SECTION 16421
UTILITY SERVICE ENTRANCE

PART 1 - GENERAL

1.1 Section Includes:

a. Arrangement with Utility Company for permanent electric, telephone and cable TV service including payment of Utility Company charges for service.

b. Underground service entrance.

c. Metering equipment.

1.2 References:

a. CEC-California Electrical Code.

1.3 System Description:

a. Power Utility Company: Southern California Edison Company (SCE)

1. System Characteristics: 408Y/277V, three phase four-wire 60 Hertz.

b. Telephone Utility Company: Verizon California, Inc.

c. Cable TV Utility Company: Time Warner Cable

1.4 Submittals:

a. Submit under provisions of Section 01340.

b. Submit Utility Company prepared drawings.

1.5 Quality Assurance:

a. Perform Work in accordance with Utility Company written requirements.

b. Maintain one copy of each document on site.

1.6 Regulatory Requirements:

a. Conform to requirements of CEC.

b. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.7 Pre-Installation Conference:

a. Convene two weeks prior to commencing work of this action.

1.8 Field Measurements:

b. Verify that field measurements are as indicated on Utility Company drawings.

PART 2 - PRODUCTS

2.1 Utility Meters:

a. Meters will be furnished by Utility Company.

2.2 Utility Meter Base:

b. Meter base shall be per Utility Company requirements.

2.3 Metering Transformer Cabinet:

a. Manufacturers: Per utility company requirements.

b. Include provisions for padlocking and sealing.

2.4 Transformer Slab Box:

a. Manufacturers:

1. Associated Quick Set.

2. Brooks.

b. Description: Precast concrete transformer slab box with cable pit sized as indicated on Drawings.

PART 3 - EXECUTION

3.1 Examination:

a. Verify conditions

b. Verify that service equipment is ready to be connected and energized.

3.2 Preparation:

a. Make arrangements with Utility Company to obtain permanent electric service to the Project.

b. Coordinate location of Utility Company's facilities to ensure proper access is available.

3.3 Installation:

a. Install service entrance conduits in concrete envelope from Utility Company's underground vault to Utility Company's pad-mounted transformer and to service entrance equipment. Utility Company will install conductors from underground vault to Utility Company's pad mounted transformer, and from pad mounted transformer to service entrance equipment.

b. Provide pre-cast concrete slab box for Utility Company transformer.

END OF SECTION - 16421

SECTION 16426
DISTRIBUTION SWITCHBOARDS

PART 1 - GENERAL

1.1 Section Includes:

a. Main switchboard.

b. Distribution switchboard.

1.2 References:

a. CEC-California Electrical Code.

b. ANSI/IEEE C12.1-Code for Electricity Metering.

c. ANSI C39.1 - Electrical Analog Indicating Instruments.

d. ANSI C57.13 - Instrument Transformers.

e. NEMA AB 1 - Molded Cases Circuit Breakers and Molded Case Switches.

f. NEMA KS 1 - Enclosed Switches.

g. NEMA PB 2 - Deadfront Distribution Switchboards.

h. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.

1.3 Submittals:

a. Submit under provisions of Section 01340.

b. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; and switchboard instrument details.

c. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.

d. Test Reports: Indicate results of factory production tests.

e. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instruction for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 Operation and Maintenance Data:

a. Submit operation and maintenance data.

b. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 Qualifications:

a. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum five years experience.

1.6 Regulatory Requirements:

a. Conform to requirements of CEC.

b. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and shown.

1.7 Pre-Installation Conference:

a. Convene one week prior to commencing work of this section.

1.8 Delivery, Storage, and Handling:

a. Deliver, store, protect, and handle products to site under provisions of Section 01600.

b. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.

c. Accept switchboards on site. Inspect for damage.

d. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction, debris, and traffic.

e. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosed, and finish.

1.9 Environmental Requirements:

a. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

1.10 Field Measurements:

a. Verify that field measurements are as instructed by manufacturer.

1.11 Maintenance Materails:

a. Provide maintenance materials.

b. Provide two of each key.

PART 2 - PRODUCTS

2.1 Manufacturers:

a. Square D

b. General Electric

2.2 Switchboard:

a. Description: NEMA PB 2 with electrical ratings and configurations as indicated.

b. Main Section Devices: Panel mounted

c. Distribution Section Devices: Panel mounted

d. Bus Material: Copper with tin plating, standard size.

e. Bus Connections: Bolted accessible from front only for maintenance.

f. Fully insulate bus bars. Do not reduce spacing of insulated bus.

g. Ground Bus: Extend length of switchboard.

h. Molded Case Circuit Breakers: NEMA AB 1, integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

i. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.

j. Ground Fault Sensor: Zero sequence type where indicated on drawings.

k. Ground Fault Relay: Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches, where indicated on drawings.

l. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.

PART 3 - EXECUTION

3.1 Examination:

a. Verify conditions.

b. Verify that surface is suitable for switchboard installation.

3.2 Preparation:

a. Provide concrete housekeeping pad.

3.3 Installation:

a. Install switchboard in locations shown on Drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1.

b. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

3.4 Field Quality Control:

a. Field inspection and testing will be performed under provisions of Section 01410.

b. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

c. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each, at test voltage of 1000 volts; minimum acceptable value for insulation resistance in 2 meg ohms.

d. Check tightness of accessible bolted bus joints using calibrated torque wrench.

3.5 Adjusting:

a. Adjust all operating mechanism for free mechanical movement.

b. Tighten bolted bus connections in accordance with manufacturer's instructions.

c. Adjust circuit breaker trip and time delay settings to values as approved by the Architect.

3.6 Cleaning:

a. Touch up scratched or marred surfaces to match original finish.

END OF SECTION - 16426

SECTION 16441
ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 Section Includes:

a. Fusible switches.

b. Nonfusible switches.

c. Fuses.

1.2 References:

a. NEMA KS 1- Enclosed Switches.

b. CEC-California Electrical Code.

c. UL 198C-High-Interrupting Capacity Fuses; Current Limiting Type.

d. UL 198E-Class R Fuses

e. NECA- Standard of Installation.

1.3 Submittals:

a. Submit under provisions of Section 01340.

b. Product Data: Provide switch ratings and enclosure dimensions.

c. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Products testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 Quality Assurance:

a. Perform Work in accordance with NECA Standard of Installation.

b. Maintain one copy of each document on site.

1.5 Qualifications:

a. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum five years experience.

1.6 Regulatory Requirements:

a. Conform to requirements of CEC.

b. Furnish products listed and classified by UL as suitable for purpose specified and shown.

1.7 Extra Materials:

a. Provide three of each size and type fuse installed.

PART 2 - PRODUCTS

2.1 Manufacturers:

a. General Electric.

b. Square D.

2.2 Enclosed Switches:

a. Fusible Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate Class RJ-5 fuses.

b. Nonfusible Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

c. Enclosures: NEMA KS 1.

1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.

2.3 Fuses:

a. Manufacturers:

1. Gould Shawmut
2. Bussman
3. Reliance

b. Description: Dual element, current limiting, time delay, one-time fuse, 600 volt, UL 198C and UL 198E, Class RK 1.

c. Interrupting Rating: 200,000 RMS amperes.

PART 3 - EXECUTION

3.1 Installation:

a. Install disconnect switches where indicated.

b. Install fuses in fusible disconnect switches.

c. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

END OF SECTION - 16441

SECTION 16450
GROUNDING

PART 1 - GENERAL

1.1 Work Included:

a. Power system grounding.

b. Communication system grounding.

c. Electrical equipment and raceway grounding and bonding.

1.2 System Description:

a. Ground the electrical service system neutral at service entrance equipment to building steel, metallic water service and to supplementary grounding electrodes to include ground rods, ufer ground and ground ring or as indicated on drawing.

b. Ground each separately-derived system neutral to nearest effectively grounded metallic water pipe, nearest effectively grounded building structural steel member, and to separate grounding electrode to include ground rods, ufer ground and ground ring, or as indicated on drawings.

c. Provide communications system grounding conductor at point of service entrance and connect to nearest effectively grounded metallic water pipe, nearest effectively grounded building structural steel member, and to separate grounding electrode to include ground rods, ufer ground and ground ring or as indicated on drawings.

d. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceway cables, receptacle ground connectors, and plumbing systems.

1.3 Submittals:

a. Submit scaled shop drawings under provisions of Section 01340.

b. Indicate layout of ground ring, location of system grounding electrode connections, and routing of grounding electrode conductor.

PART 2 - PRODUCTS

2.1 Materials:

a. Ground Rods: Copper-encased steel ¾ inch diameter, minimum length 10 feet. (Where noted on drawings.)

PART 3 - EXECUTION

3.1 Installation:

a. Provide a separate, insulated equipment grounding conductor in feeder and branch circuits. Terminate each end on a grounding lug, bus, or bushing.

b. Connect grounding electrode conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.

c. Supplementary Grounding Electrode: Use driven ground rod on exterior of building and in main service equipment area. Install ground rod in suitable recessed well; fill with gravel after connection is made. Use effectively grounded metal frame of the building. Use minimum of 40 feet, No. 4/0 bare copper wire embedded in concrete foundation and use minimum 40 feet, No. 4/0 bare copper wire embedded in concrete foundation and use minimum 40 feet, No. bare copper buried 24 inches below grade or as indicated on drawings.

d. Use minimum 1/0 AWG or as indicated on drawings, copper conductor for communications service grounding conductor. Leave 10 feet slack conductor at terminal board or cabinet.

e. Isolated Grounding System: Use insulated equipment grounding conductor and connect only to service grounding electrode or to separate grounding electrode as indicated on drawings.

f. Provide grounding and bonding at serving utility company's metering equipment and pad-mounted transformer in accordance the serving utility company requirements.

3.2 Field Quality Control:

a. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

b. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 10 ohms.

END OF SECTION - 16540

SECTION 16461
DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.0 General Requirements:

a. Section 16010, "Basic Electrical Requirements" with additions and modifications specified herein apply to this section.

1.1 Work Included:

a. Dry type two winding transformers.

1.2 References:

a. ANSI/NEMA ST 1-Specialty Transformers

b. ANSI/NEMA ST 20 - Dry Type Transformers for General Applications.

1.3 Submittals:

a. Submit product data under provisions of Section 01340.

b. Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, loss data, efficiency at 25, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, and rated temperature rise.

1.4 Delivery, Storage and Handling:

a. Store and protect products.

b. Store in a warm, dry location with uniform temperature. Cover ventilating openings to keep out dust.

c. Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet, or snow if handled in inclement weather.

PART 2 - PRODUCTS

2.1 Dry Type Two Winding Transformers:

a. Manufacturers:

1. Square D

2. General Electric

b. Dry Type Transformers shall be two winding type, air cooled, with copper windings, of the voltage rating and capacity indicated on the Drawings.

c. Transformers shall be ventilated steel enclosed with conduit knockouts to the wiring compartment.

d. Transformer primaries shall have two 2 ½ percent FCAN, and two 2 ½ percent FCBN taps.

e. Transformer noise level shall be NEMA standard for general purpose transformers. Rubber vibration dampers shall be installed between core and coil assembly and mounting bracket.

f. Transformers shall have load lugs for full capacity parallel wiring in a compartment suitable for termination with specified conductors.

g. Transformer nameplates shall carry all electrical data, including taps, voltage combination wiring diagram, tap terminal arrangement, KVA, impedance and reactance. Transformer submittal shall include nameplate information, db level, 25% - 50% - 75% and full load losses, height, width, length, and weight.

h. Identified transformers shall be furnished with engraved laminated nameplates identifying the transformer, feeder source, and panel or load fed.

PART 3 - EXECUTION

3.1 INSTALLATION

a. Set transformer plumb and level.

b. Use liquid tight flexible conduit, 2ft minimum length, for connections to transformer cases. Make conduit connections to side panel of enclosure.

c. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.

d. Provide seismic restraints.

3.2 FIELD QUALITY CONTROL

a. Check for damage and tight connections prior to energizing transformers.

b. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION - 16461

SECTION 16470
PANELBOARDS

PART I - GENERAL

1.1 Work Included:

a. Service and distribution panelboards.

b. Lighting and appliance branch circuit panelboards.

1.2 References:

a. FS W-C-375 – Circuit Breakers, Molded Case, Circuit and Service.

b. FS W-C-379 – Molded Case Circuit Breakers.

c. FS W-P-115 – Power Distribution Panel

d. NEMA AB 1 – Molded Case Circuit Breakers.

e. NEMA PB 1.1 – Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or less.

1.3 Submittals:

a. Submit shop drawings for equipment and component devices under provisions of Section 01340.

b. Include outline and support point dimensions, voltages, main bus ampacity, integrated short circuit ampere rating and circuit breaker arrangement and sizes.

1.4 Spare Parts:

a. Keys: Furnish 4 each to Owner.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers:

a. Square D

b. General Electric

2.2 Main and Distribution Panelboards:

a. Panelboards: NEMA PB 1; and FS W-P-115, circuit breaker type as indicated on drawings.

b. Enclosure: NEMA PB 1; Type 1 for dry interior and Type 3R for exterior and damp locations unless otherwise indicated on drawings. Cabinet size: As indicated on Drawings.

c. Provide cabinet front with concealed trim clamps and hinged door with flush lock. Finish in manufacturer's standard gray enamel.

d. Provide panelboards with copper bus, ratings as scheduled on Drawings. Provide separate copper neutral ground buses in all panelboards. Provide insulated ground bus as indicated on drawings.

e. Minimum Integrated Short Circuit Rating: 22,000 amperes rms symmetrical for 208 volt panelboards; 30,000 amperes rms symmetrical for 480 volt panelboards or as shown on Drawings.

f. Molded Case Circuit Breakers: NEMA AB 1 and FS W-C-375; provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

g. Current Limiting Molded Case Circuit Breakers; NEMA AB 1 and FS W-C-375; provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

2.3 Branch Circuit Panelboards:

a. Lighting and Appliance Branch Circuit Panelboards: NEMA PB1; and FS W-P-115; circuit breaker type.

b. Enclosure: NEMA PB 1; Type 1 for dry interior locations and Type 3R for exterior and damp locations unless otherwise indicated on drawings.

c. Cabinet Size: 6 inches deep; 20 inches wide.

d. Provide flush cabinet front with concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

e. Provide panelboards with copper bus, ratings as scheduled on Drawings. Provide separate copper neutral and ground buses in all panelboards. Provide insulated ground bus as indicated on drawings.

f. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards or as shown on Drawings.

g. Molded Case Circuit Breakers: NEMA AB 1 and FS W-C-375; bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on Drawings.

h. Current Limiting Molded Case Circuit Breakers: NEMA AB 1 and FS W-C-375; provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

PART 3 - EXECUTION

3.1 Installation:

a. Install panelboards plumb and flush with wall finishes, in conformance with NEMA PB 1.1.

b. Height: 6ft.

c. Provide filler plates for unused spaces in panelboards.

d. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads and/or to reflect as-built conditions.

e. Stub 5 empty ¾ inch conduits to accessible location above ceiling and below floor out of each recessed panelboard.

3.2 Field Quality Control:

a. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

b. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers.

END OF SECTION - 16470

SECTION 16476
ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 Section Includes:

a. Enclosed molded case circuit breakers

1.2 References:

a. FS W-C-375 – Circuit Breakers, Molded Case, Branch Circuit and Service.

b. NEMA AB 1-Molded Case Circuit Breakers.

1.3 Submittals:

a. Submit product data under provisions of Section 01340.

b. Include circuit breaker and current limiter ratings, trip current and let-through current curves, outline dimensions, and terminal lug sizes.

1.4 Regulatory Requirements:

a. Use circuit breakers listed by Underwriter's Laboratories, Inc., and suitable for specific application.

1.5 Extra Materials:

a. Submit extra materials.

b. Submit three of each size and type current limiter.

PART 2 - PRODUCTS

2.1 Manufacturers:

a. Square D

b. General Electric

2.2 Molded Case Circuit Breaker:

a. Circuit Breaker: NEMA AB 1 and FS W-C-375.

B Service Conditions:

1. Temperature: 115 degrees F.

2.3 Configuration:

a. Configuration: Inverse time automatic tripping.

b. Field-Adjustable Trip Circuit Breaker: NEMA AB 1; Provide circuit breakers with frame sizes 200 amperes and larger with mechanism for adjusting long time,

short time and continuous current and short time, long time pickup current setting for automatic operation.

c. Field-Changeable Ampere Rating Circuit Breakers: NEMA AB 1; provide circuit breakers with frame sizes 200 amperes and larger with changeable trip units.

d. Current Limiting Circuit Breaker: Provide circuit breaker as indicated on drawings with automatic-resetting current limiting elements in each pole. Let-through Current and Energy: Less than permitted for same size Class RK-5 fuse.

e. Solid-State Circuit Breaker: Provide circuit breaker as indicated on drawings with electronic sensing, timing and tripping circuits for adjustable current settings; ground fault trip with integral ground fault sensing; instantaneous trip; and adjustable short time trip.

2.4 Ratings:

a. Ratings: NEMA AB 1; as indicated on drawings.

2.5 Terminal Lugs:

b. Size: NEMA AB 1, copper, suitable for conductor size and quantity indicated on drawings.

2.6 Current Limiters:

a. Current Limiter: Designed for application with molded case circuit breaker.

b. Coordinate limiter size with trip rating of circuit breaker to prevent nuisance tripping and to achieve interrupting current rating specified for circuit breaker.

c. Provide interlocks to trip circuit breaker and to prevent closing circuit breaker when limiter compartment cover is removed or when one or more limiter is not in place or has operated.

2.7 Enclosure:

a. Enclosure: NEMA AB 1; Type 1 for dry interior locations and Type 3R for exterior or damp locations unless otherwise indicated on drawings.

b. Fabricate enclosure from steel.

c. Finish using manufacturer's standard enamel finish, gray color.

2.8 Accessories:

a. Provide accessories as indicated on drawings to NEMA AB.

1. Shunt Trip Device: 120 volts, AC unless otherwise indicated on drawings.
2. Under voltage Trip Device: 120 volts, AC unless otherwise indicated on drawings.
3. Auxiliary Switch: 120 volts, AC. unless otherwise indicated on drawings.
4. Alarm Switch: 120 volts, AC. unless otherwise indicated on drawings.
5. Electrical Operator: 120 volts, AC. unless otherwise indicated on drawings.

b. Handle Lock: Include provisions for padlocking.

c. Provide mechanical trip device.

PART 3 - EXECUTION

3.1 Examination:

a. Verify that surfaces are ready to receive work.

b. Verify field measurements are as shown on Drawings.

c. Verify that required utilities are available, in proper location, and ready for use.

d. Beginning of installation means installer accepts conditions.

3.2 Installation:

a. Install enclosed circuit breakers where shown on Drawings, in accordance with manufacturer's instructions.

3.3 Adjusting:

a. Adjust trip settings so that circuit breakers coordinate with other overcurrent protective devices in circuit.

b. Adjust trip settings to provide adequate protection from overcurrent and fault currents.

3.4 Field Quality Control:

a. Inspect and test each circuit breaker to NEMA AB 1.

b. Inspect visually and perform several mechanical ON-OFF operations on each circuit breaker.

c. Verify circuit continuity on each pole in closed position.

d. Determine that circuit breaker will trip on over-current condition, with tripping time to NEMA AB 1 requirements.

e. Include description of testing and results in test report.

END OF SECTION - 16476

SECTION 16480
MOTOR CONTROL

PART 1 - GENERAL

1.1 Work Included:

a. Manual motor starters.

b. Magnetic motor starters.

c. Combination magnetic motor starters.

1.2 References:

a. ANSI/NEMA ICS-Enclosures for Industrial Controls and Systems.

b. ANSI/UL 198E – Class R Fuses.

c. FS W-C-375 – Circuit Breakers, Molded Case; Branch Circuit and Service.

d. FS W-F-870- Fuseholders (For Plug and Enclosed Cartridge Fuses.)

e. FS W-S-865 – Switch Box (Enclosed), Surface-Mounted.

f. NEMA AB 1 – Molded Case Circuit Breakers.

g. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

h. NEMA KS 1 - Enclosed Switches.

i. NEMA PB 1.1 – Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.3 Submittals:

a. Submit shop drawings and product data under provisions of Section 01340.

b. Indicate on shop drawings, front and side views of motor control center enclosures with overall dimensions. Include conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral and ground; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.

c. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

d. Submit manufacturers' instructions under provisions of Section 01340.

1.4 Operation and Maintenance Data:

a. Submit operation and maintenance data.

b. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 Delivery, Storage, and Handling:

a. Deliver in 60 inch maximum width shipping splits, individually wrapped for protection, and mounted on shipping skids.

b. Store and protect products

c. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

d. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center compartments, enclosure, and finish.

1.6 Spare Parts:

a. Keys: Furnish 4 each to Owner

b. Fuses: Furnish to Owner 3 spare fuses of each type and rating installed.

c. Fuse Pullers: Furnish two fuse puller to Owner.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers – Motor Starters:

a. Square D

b. General Electric

2.2 Manual Motor Starters:

a. Manual Motor Starter: NEMA ICS 2; size M-1P, number of poles as indicated on drawings, AC general-purpose Class A manually operated non-reversing full-voltage controller for induction motors rated in horsepower, with overload relay, low voltage protection, red pilot light, NO auxiliary contact, and push button operator.

b. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, 2 pole, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle operator or key operator if indicated on drawings.

c. Motor Starting Switch: NEMA ICS 2; AC general-purpose Class A manually operated 2 pole, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, low voltage protection, red pilot light, NO auxiliary contact, and push button operator.

d. Enclosure: ANSI/NEMA ICS 6; Type 1 for dry interior locations and Type 4 for outdoor and damp locations unless otherwise indicated on drawings.

2.3 Magnetic Motor Starters:

a. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

b. Full voltage Starting: Non-reversing type.

c. Coil Operating Voltage: 120 volts, 60 Hertz

d. Size: NEMA ICS 2; Size I minimum or as shown on Drawings.

e. Overload Relay: NEMA ICS 2 bimetal

f. Enclosure: NEMA ICS 6; Type 1 for indoor locations; 3R for outdoor and wet locations.

g. Combination Motor Starters: Combine motor starters with disconnecting means, fusible switch type or as indicated on drawing.

h. Auxiliary Contacts: NEMA ICS 2; four field convertible contacts in addition to seal-in contact.

i. Pushbuttons: NEMA ICS 2; START/STOP in front cover.

j. Indicating Lights: NEMA ICS 2; RUN: Red in front cover.

k. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO, locking type, in front cover.

l. Relays: NEMA ICS 2; 120 volt 60 hertz coil; four pole.

m. Control Power Transformers: 120 volt secondary, 100 VA minimum, in each motor starter.

2.4 Controller Overcurrent Protection and Disconnecting Means:

a. Molded Cases Thermal-Magnetic Circuit Breakers: NEMA AB1 and FS W-C-375; circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

b. Motor Circuit Protector: NEMA AB 1 and FS W-C-375; circuit breakers with integral instantaneous magnetic trip in each pole.

c. Nonfusible Switch Assemblies: NEMA KS 1 and FS W-S-865; quick-make, quick-break; load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

d. Fusible Switch Assemblies: NEMA KS 1 and FS W-S-865; quick-make; quick-break; load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: FS W-F-870. Designed to accommodate Class R fuses.

2.5 Acceptable Manufacturers – Fuses:

a. Gould Shawmut

b. Bussman

c. Reliance

2.6 Fuses:

a. Fuses: ANSI/UL 198E, Class RK1. As indicated on Drawings; dual element, current limiting, time delay, one-time fuse, 600 volt or as indicated on drawings.

b. Interrupting Rating: 200,000 rms amperes.

PART 3 - EXECUTION

3.1 Installation:

a. Install motor control equipment in accordance with manufacturer's instructions.

b. Motor Starter Panelboard Installation: In conformance with NEMA PB 1.1.

c. Install fuses in fusible switches.

d. Select and install heater elements in motor starters to match installed motor characteristics.

e. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

END OF SECTION - 16480

SECTION 16485
CONTACTORS

PART 1 - GENERAL

1.1 Section Includes:

a. General purpose contactors.

b. Lighting contactors.

1.2 References:

a. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

b. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

c. ANSI/NFPA 70 - National Electrical Code.

d. C.E.C.- California Electrical Code.

1.3 Project Record Documents:

a. Submit under provisions of Section 01720.

b. Accurately record actual locations of each contactor and indicate circuits controlled.

1.4 Operation and Maintenance Data:

a. Submit operation and maintenance data.

b. Maintenance Data: Include instructions for replacing and maintaining coil and contacts.

1.5 Qualifications:

a. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years experience.

PART 2 - PRODUCTS

2.1 General Purpose Contactors:

a. Description: NEMA ICS 2, AC general purpose magnetic contactor.

b. Coil Voltage: 120 volts, 60 Hertz or as indicated on drawings.

c. Poles: As indicated on drawings.

d. Size: As indicated on drawings

e. Enclosure: ANSI/NEMA ICS 6, Type as required to meet conditions of installation.

f. Accessories: As shown.

2.2 Lighting Contactors:

a. Description: NEMA ICS 2, magnetic lighting contactor.

b. Configuration: Mechanically held, 2 wire control or as indicated on drawings.

c. Coil Voltage: 120 volts, 60 Hertz or as indicated on drawings.

d. Poles: As indicated on drawings

e. Contact Rating: Match branch circuit overcurrent protection, considering derating for continuous loads.

f. Enclosure: ANSI/NEMA ICS 6, Type as required to meet conditions of installation.

g. Accessories: As shown on drawing.

2.3 Accessories:

a. Pushbuttons and Selector Switches: NEMA ICS 2, heavy duty type.

b. Indicating Lights: NEMA ICS 2, Class A300.

PART 3 - EXECUTION

3.1 Installation:

a. Install in accordance with manufacturer's instructions.

END OF SECTION - 16485