes] [120 Hz, with horsepower constant throughout speed range]~~.

D. Unit Operating Requirements:

1. Input ac voltage tolerance of [208 V, plus or minus 5] ~~[380 to 500 V, plus or minus 10] [525 to 575 V, plus or minus 10]~~ percent.
2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
3. Minimum Efficiency: 96 percent at 60 Hz, full load.

4. Minimum Displacement Primary-Side Power Factor: 96 percent.
5. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
6. Starting Torque: 100 percent of rated torque or as indicated.
7. Speed Regulation: Plus or minus 1 percent.

E. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.

1. Electrical Signal: 4 to 20 mA at 24 V.
2. Pneumatic Signal: 3 to 15 psig (20 to 104 kPa).

F. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.
3. Acceleration: 2 to a minimum of 22 seconds.
4. Deceleration: 2 to a minimum of 22 seconds.
5. Current Limit: 50 to a minimum of 110 percent of maximum rating.

G. Self-Protection and Reliability Features:

1. Input transient protection by means of surge suppressors.
2. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
3. Motor Overload Relay: Adjustable and capable of NEMA ICS 2, Class ~~[10] [20]~~ [30] performance.
4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
5. Instantaneous line-to-line and line-to-ground overcurrent trips.
6. Loss-of-phase protection.
7. Reverse-phase protection.
8. Short-circuit protection.
9. Motor overtemperature fault.

H. Multiple-Motor Capability: Controller suitable for service to multiple motors and having a separate overload relay and protection for each controlled motor. Overload relay shall shut off controller and motors served by it when overload relay is tripped.

I. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.

J. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.

K. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

L. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

M. Input Line Conditioning: ~~<**Insert requirements.**>~~Per College standard requirement.

N. VFC Output Filtering: ~~<**Insert requirements.**>~~Per College standard requirement.

O. Status Lights: Door-mounted LED indicators shall indicate the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.

P. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.

Q. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).
6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (VDC).
9. Set-point frequency (Hz).
10. Motor output voltage (V).

R. Control Signal Interface:

1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
2. Pneumatic Input Signal Interface: 3 to 15 psig ~~(20 to 104 kPa)~~.
3. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems:

   a. 0 to 10-V dc.
   b. 0-20 or 4-20 mA.
   c. Potentiometer using up/down digital inputs.
   d. Fixed frequencies using digital inputs.
   e. RS485.
   f. Keypad display for local hand operation.

4. Output Signal Interface:

a. A minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:

1) Output frequency (Hz).
2) Output current (load).
3) DC-link voltage (VDC).
4) Motor torque (percent).
5) Motor speed (rpm).
6) Set-point frequency (Hz).

5. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:

a. Motor running.
b. Set-point speed reached.
c. Fault and warning indication (overtemperature or overcurrent).
d. PID high- or low-speed limits reached.

S. Communications: Provide an RS485 interface allowing VFC to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFC to be programmed via BMS control. Provide capability for VFC to retain these settings within the nonvolatile memory.

T. Manual Bypass: Magnetic contactor arranged to safely transfer motor between controller output and bypass controller circuit when motor is at zero speed. Controller-off-bypass selector switch sets mode, and indicator lights give indication of mode selected. Unit shall be capable of stable operation (starting, stopping, and running), with motor completely disconnected from controller (no load).

U. Bypass Controller: NEMA ICS 2, full-voltage, nonreversing enclosed controller with across-the-line starting capability in manual-bypass mode. Provide motor overload protection under both modes of operation with control logic that allows common start-stop capability in either mode.

V. Integral Disconnecting Means: [NEMA AB 1, instantaneous-trip circuit breaker], [NEMA AB 1, molded-case switch,] [NEMA KS 1, nonfusible switch or] [NEMA KS 1, fusible switch] with lockable handle.

W. Isolating Switch: Non-load-break switch arranged to isolate VFC and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.

X. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

2.3 ENCLOSURES

A. ~~<Insert enclosure requirements.~~>With NEMA 1 for indoor and NEMA 3R enclosure for outdoor.

2.4 ACCESSORIES

A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

D. Control Relays: Auxiliary and adjustable time-delay relays.

E. Standard Displays:

1. Output frequency (Hz).
2. Set-point frequency (Hz).
3. Motor current (amperes).
4. DC-link voltage (VDC).
5. Motor torque (percent).
6. Motor speed (rpm).
7. Motor output voltage (V).

F. Historical Logging Information and Displays:

1. Real-time clock with current time and date.
2. Running log of total power versus time.
3. Total run time.
4. Fault log, maintaining last four faults with time and date stamp for each.

G. Current-Sensing, Phase-Failure Relays for Bypass Controller: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

2.5 FACTORY FINISHES

A. Finish: Manufacturer's standard ~~<Insert color>~~ gray paint applied to factory-assembled and -tested VFCs before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFCs for compliance with requirements, installation tolerances, ~~<Insert Project-specific conditions,>~~ and other conditions affecting performance.

B. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Select features of each VFC to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, controller, and load.

B. Select horsepower rating of controllers to suit motor controlled.

3.3 INSTALLATION

A. Anchor each VFC assembly to steel-channel sills arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and grout sills flush with mounting surface.

B. Install VFCs on concrete bases.

C. Comply with mounting and anchoring requirements specified in Division 16 Section "Electrical Supports and Seismic Restraints."

D. Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 16 Section "Fuses."

3.4 CONCRETE BASES

A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.

B. Concrete base is specified in Division 16 Section "Basic Electrical Materials and Methods," and concrete materials and installation requirements are specified in Division 3.

3.5 IDENTIFICATION

A. Identify VFCs, components, and control wiring according to Division 16 Section "Electrical Identification."

B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

3.6 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices according to Division 16 Section "Conductors and Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect hand-off-automatic switch and other automatic-control devices where applicable.

1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
2. Connect selector switches with control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.7 CONNECTIONS

A. Conduit installation requirements are specified in other Division 16 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.

B. Ground equipment according to Division 16 "Grounding and Bonding."

3.8 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

1. Inspect controllers, wiring, components, connections, and equipment installation.[Test and adjust controllers, components, and equipment.]
2. Assist in field testing of equipment[including pretesting and adjusting of solid-state controllers].
3. Report results in writing.

C. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

D. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

E. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection, except optional tests, stated in NETA ATS. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.9 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain variable frequency controllers. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 16269

SECTION 16271 - MEDIUM-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of transformers with medium-voltage primaries:

1. Liquid-filled distribution and power transformers.
2. Dry-type distribution and power transformers.
3. Pad-mounted, liquid-filled transformers.

1.3 DEFINITIONS

A. NETA ATS: Acceptance Testing Specification.

1.4 SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, location of each field connection, and performance for each type and size of transformer indicated.

B. Shop Drawings: Diagram power signal and control wiring.

C. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Underground primary and secondary conduit stub-up location.
2. Dimensioned concrete base, outline of transformer, and required clearances.
3. Ground rod and grounding cable locations.

D. Manufacturer Seismic Qualification Certification: Submit certification that transformer assembly and components will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Qualification Data: For testing agency.

F. Source quality-control test reports.

G. Field quality-control test reports.

H. Follow-up service reports.

I. Operation and Maintenance Data: For transformer and accessories to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of transformers and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with IEEE C2.

E. Comply with ANSI C57.12.10, ANSI C57.12.28, IEEE C57.12.70, and IEEE C57.12.80.

F. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store transformers so condensation will not form on or in units. Provide temporary heating according to manufacturer's written instructions.

1.7 PROJECT CONDITIONS

A. Service Conditions: IEEE C37.121, usual service conditions except for the following:

1. Exposure to significant solar radiation.
2. Altitudes above 3300 feet.
3. Exposure to fumes, vapors, or dust.
4. Exposure to explosive environments.
5. Exposure to hot and humid climate or to excessive moisture, including steam, salt spray, and dripping water.
6. Exposure to seismic shock or to abnormal vibration, shock, or tilting.
7. Exposure to excessively high or low temperatures.
8. Unusual transportation or storage conditions.
9. Unusual grounding-resistance conditions.
10. Unusual space limitations.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate installation of louvers, doors, spill retention areas, and sumps. Coordinate installation so no piping or conduits are installed in space allocated for medium-voltage transformers except those directly associated with transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. GE Electrical Distribution & Control.~~Acme Electric Corporation; Power Distribution Products Division~~.
2. Square D; Schneider Electric
~~3. Cooper Industries; Cooper Power Systems Division.~~
4. Cutler-Hammer.
~~5. Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.~~
~~6. GE Electrical Distribution & Control.~~

~~7. Hammond Manufacturing; Transformer Group.~~
~~8. Kuhlman Electric Corporation.~~
~~9. Pauwels Transformers.~~
~~10. Pioneer Transformers.~~
~~11. Siemens Energy & Automation, Inc.~~
~~12. Square D; Schneider Electric.~~
~~13. Uptegraff, R. E. Mfg. Co.~~
~~14. Virginia Transformer Corp.~~

2.2 DRY-TYPE DISTRIBUTION AND POWER TRANSFORMERS

A. Description: NEMA ST 20, IEEE C57.12.01, ANSI C57.12.50, ANSI C57.12.51 ANSI C57.12.52, UL 1562 listed and labeled, dry-type, 2-winding transformers.

1. Outdoor, ventilated, cast coil/encapsulated coil, with primary and secondary windings individually cast in epoxy; with insulation system rated at 185 deg C with an 80 deg C average winding temperature rise above a maximum ambient temperature of 40 deg C.
2. Outdoor, ventilated, vacuum-pressure impregnated and with insulation system rated at 220 deg C with an 80 deg C average winding temperature rise above a maximum ambient temperature of 40 deg C.

B. Primary Connection: Air terminal compartment with removable hinged door. Tin-plated copper bar for incoming line termination, predrilled to accept terminals for indicated conductors.

C. Primary Connection: Transition terminal compartment with connection pattern to match switchgear.

D. Secondary Connection: Air terminal compartment with removable hinged door. Tin-plated copper bar for incoming line termination, predrilled to accept terminals for indicated conductors.

E. Secondary Connection: Transition terminal compartment with connection pattern to match switchgear,bus duct.

F. Insulation Materials: IEEE C57.12.01, rated at 220 deg C.

G. Insulation Temperature Rise: 115 deg C, maximum rise above 40 deg C.

H. Basic Impulse Level: 60 kV.

I. Full-Capacity Voltage Taps: Four nominal 2.5 percent taps, 2 above and 2 below rated primary voltage.

J. Full-Capacity Voltage Taps: Four nominal 2.5 percent taps below rated primary voltage.

K. Cooling System: Class AA, self-cooled, complying with IEEE C57.12.01.

1. Automatic forced-air cooling system controls, including thermal sensors, fans, control wiring, temperature controller with test switch, power panel with current-limiting fuses, indicating lights, alarm, and alarm silencing relay.
2. Include mounting provision for fans.

L. Sound level may not exceed sound levels listed in NEMA TR 1, without fans operating.

M. Impedance: 3.5 percent.

N. High-Temperature Alarm: Sensor at transformer with local audible and visual alarm and contacts for remote alarm.

2.3 PAD-MOUNTED, LIQUID-FILLED TRANSFORMERS

A. Description: ANSI C57.12.13, ANSI C57.12.26 IEEE C57.12.00, IEEE C57.12.22, pad-mounted, 2-winding transformers. Stainless-steel tank base and cabinet.

B. Insulating Liquid: Mineral oil, complying with ASTM D 3487, Type II, and tested according to ASTM D 117.

C. Insulating Liquid: Less flammable, edible-seed-oil based, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic.

D. Insulating Liquid: Less flammable, dielectric, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic.

E. Insulating Liquid: Less flammable, silicone-based dielectric, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall have low toxicity and be nonhazardous.

F. Insulation Temperature Rise: 65 deg C when operated at rated kVA output in a 40 deg C ambient temperature. Transformer shall be rated to operate at rated kilovolt ampere in an average ambient temperature of 30 deg C over 24 hours with a maximum ambient temperature of 40 deg C without loss of service life expectancy.

G. Basic Impulse Level: 60] kV.

H. Full-Capacity Voltage Taps: Four 2.5 percent taps, 2 above and 2 below rated high voltage; with externally operable tap changer for de-energized use and with position indicator and padlock hasp.

I. High-Voltage Switch: 800 A, make-and-latch rating of 10-kA RMS, symmetrical, arranged for radial feed with 3-phase, 2-position, gang-operated, load-break switch that is oil immersed in transformer tank with hook-stick operating handle in primary compartment.

J. Primary Fuses: 150-kV fuse assembly with fuses complying with IEEE C37.47. Rating of current-limiting fuses shall be 50-kA RMS at specified system voltage.

1. Current-limiting type in dry-fuse holder wells, mechanically interlocked with liquid-immersed switch in transformer tank to prevent disconnect under load.
2. Internal liquid-immersed cartridge fuses.
3. Bay-O-Net liquid-immersed fuses that are externally replaceable without opening transformer tank.
4. Bay-O-Net liquid-immersed fuses in series with liquid-immersed current-limiting fuses. Bay-O-Net fuses shall be externally replaceable without opening transformer tank.
5. Bay-O-Net liquid-immersed current-limiting fuses that are externally replaceable without opening transformer tank.

K. Surge Arresters: Distribution class, one for each primary phase; complying with IEEE C62.11 and NEMA LA 1; support from tank wall within high-voltage compartment. Transformers shall have three arresters for radial-feed circuits.

L. High-Voltage Terminations and Equipment: Live front with externally clamped porcelain bushings and cable connectors suitable for terminating primary cable.

M. High-Voltage Terminations and Equipment: Dead front with universal-type bushing wells for dead-front bushing-well inserts, complying with IEEE 386 and including the following:

1. Bushing-Well Inserts: One for each high-voltage bushing well.
2. Surge Arresters: Dead-front, elbow-type, metal-oxide-varistor units.
3. Parking Stands: One for each high-voltage bushing well.
4. Portable Insulated Bushings: Arranged for parking insulated, high-voltage, load-break cable terminators; one for each primary feeder conductor terminating at transformer.

N. Accessories:

1. Drain Valve: 1 inch, with sampling device.
2. Dial-type thermometer.
3. Liquid-level gage.
4. Pressure-vacuum gage.
5. Pressure Relief Device: Self-sealing with an indicator.
6. Mounting provisions for low-voltage current transformers.
7. Mounting provisions for low-voltage potential transformers.
8. Busway terminal connection at low-voltage compartment.
9. Alarm contacts for gages and thermometer listed above.

2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 16 Section "Electrical Identification."

2.5 SOURCE QUALITY CONTROL

A. Factory Tests: Perform design and routine tests according to standards specified for components. Conduct transformer tests according to ANSI C57.12.50, ANSI C57.12.51 IEEE C57.12.90, IEEE C57.12.91.

B. Factory Tests: Perform the following factory-certified tests on each transformer:

1. Resistance measurements of all windings on rated-voltage connection and on tap extreme connections.
2. Ratios on rated-voltage connection and on tap extreme connections.
3. Polarity and phase relation on rated-voltage connection.
4. No-load loss at rated voltage on rated-voltage connection.
5. Excitation current at rated voltage on rated-voltage connection.
6. Impedance and load loss at rated current on rated-voltage connection and on tap extreme connections.
7. Applied potential.
8. Induced potential.
9. Temperature Test: If transformer is supplied with auxiliary cooling equipment to provide more than one rating, test at lowest kilovolt-ampere Class OA or Class AA rating and highest kilovolt-ampere Class OA/FA or Class AA/FA rating.

   a. Temperature test is not required if record of temperature test on an essentially duplicate unit is available.

10. Owner will witness all required factory tests. Notify Architect at least 14 days before date of tests and indicate their approximate duration.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for medium-voltage transformers.

B. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements.
2. Entries are within conduit-entry tolerances specified by manufacturer and no feeders will have to cross section barriers to reach load or line lugs.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and that requirements in Division 16 Section "Grounding and Bonding" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install transformers on concrete bases.

1. Anchor transformers to concrete bases according to manufacturer's written instructions, seismic codes at Project, and requirements in Division 16 Section "Electrical Supports and Seismic Restraints."
2. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit and 4 inches high.
3. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete." Install dowel rods to connect concrete bases to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
4. Install epoxy-coated anchor bolts, for supported equipment, that extend through concrete base and anchor into structural concrete floor.
5. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
6. Tack-weld or bolt transformers to channel-iron sills embedded in concrete bases. Install sills level and grout flush with floor or base.

B. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

3.3 IDENTIFICATION

A. Identify field-installed wiring and components and provide warning signs as specified in Division 16 Section "Basic Electrical Materials and Methods, Electrical Identification."

3.4 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Conductors and Cables."

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

C. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

D. Perform the following field tests and inspections and prepare test reports:

1. After installing transformers but before primary is energized, verify that grounding system at substation is tested at specified value or less.
2. After installing transformers and after electrical circuitry has been energized, test for compliance with requirements.
3. Perform visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Remove and replace malfunctioning units and retest as specified above.

F. Test Reports: Prepare written reports to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective actions taken to achieve compliance with requirements.

3.6 FOLLOW-UP SERVICE

A. Voltage Monitoring and Adjusting: If requested by Owner, perform the following voltage monitoring after Substantial Completion but not more than six months after Final Acceptance:

1. During a period of normal load cycles as evaluated by Owner, perform seven days of three-phase voltage recording at secondary terminals of each transformer. Use voltmeters with calibration traceable to National Institute of Science and Technology standards and with a chart speed of not less than 1 inch (25 mm) per hour. Voltage unbalance greater than 1 percent between phases, or deviation of any phase voltage from nominal value by more than plus or minus 5 percent during test period, is unacceptable.
2. Corrective Actions: If test results are unacceptable, perform the following corrective actions, as appropriate:

   a. Adjust transformer taps.
   b. Prepare written request for voltage adjustment by electric utility.

3. Retests: After corrective actions have been performed, repeat monitoring until satisfactory results are obtained.
4. Report: Prepare written report covering monitoring and corrective actions performed.

B. Infrared Scanning: Perform as specified in Division 16 Section "Medium-Voltage Switchgear."

END OF SECTION 16271

SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Nonfusible switches.
3. Bolted-pressure contact switches.
4. High-pressure, butt-type contact switches.
5. Molded-case circuit breakers.
6. Molded-case switches.
7. Enclosures.

1.3 DEFINITIONS

A. GD: General duty.

B. GFCI: Ground-fault circuit interrupter.

C. HD: Heavy duty.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current rating.
4. UL listing for series rating of installed devices.

5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Qualification Data: For testing agency.

D. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1, include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spares: For the following:

a. Potential Transformer Fuses: 4
b. Control-Power Fuses: 4
c. Fuses for Fusible Switches: 8
d. Fuses for Fused Power Circuit Devices: 8

2. Spare Indicating Lights: Six of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. ~~Siemens Energy & Automation, Inc.~~
4. Square D/Group Schneider.

B. Fusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Nonfusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.3 FUSED POWER CIRCUIT DEVICES

A. Bolted-Pressure Contact Switch: UL 977; operating mechanism shall use a rotary-mechanical-bolting action to produce and maintain high-clamping pressure on the switch blade after it engages the stationary contacts.

1. ~~[Available]~~Manufacturers:

a. Boltswitch, Inc.
b. Eaton Corporation; Cutler-Hammer Products.
c. Pringle Electrical Mfg. Co.
d. Siemens Energy & Automation, Inc.
e. Square D/Group Schneider.
~~f. <Insert manufacturer's name.>~~

2.4 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:

~~Eaton Corporation; Cutler-Hammer Products.~~
1. General Electric Co.; Electrical Distribution & Control Division.
~~2. Moeller Electric Corporation.~~
~~3. Siemens Energy & Automation, Inc.~~
~~4. Square D/Group Schneider.~~

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

a. Instantaneous trip.

b. Long- and short-time pickup levels.
c. Long- and short-time time adjustments.
d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.

C. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
7. Auxiliary Switch: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
9. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

D. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

E. Molded-Case Switch Accessories:

1. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage. Provide "dummy" trip unit where required for proper operation.
4. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay. Provide "dummy" trip unit where required for proper operation.
5. Auxiliary Switch: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
6. Key Interlock Kit: Externally mounted to prohibit operation; key shall be removable only when switch is in off position.

2.5 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
3. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONCRETE BASES

A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.

3.3 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section 16075.

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 16 Section 16075.

3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.
2. Verify switch and relay type and labeling verification.
3. Verify rating of installed fuses.

B. Perform the following field tests and inspections and prepare test reports:
   1. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   2. Infrared Scanning:
      a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors or panels so connections are accessible to portable scanner.
      b. Follow-Up Infrared Scanning: Perform an additional follow-up infrared scan of each unit 11 months after date of Substantial Completion.
      c. Instruments, Equipment and Reports:
         1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
         2) Prepare a certified report that identifies enclosed switches and circuit breakers included and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.7 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 16410

SECTION 16430 - SWITCHGEAR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes metal-enclosed, low-voltage power circuit-breaker switchgear rated 1000 V and less for use in ac systems.

B. Related Sections include the following:

1.3 DEFINITIONS

A. ATS: Acceptance Testing Service.

B. GFCI: Ground-fault circuit interrupter.

1.4 SUBMITTALS

A. Product Data: For each type of switchgear, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each type of switchgear and related equipment.

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:

    a. Tabulation of installed devices with features and ratings.
    b. Enclosure types and details.
    c. Outline and general arrangement drawing showing dimensions, shipping sections, and weights of each assembled section.
    d. Bus configuration with size and number of conductors in each bus run, including phase, neutral, and ground conductors of main and branch buses.
    e. Current rating of buses.
    f. Short-time and short-circuit current rating of switchgear assembly.
    g. Nameplate legends.
    h. Mimic-bus diagram.
    i. Utility company's metering provisions with indication of approval by utility company.

j. UL listing for series rating of installed devices.
k. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around switchgear where pipe and ducts are prohibited. Show switchgear layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

D. Samples: Representative portion of mimic bus with specified finish. Manufacturer's color charts showing colors available for mimic bus.

E. Qualification Data: For testing agency.

F. Field quality-control test reports.

G. Updated mimic-bus diagram reflecting field changes after final switchgear load connections have been made, for record.

H. Operation and Maintenance Data: For switchgear and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Source Limitations: Obtain switchgear through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of switchgear and are based on the specific system indicated.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchgear in sections of lengths that can be moved past obstructions in delivery path.

B. Store switchgear indoors in clean dry space with uniform temperature to prevent condensation. Protect switchgear from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.7 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace building components and structures to provide pathway for moving switchgear into place.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchgear, including clearances between switchgear, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not exceeding 40 deg C.
2. Altitude: Not exceeding 6600 feet.

1.8 COORDINATION

A. Coordinate layout and installation of switchgear and components with other construction that penetrates ceilings or is supported by them, including conduit, piping, equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels.

B. Coordinate size and location of concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

~~1. ABB Inc.~~
2. ~~Cutler-Hammer, Inc.; Eaton Corporation.~~
3. General Electric Company.
~~4. Siemens Energy & Automation, Inc.~~
5. ~~Square D; Schneider Electric.~~

2.2 FABRICATION

A. Factory assembled and tested and complying with IEEE C37.20.1.

B. Indoor Enclosure Material: Steel.

C. Finish: IEEE C37.20.1, manufacturer's standard gray finish over a rust-inhibiting primer on phosphatizing-treated metal surfaces.

D. Section barriers between main and tie circuit-breaker compartments shall be extended to rear of section.

E. Bus isolation barriers shall be arranged to isolate line bus from load bus at each main and tie circuit breaker.

F. Circuit-breaker compartments shall be equipped to house drawout-type circuit breakers and shall be fitted with hinged outer doors.

G. Fabricate enclosure with removable, hinged, rear cover panels to allow access to rear interior of switchgear.

H. Auxiliary Compartments: Match and align with basic switchgear assembly. Include the following:

1. Utility metering compartment that complies with utility company requirements.
2. Bus transition sections.
3. Incoming-line pull sections.
4. Hinged front panels for access to metering, accessory, and blank compartments.
5. Pull box on top of switchgear for extra room for pulling cable, with removable top, front, and side covers and ventilation provisions adequate to maintain air temperature in pull box within same limits as switchgear.

   a. Set pull box back from front to clear circuit-breaker lifting mechanism.
   b. Bottom: Insulating, fire-resistant material with separate holes for cable drops into switchgear.

c. Cable Supports: Arranged to ease cabling and adequate to support cables indicated, including those for future installation.

I. Bus bars connect between vertical sections and between compartments. Cable connections are not permitted.

1. Main Phase Bus: Uniform capacity the entire length of assembly.
2. Neutral Bus: 100 percent of phase-bus ampacity, except as indicated. Equip bus with pressure-connector terminations for outgoing circuit neutral conductors. Include braces for neutral-bus extensions for busway feeders.
3. Vertical Section Bus Size: Comply with IEEE C37.20.1, including allowance for spare circuit breakers and spaces for future circuit breakers.
4. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent minimum conductivity, with copper feeder circuit-breaker line connections.
5. Use copper for connecting circuit-breaker line to copper bus.
6. Contact Surfaces of Buses: Silver plated.
7. Feeder Circuit-Breaker Load Terminals: Silver-plated copper bus extensions equipped with pressure connectors for outgoing circuit conductors.
8. Ground Bus: Hard-drawn copper of 98 percent minimum conductivity, with pressure connector for feeder and branch-circuit ground conductors, minimum size 1/4 by 2 inches.
9. Supports and Bracing for Buses: Adequate strength for indicated short-circuit currents.
10. Neutral bus equipped with pressure-connector terminations for outgoing circuit neutral conductors. Neutral-bus extensions for busway feeders are braced.
11. Neutral Disconnect Link: Bolted, uninsulated, 1/4-by-2-inch copper bus, arranged to connect neutral bus to ground bus.
12. Provide for future extensions from either end of main phase, neutral, and ground bus by means of predrilled bolt-holes and connecting links.
13. Bus-Bar Insulation: Individual bus bars wrapped with factory-applied, flame-retardant tape or spray-applied, flame-retardant insulation.

    a. Sprayed Insulation Thickness: 3 mils, minimum.
    b. Bolted Bus Joints: Insulate with secure joint covers that can easily be removed and reinstalled.

2.3 COMPONENTS

A. Instrument Transformers: Comply with IEEE C57.13.

1. Potential Transformers: Secondary-voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
2. Current Transformers: Ratios as indicated; burden and accuracy class suitable for connected relays, meters, and instruments.

B. Multifunction Digital-Metering Monitor: UL-listed or -recognized, microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Inputs from sensors or 5-A current-transformer secondaries, and potential terminals rated to 600 V.

2. Switch-selectable digital display of the following:

   a. Phase Currents, Each Phase: Plus or minus 1 percent.
   b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
   c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
   d. Three-Phase Real Power: Plus or minus 2 percent.
   e. Three-Phase Reactive Power: Plus or minus 2 percent.
   f. Power Factor: Plus or minus 2 percent.
   g. Frequency: Plus or minus 0.5 percent.
   h. Integrated Demand, with Demand Interval Selectable from 5 to 60 Minutes: Plus or minus 2 percent.
   i. Accumulated energy, in megawatt hours (joules), plus or minus 2 percent; stored values unaffected by power outages for up to 72 hours.

3. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

C. Relays: Comply with IEEE C37.90, types and settings as indicated; with test blocks and plugs.

D. Surge Arresters: Distribution class, metal-oxide-varistor type. Comply with IEEE C62.11 and NEMA LA 1.

1. Install in cable termination compartments and connect in each phase of circuit.
2. Coordinate rating with circuit voltage.

E. Provision for Future Devices: Equip compartments with rails, mounting brackets, supports, necessary appurtenances, and bus connections.

F. Control Wiring: Factory installed, complete with bundling, lacing, and protection; and complying with the following:

1. Flexible conductors for No. 8 AWG and smaller, for conductors across hinges and for conductors for interconnections between shipping units.
2. Conductors sized according to NFPA 70 for duty required.

2.4 CIRCUIT BREAKERS

A. Description: Comply with IEEE C37.13.

B. Ratings: As indicated for continuous, interrupting, and short-time current ratings for each circuit breaker; voltage and frequency ratings same as switchgear.

C. Operating Mechanism: Mechanically and electrically trip-free, stored-energy operating mechanism with the following features:

1. Normal Closing Speed: Independent of both control and operator.
2. Slow Closing Speed: Optional with operator for inspection and adjustment.
3. Stored-Energy Mechanism: Electrically charged, with optional manual charging.
4. Operation counter.

D. Trip Devices: Solid-state, overcurrent trip-device system consisting of one or two current transformers or sensors per phase, a release mechanism, and the following features:

1. Functions: Long-time-delay, short-time-delay, and instantaneous-trip functions, independent of each other in both action and adjustment.
2. Temperature Compensation: Ensures accuracy and calibration stability from minus 5 to plus 40 deg C.
3. Field-adjustable, time-current characteristics.
4. Current Adjustability: Dial settings and rating plugs on trip units or sensors on circuit breakers, or a combination of these methods.
5. Pickup Points: Five minimum, for instantaneous-trip functions.
6. Ground-fault protection with at least three short-time-delay settings and three trip-time-delay bands; adjustable current pickup. Arrange to provide protection for the following:

   a. Four-wire circuit or system.
   b. Four-wire, double-ended substation.

7. Trip Indication: Labeled, battery-powered lights or mechanical targets on trip device to indicate type of fault.

E. Drawout Features: Circuit-breaker mounting assembly equipped with a racking mechanism to position circuit breaker and hold it rigidly in connected, test, and disconnected positions. Include the following features:

1. Interlocks: Prevent movement of circuit breaker to or from connected position when it is closed, and prevent closure of circuit breaker unless it is in connected, test, or disconnected position.
2. Circuit-Breaker Positioning: An open circuit breaker may be racked to or from connected, test, and disconnected positions only with the associated compartment door closed unless live parts are covered by a full dead-front shield. An open circuit breaker may be manually withdrawn to a position for removal from the structure with the door open. Status for connection devices for different positions includes the following:

   a. Test Position: Primary disconnect devices disengaged, and secondary disconnect devices and ground contact engaged.
   b. Disconnected Position: Primary and secondary devices and ground contact disengaged.

F. Arc Chutes: Readily removable from associated circuit breaker when it is in disconnected position, and arranged to permit inspection of contacts without removing circuit breaker from switchgear.

G. Padlocking Provisions: For installing at least three padlocks on each circuit breaker to secure its enclosure and prevent movement of drawout mechanism.

H. Operating Handle: One for each circuit breaker capable of manual operation.

I. Electric Close Button: One for each electrically operated circuit breaker.

J. Key Interlocks: Arranged so keys are attached at devices indicated. Mountings and hardware are included where future installation of key-interlock devices is indicated.

K. Undervoltage Trip Devices: Adjustable time-delay and pickup voltage.

L. Shunt-Trip Devices: Where indicated.

M. Indicating Lights: To indicate circuit breaker is open or closed, for main and bus tie circuit breakers interlocked either with each other or with external devices.

2.5 ACCESSORIES

A. Accessory Set: Furnish tools and miscellaneous items required for circuit-breaker and switchgear test, inspection, maintenance, and operation.

1. Portable test set for testing all functions of circuit-breaker, solid-state trip devices without removal from switchgear.
2. Relay and meter test plugs suitable for testing switchgear meters and switchgear class relays.

B. Circuit-Breaker Removal Apparatus: Portable, floor-supported, roller-base, elevating carriage arranged for moving circuit breakers in and out of compartments.

C. Spare-Fuse Cabinet: Identified and compartmented steel box or cabinet with lockable door.

D. Storage for Manual: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

2.6 IDENTIFICATION

A. System Power Riser Diagrams: Depict power sources, feeders, distribution components, and major loads. Include as-built data for low-voltage power switchgear and connections as follows:

1. Frame size of each circuit breaker.
2. Trip rating for each circuit breaker.
3. Conduit and wire size for each feeder.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces where switchgear will be installed for compliance with installation tolerances, required clearances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with applicable portions of NECA 400.

B. Anchor switchgear assembly to 4-inch, channel-iron floor sill embedded in concrete base and attach by bolting.

1. Sills: Select to suit switchgear; level and grout flush into concrete base.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, brackets, and temporary blocking of moving parts from switchgear units and components.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section 16075.

B. Diagram and Instructions:

1. Frame and mount under clear acrylic plastic on the front of switchgear.

a. Operating Instructions: Printed basic instructions for switchgear, including control and key-interlock sequences and emergency procedures.
b. System Power Riser Diagrams: Depict power sources, feeders, distribution components, and major loads.

2. Storage for Maintenance: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

3.4 CONNECTIONS

A. Ground equipment according to Division 16 Section 16060.

B. Connect wiring according to Division 16 Section 16120.

3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each switchgear bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

1. Inspect switchgear installation, including wiring, components, connections, and equipment. Test and adjust components and equipment.

2. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 16 Sections.
3. Complete installation and startup checks according to manufacturer's written instructions.
4. Assist in field testing of equipment.
5. Report results in writing.

C. Perform the following field tests and inspections and prepare test reports:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for each of the following NETA categories:

   a. Switchgear.
   b. Circuit breakers.
   c. Protective relays.
   d. Instrument transformers.
   e. Metering and instrumentation.
   f. Ground-fault systems.

2. Remove and replace malfunctioning units and retest as specified above.

3.6 ADJUSTING

A. Set field-adjustable, protective-relay trip characteristics.

3.7 CLEANING

A. On completion of installation, inspect interior and exterior of switchgear. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.8 PROTECTION

A. Temporary Heating: Apply temporary heat to switchgear, according to manufacturer's written instructions, throughout periods when switchgear environment is not controlled for temperature and humidity within manufacturer's stipulated service conditions.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchgear. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 16430

SECTION 16441 - SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes service and distribution switchboards rated 600 V and less.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RFI: Radio-frequency interference.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

   a. Enclosure types and details for types other than NEMA 250, Type 1.
   b. Bus configuration, current, and voltage ratings.
   c. Short-circuit current rating of switchboards and overcurrent protective devices.
   d. Descriptive documentation of optional barriers specified for electrical insulation and isolation.
   e. Utility company's metering provisions with indication of approval by utility company.
   f. Mimic-bus diagram.

g. UL listing for series rating of installed devices.
h. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Samples: Representative portion of mimic bus with specified finish, for color selection.

D. Manufacturer Seismic Qualification Certification: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Qualification Data: For testing agency.

F. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

G. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section " Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical

Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

C. Source Limitations: Obtain switchboards through one source from a single manufacturer.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Comply with NEMA PB 2, "Deadfront Distribution Switchboards."

G. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver in sections or lengths that can be moved past obstructions in delivery path.

B. Store indoors in clean dry space with uniform temperature to prevent condensation. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. If stored in areas subjected to weather, cover switchboards to provide protection from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside switchboards; install electric heating (250 W per section) to prevent condensation.

D. Handle switchboards according to NEMA PB 2.1 and NECA 400.

1.7 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2000 m).

C. Service Conditions: NEMA PB 2, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify, Architect,Construction Manager, Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Architect's, Construction Manager's, Owner's written permission.

1.8 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Potential Transformer Fuses: Equal to 10 percent of amount installed for each size and type, but no fewer than 2 of each size and type.
2. Control-Power Fuses: Equal to 10 percent of amount installed for each size and type, but no fewer than 2 of each size and type.
3. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of amount installed for each size and type, but no fewer than 3 of each size and type.
4. Fuses for Fused Switches: Equal to 10 percent of amount installed for each size and type, but no fewer than 3 of each size and type.
5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of amount installed for each size and type, but no fewer than 3 of each size and type.
6. Indicating Lights: Equal to 10 percent of amount installed for each size and type, but no fewer than 1 of each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MANUFACTURED UNITS

A. Available Manufacturers:

~~Eaton Corporation; Cutler-Hammer Products.~~
1. General Electric Co.; Electrical Distribution & Protection Div.
~~2. Siemens Energy & Automation, Inc.~~
3. ~~Square D.~~

B. Front-Connected, Front-Accessible Switchboard Fixed, individually mounted main device, panel-mounted branches, and sections rear aligned.

C. Front- and Side-Accessible Switchboard: Fixed, individually mounted main device; panel-mounted branches; and sections rear aligned.

D. Front- and Rear-Accessible Switchboard: Front and rear aligned, with features as follows:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel and fixed, individually mounted.

E. Nominal System Voltage: 208Y/120 V.

F. Main-Bus Continuous: 800A

G. Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints."

H. Enclosure: Steel, NEMA 250, Type 3R.

I. Enclosure Finish for Outdoor Units: Factory-applied finish in manufacturer's standard color, undersurfaces treated with corrosion-resistant undercoating.

J. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

K. Barriers: Between adjacent switchboard sections.

L. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

M. Utility Metering Compartment: Fabricated compartment and section complying with utility company's requirements. If separate vertical section is required for utility metering, match and align with basic switchboard.

N. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

O. Removable, Hinged Rear Doors and Compartment Covers: Secured standard bolts, for access to rear interior of switchboard.

P. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

Q. Pull Box on Top of Switchboard:

1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
2. Set back from front to clear circuit-breaker removal mechanism.
3. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

R. Buses and Connections: Three phase, four wire, unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity with feeder circuit-breaker line connections.
2. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with copper- or tin-plated, aluminum circuit-breaker line connections.
3. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity or tin-plated, high-strength, electrical-grade aluminum alloy.

   a. If bus is aluminum, use copper- or tin-plated aluminum for circuit-breaker line connections.
   b. If bus is copper, use copper for feeder circuit-breaker line connections.

4. Load Terminals: Insulated, rigidly braced, silver-plated, copper runback bus extensions equipped with pressure connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full ampere rating of circuit-breaker position.
5. Ground Bus: 1/4-by-2-inch- minimum-size, hard-drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
6. Contact Surfaces of Buses: Silver plated.

7. Main Phase Buses, Neutral Buses, and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
8. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.
9. Neutral Buses: 50 percent of the ampacity of phase buses, unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables. Bus extensions for busway feeder neutral bus are braced.
10. Neutral Buses: 100 percent of the ampacity of phase buses, unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables. Bus extensions for busway feeder neutral bus are braced.

S. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

T. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating: 105 deg C.

2.3 TRANSIENT VOLTAGE SUPPRESSION DEVICES

A. IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules.

B. Minimum single-impulse current rating shall be as follows:

1. Line to Neutral: 100,000 A.
2. Line to Ground: 100,000 A.
3. Neutral to Ground: 50,000 A.

C. Protection modes shall be as follows:

1. Line to neutral.
2. Line to ground.
3. Neutral to ground.

D. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.

E. Maximum Category C combination wave clamping voltage shall not exceed 600 V, line to neutral and line to ground on 120/208 V systems.

F. Maximum UL 1449 clamping levels shall not exceed 400 V, line to neutral and line to ground on 120/208 V systems.

G. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.

H. Accessories:

1. Form-C contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts to reverse position on failure of any surge diversion module.
2. Audible alarm activated on failure of any surge diversion module.
3. Six-digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125 V.

2.4 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: NEMA AB 3, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip-unit circuit breakers shall have RMS sensing, field-replaceable rating plug, and the following field-adjustable settings:

   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with 30mA trip sensitivity.

B. Bolted-Pressure Contact Switch: Operating mechanism uses rotary-mechanical-bolting action to produce and maintain high clamping pressure on the switch blade after it engages the stationary contacts.

1. Available Manufacturers:

   a. Boltswitch, Inc.
   b. Cutler-Hammer Products; Eaton Corporation.
   c. Pringle Electrical Mfg. Co.
   d. Siemens Energy & Automation, Inc.
   e. Square D.

C. High-Pressure, Butt-Type Contact Switch: Operating mechanism uses butt-type contacts and a spring-charged mechanism to produce and maintain high-pressure contact when switch is closed.

1. Available Manufacturers:

a. General Electric Co.

2. Main Contact Interrupting Capability: 12 times the switch current rating, minimum.
3. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for closing and opening.

   a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
   b. Mechanical Trip: Operation of mechanical lever, push button, or other device causes switch to open.

4. Auxiliary Switches: Factory installed, single pole, double throw, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
5. Service-Rated Switches: Labeled for use as service equipment.
6. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.

   a. Configuration: Remote-mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   b. Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
   c. No-Trip Relay Test: Permits ground-fault simulation test without tripping switch.
   d. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).

7. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.

D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

E. Fuses are specified in Division 16 Section "Fuses."

2.5 INSTRUMENTATION

A. Instrument Transformers: NEMA EI 21.1, IEEE C57.13, and the following:

1. Potential Transformers: Secondary voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
2. Current Transformers: Ratios shall be as indicated with accuracy class and burden suitable for connected relays, meters, and instruments.
3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kV.
4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondaries to ground overcurrent relays to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker ground-fault protection.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

   a. Phase Currents, Each Phase: Plus or minus 1 percent.
   b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
   c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
   d. Megawatts: Plus or minus 2 percent.
   e. Megavars: Plus or minus 2 percent.
   f. Power Factor: Plus or minus 2 percent.
   g. Frequency: Plus or minus 0.5 percent.
   h. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from 5 to 60 minutes.
   i. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent. Accumulated values unaffected by power outages up to 72 hours.

2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

C. Ammeters, Voltmeters, and Power-Factor Meters: ANSI C39.1.

1. Meters: 4-inch diameter or 6 inches square, flush or semiflush, with antiparallax 250-degree scales and external zero adjustment.
2. Voltmeters: Cover an expanded-scale range of nominal voltage plus 10 percent.

D. Instrument Switches: Rotary type with off position.

1. Voltmeter Switches: Permit reading of all phase-to-phase voltages and, where a neutral is indicated, phase-to-neutral voltages.
2. Ammeter Switches: Permit reading of current in each phase and maintain current-transformer secondaries in a closed-circuit condition at all times.

E. Feeder Ammeters: 2-1/2-inch- minimum size with 90- or 120-degree scale. Meter and transfer device with an off position, located on overcurrent device door for indicated feeder circuits only.

F. Watt-Hour Meters: Flush or semiflush type, rated 5 A, 120 V, 3 phase, 3 wire, with 3 elements, 15-minute-indicating-demand register, and provision for testing and adding pulse initiation.

G. Recording Demand Meter: Usable as totalizing relay or as indicating and recording maximum-demand meter with 15-minute interval. Meter shall count and control a succession of pulses entering two channels. House in drawout, back-connected case arranged for semiflush mounting.

2.6 CONTROL POWER

A. Control Circuits: 120 V, supplied through secondary disconnecting devices from control-power transformer.

B. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.

C. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

D. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.7 ACCESSORY COMPONENTS AND FEATURES

A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Furnish portable test set to test functions of solid-state trip devices without removal from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

C. Furnish one portable, floor-supported, roller-based, elevating carriage arranged for movement of circuit breakers in and out of compartments for present and future circuit breakers.

D. Furnish overhead circuit-breaker lifting device, mounted at top front of switchboard, with hoist and lifting yokes matching each drawout circuit breaker.

E. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

F. Fungus Proofing: Permanent fungicidal treatment for switchboard interior, including instruments and instrument transformers.

2.8 IDENTIFICATION

A. Mimic Bus: Continuously integrated mimic bus factory applied to front of switchboard. Arrange in single-line diagram format, using symbols and letter designations consistent with final mimic-bus diagram. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.

B. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.

PART 3 - EXECUTION

3.1 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

3.2 EXAMINATION

A. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1 and NECA 40.

B. Install and anchor switchboards level on concrete bases, 4-inch nominal thickness. Concrete base is specified in Division 16 Section "Electrical Supports and Seismic Restraints," and concrete materials and installation requirements are specified in Division 3.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
2. For switchboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

E. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

F. Install spare-fuse cabinet.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Switchboard Nameplates: Label each switchboard compartment with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

C. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

D. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Sections 7.1, 7.5, 7.6, 7.9, 7.10, 7.11, and 7.14 as appropriate. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
c. Instruments, Equipment, and Reports:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2) Prepare a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of switchboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 16441

SECTION 16442 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.
4. Transient voltage suppression panelboards.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RFI: Radio-frequency interference.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Bus configuration, current, and voltage ratings.
c. Short-circuit current rating of panelboards and overcurrent protective devices.

d. UL listing for series rating of installed devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Qualification Data: For testing agency.

D. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. nclude also the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

C. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

   ~~a. Eaton Corporation; Cutler-Hammer Products.~~
   b. General Electric Co.; Electrical Distribution & Protection Div.
      1) A-series Panelboards, or
      2) SpectraSeries Power Panelboards
   ~~c. Square D.~~

2. Transient Voltage Suppression Panelboards:

   a. Current Technology.
   b. Liebert Corporation.

2.2 MANUFACTURED UNITS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces.

B. Enclosures: Flush, Surface. NEMA PB 1, Type 1.

1. Rated for environmental conditions at installed location.

   a. Outdoor Locations: NEMA 250, Type 3R.
   b. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
   c. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.
6. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
7. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

C. Phase and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
3. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
5. Split Bus: Vertical buses divided into individual vertical sections.

D. Conductor Connectors: Suitable for use with conductor material.

1. Main and Neutral Lugs: Mechanical type.
2. Ground Lugs and Bus Configured Terminators: Compression type.
3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
4. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. UL label indicating series-connected rating with integral or remote upstream overcurrent protective devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.

B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 DISTRIBUTION PANELBOARDS

A. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.

B. Main Overcurrent Protective Devices: Circuit breaker.

C. Branch Overcurrent Protective Devices:

1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.6 LOAD CENTERS

A. Overcurrent Protective Devices: Plug-in, full-module circuit breaker.

B. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.7 TRANSIENT VOLTAGE SUPPRESSION PANELBOARDS

A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

B. Main Overcurrent Devices: Thermal-magnetic circuit breaker.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

D. Bus: Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.

E. Transient Voltage Suppression Device: IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules.

1. Minimum Single-Impulse Current Ratings:

   a. Line to Neutral: 100,000 A.
   b. Line to Ground: 100,000 A.
   c. Neutral to Ground: 50,000 A.

2. Protection modes shall be as follows:

   a. Line to neutral.
   b. Line to ground.
   c. Neutral to ground.

3. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
4. Maximum UL 1449 Clamping Levels: 400 V, line to neutral and line to ground on 120/208 V, 800 V, line to neutral and line to ground on 277/480 V systems.
5. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.
6. Accessories:

   a. Six-digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125 V.

2.8 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with series-connected rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:

   a. Instantaneous trip.
   b. Long- and short-time pickup levels.

c. Long- and short-time time adjustments.
d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
4. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 16 Section "Electrical Power Monitoring and Control."
5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
9. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
10. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

D. Fuses are specified in Division 16 Section 16491.

2.9 CONTROLLERS

A. Motor Controllers: NEMA ICS 2, Class A, combination controller equipped for panelboard mounting and including the following accessories:

1. Individual control-power transformers.
2. Bimetallic-element overload relay.
3. Indicating lights.
4. Seal-in contact.

5. Push buttons.
6. Selector switches.

B. Contactors: NEMA ICS 2, Class A, combination controller equipped for panelboard mounting and including the following accessories:

1. Individual control-power transformers.
2. Fuses for control-power transformers.
3. Indicating lights.
4. Seal-in contact.
5. Push buttons.
6. Selector switches.

C. Controller Disconnect Switches: Fused switch mounted adjacent to and interlocked with controller.

2.10 ACCESSORY COMPONENTS AND FEATURES

A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Furnish portable test set to test functions of solid-state trip devices without removal from panelboard.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 74 inches above finished floor, unless otherwise indicated.

C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Install overcurrent protective devices and controllers.

1. Set field-adjustable switches and circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section 16075.

B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Ground equipment according to Division 16 Section 16060.

B. Connect wiring according to Division 16 Section 16120.

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16442

SECTION 16461 - DRY-TYPE TRANSFORMERS (600 V AND LESS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.
2. Buck-boost transformers.

1.3 SUBMITTALS

A. Product Data Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Shop Drawings: Wiring and connection diagrams.

C. Source quality-control test reports.

D. Output Settings Reports: Record of tap adjustments specified in Part 3.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C 57.12.91.

C. Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting NEMA TP 1, Class 1 efficiency levels when tested according to NEMA TP 2.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which

equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate installation of wall-mounting and structure-hanging supports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D/Groupe Schneider NA.
2. Cutler-Hammer.
3. GE Electrical Distribution & Control.
4. ~~Siemens Energy & Automation, Inc.~~
5. ~~Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.~~

2.2 MATERIALS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices, except for taps.

1. Internal Coil Connections: Brazed or pressure type.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Enclosure: Ventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

D. Indoor Transformer Enclosure Finish: Comply with NEMA 250 for "Indoor Corrosion Protection."

1. Finish Color: ANSI 49 gray.

E. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

F. Taps for Transformers Smaller Than 3 kVA: None.

G. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

I. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
2. Indicate value of K-factor on transformer nameplate.

J. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
2. Include special terminal for grounding the shield.
3. Shield Effectiveness:

a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
b. Common-Mode Noise Attenuation: Minus 120 dBA minimum at 0.5 to 1.5 kHz; minus 65 dBA minimum at 1.5 to 100 kHz.
c. Normal-Mode Noise Attenuation: Minus 52 dBA minimum at 1.5 to 10 kHz.

K. Wall Brackets: Manufacturer's standard brackets.

2.4 BUCK-BOOST TRANSFORMERS

A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.

B. Enclosure: Ventilated, NEMA 250, Type 2.

1. Finish Color: ANSI 49 gray.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls and floors for suitable mounting conditions where transformers will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Brace wall-mounting transformers as specified in Division 16 Section "Electrical Supports and Seismic Restraints."

B. Install floor-mounting transformers level on concrete bases.

3.3 CONNECTIONS

A. Ground equipment according to Division 16 Section 16060.

B. Connect wiring according to Division 16 Section 16120.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent. Submit recording and tap settings as test results.

B. Adjust buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION 16461

SECTION 16718 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. UTP cabling.
2. 50/125-micrometer, multimode optical fiber cabling.
3. Coaxial cabling.
4. RS-232 cabling.
5. RS-485 cabling.
6. Low-voltage control cabling.
7. Control-circuit conductors.
8. Fire alarm wire and cable.
9. Identification products.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. BICSI: Building Industry Consulting Service International.

C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.

D. EMI: Electromagnetic interference.

E. IDC: Insulation displacement connector.

F. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

G. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

H. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

I. RCDD: Registered Communications Distribution Designer.

J. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.

K. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

L. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For coaxial cable, include the following installation data for each type used:

a. Nominal OD.
b. Minimum bending radius.
c. Maximum pulling tension.

B. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

1. Vertical and horizontal offsets and transitions.
2. Clearances for access above and to side of cable trays.
3. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
4. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

F. Maintenance Data: For wire and cable to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical-fiber flashlight or optical loss test set.
2. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

B. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Cable Management Solutions, Inc.

b. Cablofil Inc.
c. Cooper B-Line, Inc.
d. Cope - Tyco/Allied Tube & Conduit.
e. GS Metals Corp.

2. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by hot-dip galvanizing, complying with ASTM A 123/A 123M Grade 0.55, not less than 0.002165 inch thick.

a. Basket Cable Trays: 6 inches wide and 2 inches deep. Wire mesh spacing shall not exceed 2 by 4 inches.
b. Trough Cable Trays: Nominally 6 inches wide.
c. Ladder Cable Trays: Nominally 18 inches wide, and a rung spacing of 12 inches.
d. Channel Cable Trays: One-piece construction, nominally 4 inches wide. Slot spacing shall not exceed 4-1/2 inches o.c.
e. Solid-Bottom Cable Trays: One-piece construction, nominally 12 inches wide. Provide without solid covers.

C. Conduit and Boxes: Comply with requirements in Division 16 Section "Raceways and Boxes." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Division 6 Section "Rough Carpentry".

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Belden CDT Inc.; Electronics Division.
2. Berk-Tek; a Nexans company.
3. CommScope, Inc.
4. Draka USA.
5. Genesis Cable Products; Honeywell International, Inc.
6. KRONE Incorporated.
7. Mohawk; a division of Belden CDT.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Superior Essex Inc.
10. SYSTIMAX Solutions; a CommScope, Inc. brand.
11. 3M.
12. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: 100-ohm, 4-pair UTP, formed into 25-pair binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

   a. Communications, General Purpose: Type CM or CMG; or MPP, CMP, MPR, CMR, MP, or MPG.
   b. Communications, Plenum Rated: Type CMP or MPP, complying with NFPA 262.
   c. Communications, Riser Rated: Type CMR; or MPP, CMP, or MPR, complying with UL 1666.
   d. Communications, Limited Purpose: Type CMX; or MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG.
   e. Multipurpose: Type MP or MPG; or MPP or MPR.
   f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
   g. Multipurpose, Riser Rated: Type MPR or MPP, complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Technology Systems Industries, Inc.
2. Dynacom Corporation.
3. Hubbell Premise Wiring.
4. KRONE Incorporated.
5. Leviton Voice & Data Division.
6. Molex Premise Networks; a division of Molex, Inc.
7. Nordex/CDT; a subsidiary of Cable Design Technologies.
8. Panduit Corp.
9. Siemon Co. (The).
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: 110-style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL FIBER CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Berk-Tek; a Nexans company.
2. CommScope, Inc.
3. Corning Cable Systems.
4. General Cable Technologies Corporation.
5. Mohawk; a division of Belden CDT.
6. Nordex/CDT; a subsidiary of Cable Design Technologies.
7. Optical Connectivity Solutions Division; Emerson Network Power.
8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope, Inc. brand.
10. 3M.
11. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: Multimode, 50/125-micrometer, 24-fiber, nonconductive, tight buffer, optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA/EIA-568-B.3 for performance specifications.
3. Comply with TIA/EIA-492AAAA-B for detailed specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

   a. General Purpose, Nonconductive: Type OFN or OFNG, or OFNR, OFNP.
   b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
   c. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
   d. General Purpose, Conductive: Type OFC or OFCG; or OFNG, OFN, OFCR, OFNR, OFCP, or OFNP.
   e. Plenum Rated, Conductive: Type OFCP or OFNP, complying with NFPA 262.
   f. Riser Rated, Conductive: Type OFCR; or OFNR, OFCP, or OFNP, complying with UL 1666.

5. Conductive cable shall be aluminum armored type.
6. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

C. Jacket:

1. Jacket Color: Aqua for 50/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.6 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ADC.
2. American Technology Systems Industries, Inc.
3. Berk-Tek; a Nexans company.
4. Corning Cable Systems.
5. Dynacom Corporation.
6. Hubbell Premise Wiring.
7. Molex Premise Networks; a division of Molex, Inc.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Optical Connectivity Solutions Division; Emerson Network Power.
10. Siemon Co. (The).

B. Cable Connecting Hardware: Meet the Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.

1. Quick-connect, simplex and duplex, Type SC or Type ST connectors. Insertion loss not more than 0.75 dB.
2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 COAXIAL CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alpha Wire Company.
2. Belden CDT Inc.; Electronics Division.
3. Coleman Cable, Inc.
4. CommScope, Inc.
5. Draka USA.

B. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

C. RG-11/U: NFPA 70, Type CATV.

1. No. 14 AWG, solid, copper-covered steel conductor.
2. Gas-injected, foam-PE insulation.
3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.

4. Jacketed with sunlight-resistant, black PVC or PE.
5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.

D. RG59/U: NFPA 70, Type CATVR.

1. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
2. Gas-injected, foam-PE insulation.
3. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
4. Color-coded PVC jacket.

E. RG-6/U: NFPA 70, Type CATV or CM.

1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
3. Jacketed with black PVC or PE.
4. Suitable for indoor installations.

F. RG59/U: NFPA 70, Type CATV.

1. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
3. PVC jacket.

G. RG59/U (Plenum Rated): NFPA 70, Type CMP.

1. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
2. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
3. Copolymer jacket.

H. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655, and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Cable: Type CATV, or CATVP or CATVR.
2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
3. CATV Riser Rated: Type CATVR; or CATVP, CATVR, or CATV, complying with UL 1666.
4. CATV Limited Rating: Type CATVX.

2.8 COAXIAL CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Aim Electronics; a brand of Emerson Electric Co.
2. Leviton Voice & Data Division.
3. Siemon Co. (The).

B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.9 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.10 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM or CMG.

1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.11 LOW-VOLTAGE CONTROL CABLE

A. Paired Lock Cable: NFPA 70, Type CMG.

1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.

1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

C. Paired Lock Cable: NFPA 70, Type CMG.

1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

D. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.

1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Plastic jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.12 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway power-limited tray cable, in cable tray complying with UL 83.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.13 FIRE ALARM WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Comtran Corp.
2. Draka USA.
3. Genesis Cable Products; Honeywell International, Inc.
4. Rockbestos-Suprenant Cable Corporation.
5. West Penn Wire/CDT; a division of Cable Design Technologies.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG size as recommended by system manufacturer.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.
3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

2.14 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Brady Corporation
2. HellermannTyton.
3. Kroy LLC.
4. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 16 Section "Electrical Identification."

2.15 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

E. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

F. Cable will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

C. Comply with requirements in Division 16 Section "Raceways and Boxes" for installation of conduits and wireways.

D. Install manufactured conduit sweeps and long-radius elbows whenever possible.

E. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 72 inches long shall be neatly coiled not less than 12 inches in diameter below each feed point.

G. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.3 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal raceway according to Division 16 Section "Raceways and Boxes."

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring Method:

1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
2. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is permitted.
3. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

H. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No. 14 AWG.
2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.5 CONNECTIONS

~~A. Comply with requirements in Division 13 Section "Perimeter Security" for connecting, terminating, and identifying wires and cables.~~

~~B. Comply with requirements in Division 13 Section "Intrusion Detection" for connecting, terminating, and identifying wires and cables.~~

C. ~~Comply with requirements in Division 13 Section "Security Access" for connecting, terminating, and identifying wires and cables.~~

D. Comply with requirements in Division 13 Section "Video Surveillance" for connecting, terminating, and identifying wires and cables.

E. Comply with requirements in Division 13 Section "Detention Monitoring and Control (PLC Based)" for connecting, terminating, and identifying wires and cables.

F. Comply with requirements in Division 13 Section "Fire Alarm" for connecting, terminating, and identifying wires and cables.

G. Comply with requirements in Division 15 Section "Refrigerant Monitoring and Safety Equipment" for connecting, terminating, and identifying wires and cables.

3.6 FIRESTOPPING

A. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

B. Comply with TIA/EIA-569-A, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.7 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 16 Section "Grounding and Bonding."

3.8 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 16 Section "Electrical Identification."

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.

   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. Optical Fiber Cable Tests:

   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   b. Link End-to-End Attenuation Tests:

      1) Multimode Link Measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
      2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

5. Coaxial Cable Tests: Comply with requirements in Division 16 Section "Master Antenna Television System."

D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 16718

SECTION 16735 - CLOCK SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Transmission System

1. System Controller with CDMA Receiver, GPS receiving antenna or Ethernet connection
2. Primary Internal Transmitter
3. Primary External Transmitter
4. Magnetic mount or Campus transmitting antenna

B. Wireless Synchronized Devices

1. Analog Clock
2. Digital Clock
3. Master Clock Synchronizer Module
4. Wireless Relay Module
5. Signal Indicator SiteSync IQ

1.2 RELATED SECTIONS

A. Division 16 – Electrical 120V 60Hz grounded outlet required for SiteSync IQ System Controller. Ex: Minimum 10 amp circuit

B. Division 16 - Electrical 120V 60Hz grounded outlet required for external transmitter. Ex: Minimum 10 amp circuit

C. Division 16 – Electrical 120V 60Hz grounded outlet for each AC powered clock, Master Clock Synchronizer and Wireless Relay.

1.3 REFERENCES

A. This Technical Specification and Associated Drawings.

B. National Fire Protection Agency (NFPA) – 70, National Electric Code 2005.

C. American Time & Signal, Co. SiteSync IQ Wireless Clock System User Manual.

D. American Time & Signal, Co. Master Clock Synchronizer User Manual.

E. American Time & Signal, Co. Wireless Relay (User Manual)

1.4 DEFINITIONS

A. CDMA: Use of Code Division Multiple Access (CDMA) to provide time synchronization. This is often used in the mobile telephone industry. This mode of synchronization eliminates the need to mount an outside data receiving antenna. No wiring hookup is needed for this option as the CDMA receiver is installed inside the system controller. Simply attach the hinged antenna to the system controller to initiate time synchronization. The CDMA sets the time zone information from the cell tower (no service contract required).

B. GPS: Global Positioning System, a worldwide system that employs a constellation of satellites in an integrated network to determine geographic location anywhere in the world, and which employs and transmits atomic time, the most accurate and reliable time. GPS antenna should be mounted outside with a clear view of the sky.

C. Ethernet: Time synchronization via SNTP (Simple Network Time Protocol) or Daytime Protocol. The system controller receives the same time via an Ethernet connection, which is then transmitted to your clocks. This requires a TCP/IP Network with Internet access or connection to a Network Time Server.

D. Ethernet option with CDMA or GPS: To provide system redundancy and to sync with GPS or CDMA time with the ability to control remote circuits via Remote Connect.

1.5 SYSTEM DESCRIPTION

A. SiteSync IQ Wireless Timekeeping system shall be capable of synchronizing clocks, intercom, server, computers and other equipment throughout a facility.

B. The system shall synchronize all clocks to each other. The system shall utilize CDMA, GPS, or Ethernet technology to provide atomic time to all its components. The system shall not

5 watt mag	**10 watt mag**	**10 watt campus**	**25 watt campus**	**45 watt campus**
1-2 stories	3-5 stories	3-6 stories	6-8 stories	8-12 stories
200K sq ft per floor	100K sq ft per floor	Small Campus	1 city block	1-2 city blocks
5-10 acres	10-30 acres	30-100 acres	125 acre Campus	285 acre Campus

Call American Time & Signal Co. for more information 1-800-328-8996

require any hard wiring for operation (besides AC power for specified components) except for an Ethernet patch cable for Ethernet connection or GPS antenna cable to pick up GPS signal. Analog clocks could be battery operated for full portability if required. Clocks shall automatically adjust for Daylight Saving Time per the settings in the SiteSync IQ System Controller.

C. Clocks shall synchronize to ±1 second of the time displayed on the system controller.

D. The system shall include an internal real time clock reference so that failure of the CDMA, GPS or Ethernet signal shall not cause the clocks to fail to indicate the correct time.

E. The system shall incorporate a "fail-proof" design so that a temporary power interruption shall not cause failure of the system. Upon restoration of power, the system shall resume normal operation.

F. The system shall include a signal indicator to notify local supervisor or maintenance personnel when the SiteSync IQ System Controller transmits to verify signal reception.

G. Analog clocks to be battery operated for complete portability and relocation freedom, or AC powered for many years of maintenance free operation. Batteries included.

H. Site survey instruction manual and equipment to be available for building site transmitter signal reception diagnosis.

I. System controller equipped with wired clock system run and correction output circuits and correction protocols for select wired clock systems. System controller can simultaneously operate a wired clock system and provide wireless clock signal to maintain synchronization of the wired and wireless clock systems throughout a facility. Specify wired clock correction protocol at time of order. Contact American Time & Signal Co. at 1-800-328-8996 to obtain list of standard clock codes or to obtain a custom clock code.

J. System Controller with 6 integrated signal relay circuits available for operating bells, tone generators, lighting circuits, intercom and other electrical equipment. This can be done via a direct wired connection or wirelessly via one or more wireless relay modules. System controller capable of programming and storing 99 schedules with 9999 events. Events may be programmed for momentary 1-9 second activation or toggled on and off.

K. System Controller (with Ethernet option) capable of Remote Connect Web Interface which allows for event and circuit programming as well as manual circuit activation from a remote location via a web browser. No software required.

L. Wireless Relay Module (P/N H004296, H004296-2): A remote relay that receives a wireless signal and supplies a contact closure based on the schedule in the system controller that is assigned to that circuit.

1.6 REGULATORY REQUIREMENTS

A. Equipment and components furnished shall be of manufacturer's latest model.

B. System Controller, Transmitter and Receiver shall comply with Part 90 of FCC rules, as follows:

1. This device may not cause harmful interference.
2. Transmitter frequency shall be governed by FCC Part 90.35.
3. Transmitter output power shall be governed by FCC Parts 90 and 74.

C. System shall be installed in compliance with local and state authorities having jurisdiction.

1.7 SUBMITTALS

A. Product Data: Submit complete catalog data for each component, describing physical characteristics and method of installation. Submit brochure showing available colors and finishes of clocks.

B. Operating License: A copy of the shared nationwide FCC license can be obtained from American Time & Signal Co. if desired. No special licensing is required for installation or operation.

C. Samples: Submit one clock for approval. Approved sample shall be tagged and shall be installed in the work at location directed. End user logo, mascot or custom artwork on dials is available at no charge. American Time & Signal Co. requires approval of custom dial design by end user prior to volume dial printing.

D. Manufacturer's Instructions: Submit complete installation, set-up and maintenance instructions.

1.8 SUBSTITUTIONS

A. Proposed substitutions to be considered, shall be manufactured of equivalent materials that meet or exceed specified requirements of this Section.

B. Proposed substitutions shall be identified not less than 10 days prior to bid date.

C. Other systems requiring wiring and/or conduit between system controller and clocks will not be acceptable.

1.9 QUALITY ASSURANCE

A. Permits: American Time & Signal Co. offers the use of a shared nationwide FCC license.

B. Qualifications:

1. Manufacturer: Company specializing in manufacturing commercial timekeeping systems with a minimum of 10 continuous years of documented experience.
2. Installer: End user technicians or contractor with documented experience in the installation of commercial timekeeping systems.

C. Warranty: Two year warranty on all SiteSync IQ products excluding batteries.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver all components to the site in the manufacturer's original packaging. Packaging shall contain manufacturer's name and address, product identification number, and other related information.

B. Store equipment in finished building, unopened containers until ready for installation.

1.11 PROJECT SITE CONDITIONS

A. Clocks shall not be installed until painting and other finish work in each room is complete.

B. Verify reception of CDMA signal via the use of a CDMA cell phone in the area the system Controller will be installed. No external wiring or antennas required.

C. Coordinate installation of the GPS external signal receiving antenna for access to the roof or exterior side wall so the bracket and related fasteners are securely mounted.

D. Provide Cat 6 with Internet access or connection to a Network Time; Static IP address from Network Administrator, Gateway IP address, Subnet Mask, Firewall Port, and SNTP Server Address.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. SiteSync IQ wireless timekeeping system and its components shall be manufactured by American Time & Signal Company, Dassel, MN 55325.

2.2 SYSTEM OPERATION AND START UP SEQUENCE

The SiteSync IQ system receives atomic time information from the CDMA cell towers, GPS satellite system or the Ethernet. The system controller is a powerful multitasking device that is capable of sending precise time information to synchronize all the system wireless clocks and accessories. The system can be monitored and programmed from the SiteSync IQ system controller keypad or via your PC web browser if you have the Remote Connect capability. It's important to follow steps in this order: Install system controller, confirm signal reception and then install clocks.

A. Wireless System Controller Operation:

When power is first applied to the SiteSync IQ system controller, the user shall complete the Startup Wizard to initiate system operation and signal transmission. The SiteSync IQ system controller looks for the time signal every hour from the time source your system is

designed to synchronize with. Once the system controller has received the time synchronization it sets its internal clock to that time. The system controller then starts to transmit the internal time. The system controller features an on-demand CDMA, GPS or Ethernet sync capability which is initiated by the user/installer to sync the time.

B. Analog Clock Operation:

For battery clocks, remove the insulator tab from the battery compartment of the clock. For AC powered analog clocks, apply AC power. There is no need for any additional adjustment (the clock movement adjustment is fully automatic).

After a few seconds of initial setup, the clock receiver will look for valid time transmission. The monitoring LED at the back of the clock will flash red during that period of time. After a valid time data is received the monitoring LED will turn green and ultimately stop blinking when the clock begins the correction or synchronization period. The clock will automatically look for valid time signals 4 times each day, and will adjust to the correct time if needed.

C. Digital Clock Operation:

Connect the digital clock to the120V AC power source. After several seconds of initial startup, the clock receiver will look for a valid signal transmission and synchronize to the correct time as soon as it receives a valid time from the system controller.

Note: Refer to system installation and operation manual for wiring instructions and mounting.

2.3 EQUIPMENT

A. General: A basic clock system shall include a system controller, internal or external transmitter, CDMA antenna, GPS time signal receiving antenna or Ethernet connection, analog and/or digital clocks. An expanded system can also include all accessories and options, (such as tone generator, anti-theft brackets, wireless sync relays, remote connect, wired synchronous clocks, bells, signal reception indicator, tone generators....) as needed.

B. Wireless Master: The SiteSync IQ system controller shall incorporate a display and a keypad to provide the following features:

Time zone selection via the keypad and display for all USA time zones as well as custom time zones. Includes all U.S. time zones: Eastern, Central, Mountain, Pacific, Alaska and Hawaii.
Automatic Daylight Saving Time: adjustment can be enabled or disabled from keypad
CDMA, GPS or Ethernet interface and real time status display mode
Password protected Programming Menu to set the date, local time zone, DST and other system parameters as needed

1. The system controller shall contain an internal clock such that failure of reception from the CDMA, GPS, or Ethernet will not disable the operation of the clocks

C. Time Synchronization Mode:

1. CDMA Antenna: Attach hinged CDMA antenna to the appropriate location on the back of the system controller and swing it into a vertical position for best operation.
2. GPS Antenna: Plug antenna cord into the appropriate receptacle on the back of the system controller and locate the GPS antenna outside with a clear view of the sky
3. Ethernet: Plug Cat 5 or higher patch cable into the appropriate receptacle on the back of the system controller. The controller must be linked with a TCP/IP Network with Internet access or connection to a Network Time Server

D. Transmitter: American Time & Signal Co. wireless transmitters may be internal 5 or 10 watts, or external 25, 45 and up to 100 watts. The transmitter parameters shall be:

1. Frequency Range: 450-470 MHz
2. Transmitter output power: Internal 5 or 10 watts (built into the SiteSync IQ system controller) or External 25-100 watts in external metal case
3. Transmission Range: Up to 50 miles radius (transmitter dependent)
4. Radio technology: Narrowband FM, 12.5 KHz bandwidth
5. Transmission format: POCSAG, digital one-way communication
6. Digital Data rate: 512 baud
7. Operating range: 0 to 60 degrees C / 32 to 140 degrees F

E. Transmitting Antenna: Shall be American Time & Signal Co. Part # H001263 or H002978 for indoor or outdoor applications. Antenna polarization shall be vertical.

F. Power supply: (included with system controller)

Input: 120-volt AC 50/60 Hz
Output: 12-volt DC, 3 Amps

G. Surge Protector/Battery Backup: American Time & Signal Co. Part # H002717A.

Input: 120-volt AC 60 Hz +/- 1 Hz.
Output: 120-volt AC, 550VA, 300-watts
Surge Energy Rating: 700 joules with 10x1000uS pulse

H. Analog Clocks: American Time & Signal Co. plastic analog clocks are round 10.375", 13.375" or 17.25" outside diameter. Additional colors and finishes are available from manufacturer. Metal case clocks are round and 11.125", 13.187" or 16" outside diameter. Square analog clocks are 12.562" square. Wood frame clocks are 11.750" or 17" outside diameter. Analog clocks, whether round or square, shall be wall mounted and surface or semi-flush mount. Plastic clocks shall have polystyrene frame and polycarbonate lens and metal clocks will use metal frames with glass crystals. Face (dials) shall be white (other options available). Hour and minute hands shall be black and sweep (second) hand is red. Analog clocks available as wall or ceiling mount double dial assemblies.

Other clock features shall be:

1. Analog clocks with no user mechanical adjustments. Run time of a half hour after power loss without losing time for AC versions.

2. Time shall be automatically updated from the transmitter 4 times per day.

3. Use one AA lithium or alkaline battery, battery booster pack with 4 AA lithium or alkaline batteries or AC power adapter without battery.

4. The clock shall have an ultra sensitive UHF receiver (better than -110dBm) and integrated internal antenna.

5. The clock will keep operating using its internal quartz clock in case of signal reception loss due to malfunction of the wireless system controller or transmitter.

6. Analog clock faces shall bear Owner's logo as indicated.

7. Wire guards: Provide one for each analog clock as follows:
   a. Part # 1200, 15 by 15 inch size, for nominal 12-inch diameter analog clocks.
   b. Part # 1500, 19 by 19-inch size, for nominal 15-inch diameter analog clocks.

8. Anti-theft Bracket:
   a. 12" plastic - Part # H001141
   b. 15" plastic - Part # H003699

I. Digital clocks: American Time & Signal Co. SiteSync IQ digital clocks are available with 4 digits (hours and minutes) or 6 digits (hours, minutes, and seconds) and with 1.8", 2.3", 2.5" or 4" or 8" high digits. Digital clocks are available as double dial and wall or ceiling mount. Digital clocks require 110VAC or 24VAC (optional) for operation. Time signal is received via wireless signal (other options and features available).

Other Digital Clock Features are available. Contact American Time & Signal Company directly for various options.

J. Digital Elapsed Time Indicators: Multifunction Operating Room/ ICU Elapsed Timers with count up timer with audible alarm and hold or count down timer with audible alarm and hold. Setting and control is by the Timer Control Station (included) which can be mounted up to 30' from the timer. Battery backup (included) is provided by a 9-volt rechargeable ni-cad battery (other options available). Elapsed time indicators require AC power for operation and direct wire to the Timer Control Station.

K. Wireless Relay (Part # H004296, H004296-2): A remote relay receives a wireless signal and supplies a contact closure based on the schedule in the system controller that is assigned to that circuit. Multiple modules are available that operate specifically with 1 of 6 corresponding dry contact circuits in the system controller for wireless communication with multiple products. The wireless relay module is programmable via the system controller scheduling capability for a 1-9 second momentary signal or toggled on and off.

L. Remote Connect: The Remote Connect Web interface allows for SiteSync IQ System Controller event and circuit schedule programming, manual circuit activation, time/date settings and other system configurations from your PC.

Remote Connect capabilities include triggering wired and wireless events, assigning custom durations to signals, managing programming of up to six circuits, backing up and restoring schedules to and from PC's and activating circuits manually.

Remote Connect requires Windows 2000, XP, Vista or Windows 7.

M. Digital Calendar Clocks (Part # ATS92412V-SQIT(B,R,Y,G = Blue, Red Yellow, or Green LED's): 9.25" high by 13.25" wide by 1.375" deep wireless calendar clocks receive the time and date from the SiteSync IQ System Controller. These Digital Calendar Clocks require direct connection to 120 VAC and are available with blue, red, yellow and green LED digits.

Other Digital Calendar Clock features:

1. Super bright LED's for high readability
2. Selectable 12 or 24-hour format
3. 10 year lithium battery maintains correct time during a power failure

N. SiteSync IQ Signal Indicator w/ 9v Battery Option (P/N H004292): American Time & Signal Co hand held signal indicator runs off one 9v battery or may be powered with an AC power adaptor. The Signal indicator receives data transmission from the system controller and indicates signal reception via LED lights. The Indicator LED shows red each time the unit receives signal if it is within range of the transmitter. Blinking green indicates unit has received signal within the past 5 minutes and blinking red indicates the unit has not received signal.

O. Remote Receiver: Analog clocks may be equipped with remote receivers. This option is for rooms shielded from the radio frequencies, such as hospital X-ray rooms. This option uses common RJ11 connectors on both ends of the included 25 or 50 foot cable separating the receiver component from the clock. Simply locate the clock where it needs to be, place the receiver in a known area with signal reception, and join the two via the cable. One end of the cable will plug into the remote receiver and the other end will plug into the RJ11 jack on the clock.

PART 3 – INSTALLATION

3.1 SITE EXAMINATION:

A. Verify that construction is complete in the areas where equipment is to be installed and that rooms are clean and dry.

B. Verify that a 120 VAC electrical outlet is located within 6 feet of the location of the System Controller and the outlet is operational and properly grounded.

C. Verify that all 120-volt electrical outlets for the AC powered clocks are located at the exact installation points and the outlets are operational and properly grounded.

3.2 SYSTEM INSTALLATION:

Refer to the manufacturer installation manuals as supplied with the system, to install each one of the system components.

3.3 INSPECTION:

Prior to final acceptance, inspect each system component to function properly and replace parts that are found defective.

3.4 CLEANING:

Prior to final acceptance, clean exposed surfaces of all system components, using cleaning methods recommended by the manufacturer.

3.5 DELIVERY:

If needed, provide technical assistance as demonstrated in the manufacturer's system user guide, on product start up and system setup, to owners or installers representatives via phone: 800-328-8996, fax: 800-789-1882 or e-mail: www.sitesyncwireless.com

SECTION 16775 - ASSISTIVE LISTENING SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work included: All labor, materials, appliances tools, equipment, facilities transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section. Complete as specified herein. Work includes, but is not necessarily limited to, the following:

a. Examine all other sections for work related to those other sections and required to be included as work under this section.
b. General provisions and requirements for electrical work.

A. Conduit system, outlets, and related equipment shall be furnished and installed complete by the same contractor. All wiring shall be installed in a conduit system. The system shall be installed by the manufacturer's authorized installer. The entire system operation, function, testing, and maintenance for one year after final acceptance by the District, shall be the responsibility of the Contractor.

B. The Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system, so that the system shall perform the function listed herein compliance with all the specified requirements.

1.2 SUBMITTAL

A. Complete bill of materials, including all quantities of components, devices, equipment, and wiring, required shall be submitted to complete this project.

B. Complete bill of materials, including all quantities of components, devices, equipment, and wiring, required shall be submitted to complete this project.

C. Manufacturers specification sheets, model numbers of equipment, and descriptions of component operation shall be submitted.

1.3 EQUIPMENT QUALIFICATION

A. The specification is based on the equipment of manufacturers who have been approved by the District, and the manufacturers herein named shall be considered as meeting the requirements of this specification. For all items which are identified by part number and manufacturer, the performance specifications, which are published in the most recent manufacturer's data sheets, available at the time of bidding this project shall be applicable to the present work as though fully written out herein.

B. All equipment shall conform to all federal, state, and local applicable codes and ordinances, and shall be listed by Underwriter Laboratories.

PART 2 - PRODUCTS

2.1 CONFERENCE AND MEETING ROOMS: Provide Assistive Listening System per CBC Section 1104B.2. The minimum number of receivers shall be equal to 4% of the seating and as indicated in this section, but not less than two. The System is a FM Hearing Assistance System as manufactured by Phonic Ear or equal by William Sound. The system for Conference And Meeting Rooms shall include the following:

A. Provide 1/2 wave 3 dB gain co-linear UHF ground-independent antenna, universal mounting bracket, tripod, and necessary coax cable on roof. Tripod to be provided under this section and installed by General Contractor. Verify exact location.

B. Provide Assistive Listening System to include the following devices and additional devices as required by DSA:

a. (1) Transmitters, Catalog number PE 550T Base Station mounted in 19" rack. The base station shall operate at in 72 MHZ – 76 MHZ band and shall be furnished with remote mounted antenna to cover a minimum of 1000 ft.
b. (40) Receivers, Catalog number PE 300R Single Channel Receiver for use by the listener with standard Walkman-style headset AT541. Receiver must be capable of being clipped to a pocket or belt. Unit must be provided with two AA rechargeable nickel cadmium batteries.
c. (40) Ear-buds.
d. (1) Antennas, TELEX HGA-1, or equal (no known equal)
e. (4) Catalog number PE 300C Battery Charger Organizer. Unit must be capable of storing or recharging up to 12 receiver at one time. The charger must be capable of recharging the nickel cadmium batteries without removing the batteries from the receiver.

C. Provide the following IPA Accessories:

a. (1) Direct microphone compatible with TELEX system, ST-200, or equal (no known equal).

2.2 The system for the conference room shall include the following:

a. Four (4) Portable transmitter(as required by DSA), Telex TW 6, or equal (no known equal)

END OF SECTION 16775

SECTION 16852 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Nonsystem smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Remote annunciator.
8. Addressable interface device.
9. Digital alarm communicator transmitter.
10. System printer.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.6 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

   a. Trained and certified by manufacturer in fire-alarm system design.
   b. NICET-certified fire-alarm technician, Level III minimum.
   c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72. 2002
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. 2002

E. Qualification Data: For qualified Installer.

F. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

G. Field quality-control reports.

H. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

   a. Frequency of testing of installed components.
   b. Frequency of inspection of installed components.
   c. Requirements and recommendations related to results of maintenance.
   d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

I. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.8 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
5. Keys and Tools: One extra set for access to locked and tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fire Alarm System shall be Manufactured by Notifier unless pre-approved during Bid process. Contractor shall incure all cost associated by any substitution including, but not limited to obtaining approved DSA shop drawings.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Close smoke dampers in air ducts of designated air-conditioning duct systems.
5. Recall elevators to primary or alternate recall floors.
6. Activate systems as identified on Sheet E0.03 fire alarm sequence of operations.

C. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

D. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

Version 5.3

a. Applicable system software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
b. Include a real-time clock for time annotation of events on the event recorder and printer.

2. Addressable initiation devices that communicate device identity and status.

   a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
   b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.

   a. Initiating Device Circuits: Style B.
   b. Notification Appliance Circuits: Style Y.
   c. Signaling Line Circuits: Style 4.

D. Elevator Recall:

1. Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall.

   a. Elevator lobby detectors except the lobby detector on the designated floor.
   b. Smoke detector in elevator machine room.
   c. Smoke detectors in elevator hoistway.

2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

   a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

E. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Vented, wet-cell pocket, plate nickel cadmium.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
3. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.
4. MAXIMUM PROJECTION FROM WALL, 4 INCHES.
5. WITHOUT AUTOMATIC ALERT.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

3. Each sensor shall have multiple levels of detection sensitivity.
4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
5. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

2.8 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.9 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall.

2.10 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter

shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches above the finished floor.

1. Comply with requirements for seismic-restraint devices.

C. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.

5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

E. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

F. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

H. Device Location-Indicating Lights: Locate in public space near the device they monitor.

I. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

J. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

3.2 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections. Connect hardware and devices to fire-alarm system.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated air-conditioning duct systems.
4. Alarm-initiating connection to elevator recall system and components.
5. Alarm-initiating connection to activate emergency lighting control.
6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
9. Supervisory connections at fire-pump engine control panel.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 16 Section 16075.

B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter 4/10 in NFPA 72, 2002.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire

Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 13852