

## SECTION 262400 - ELECTRICAL DISTRIBUTION EQUIPMENT

## 1. GENERAL

- A. All electrical distribution equipment shall be dead front UL listed for the purpose and application. All equipment shall meet or exceed all applicable requirements of the National Electrical Code (N.E.C.). Any device or component, i.e., switchboard, panel, breaker, switch, etc., used as service entrance equipment, shall be listed for use at 100% of the rated capacity.

**\*NOTE TO DESIGNER, REMOVE IF NOT APPLICABLE****2. UL RE-CERTIFICATION OF EXISTING EQUIPMENT**

- A. *Where existing switchboards, panelboards, motor control centers, and similar are modified in a manner that changes how the original equipment was shipped from the factory the contractor shall obtain a UL Field Evaluation and the equipment shall be provided with new UL certifications and UL Field Evaluation Marking. Modifications include but are not limited to tapping of bussing, dismantling and rebuilding of gear, or the installation of aftermarket breakers, components, etc. UL re-certification shall not be required for the following conditions:*

- (1) If a new breaker listed or classified by the manufacturer for installation in the gear is provided in an existing prepared space. Contractor must submit documentation of this classification if the breaker type is not specifically noted on the panelboard product data.*
- (2) Removal of existing breakers*
- (3) Removal of conductors to/from gear*
- (4) Addition of conductors to/from gear*

*The contractor shall carry all costs associated with the evaluation and re-certification. The contractor shall submit the service agreement with the UL certified for review by the engineer prior to execution. All work shall be approved by the Authority Having Jurisdiction.*

## 3. DISTRIBUTION PANELBOARDS (600 AMPERE OR GREATER)

- A. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinets to be equipped with latch and tumbler-type lock on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. End walls shall be removable. Fronts shall be of code gauge steel, with gray baked enamel finish electrodeposited over cleaned, phosphatized steel.
- B. The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers. Bus structure shall be full height of panel.
- C. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50°C. rise above ambient. Heat rise tests shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of conductor

dimensions will not be accepted in lieu of actual heat tests. All panelboards unless otherwise noted shall have space to accept forty-two 20 amp one pole circuit breakers.

- D. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between "ON" and "OFF." Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. All panelboards shall be capable of accepting 225 amp 3 pole branch breakers as a minimum unless otherwise noted.
- E. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on schedules on the plans or as determined by verification with local utility company. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. The short circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Testing of panelboard overcurrent devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.
- F. Arc Flash Hazard warning labels shall be affixed to all panelboards in accordance with Article 110.16 of the National Electrical Code. All components protected by a manually-operated arc energy reduction means shall have an additional label affixed that describes the location of the energy reduction means.
- G. Provide energy reducing maintenance switch with local status indicator for any breaker or equipment rated or adjustable to 1,200 Amps or greater.
- H. Distribution panelboards shall be Square "D", G.E., Siemens, Eaton/Cutler-Hammer or approved equivalent.
- I. Lockable breakers shall be provided for all breakers serving all HVAC equipment, Plumbing equipment, and kitchen appliances.

#### 4. BRANCH PANELBOARDS

- A. This section covers lighting and power panelboards (refer to schedules, notes on Drawings and the Electrical One-Line Diagram, of the Contract Drawings).
- B. All panelboards shall be of the circuit breaker type, and shall be of one manufacturer.
- C. Branch panelboards shall be as indicated on the drawings and as specified herein. The lighting panelboards shall be of the dead-front, quick-make, quick-break, plug-in circuit breaker type, with trip indicating and trip free handles. All circuits shall be clearly and properly numbered and shall be provided with thermal magnetic protection. The panelboards shall be enclosed in code gauge, galvanized steel cabinets with smooth finished hinged doors without visible external fasteners and

heavy chrome locks. Locks shall all be keyed alike. Each door shall have a directory card inside, covered with a plastic shield, filled in with black india ink or typewritten with circuit numbers and description indicated. Room numbers shall be coordinated with final room numbers as selected by Owner -- not numbers on Contract Documents.

Special Note: The room numbers used to fill out the panel directories shall match the actual final name and numbering scheme selected by the Owner. They shall not be filled out per the construction drawing numbering scheme, unless the Contractor is directed to do so by the Architect or Engineer.

- D. Branch panelboards shall be surface or flush mounted as indicated on the Contract Drawings.
- E. Circuit breakers for 120/208 volt systems shall be of 10,000 A.I.C. RMS symmetrical rating unless otherwise indicated on the Contract Drawings. For 277/480 volt systems, provide circuit breakers with 14,000 A.I.C. ratings unless otherwise indicated.
- F. All main bus and connections thereto in branch panelboards shall be copper. All bus bars shall extend full length of panelboards.
- G. All circuit breakers used to switch lights shall be SWD (switching duty) rated and U.L. listed for the purpose.
- H. Where required by the National Electrical Code, provide branch arc-fault circuit interrupters (A.F.C.I.'s) in branch panelboards, whether indicated on the panel schedule or not. They shall be U.L. listed, latest edition.
- I. Where branch circuit breakers feed hermetically, sealed compressor for cooling or refrigeration equipment, provide U.L. listed H.A.C.R.-style circuit breakers.
- J. Where branch circuit breakers are indicated or required to be ground-fault circuit-interrupting type (G.F.C.I.), they shall have test and reset buttons and be U.L. listed, latest edition. Do not share neutrals with other circuits.
- K. Where branch circuit breakers are feeding H.I.D. (high-intensity-discharge) loads, they shall be rated and listed for such loads. Provide proper circuit breaker whether indicated on panel schedules or not.
- L. Arc Flash Hazard warning labels shall be affixed to all panelboards in accordance with Article 110.16 of the National Electrical Code. All components protected by a manually-operated arc energy reduction means shall have an additional label affixed that describes the location of the energy reduction means.
- M. Panels shall be Square "D", G.E., Siemens, Eaton/Cutler-Hammer or approved equivalent.
- N. Lockable breakers shall be provided for all breakers serving all HVAC equipment, Plumbing equipment, and kitchen appliances.

## 5. INSTALLATION INSTRUCTIONS

- A. Panelboards with circuit breakers installed before the building has been finished and cleaned shall be masked.
- B. All dust and debris shall be removed from the panels before they are energized and placed in service.
- C. All panelboard fronts shall be omitted until final punch list inspection is made. Directories for each panelboard shall be completed and available for review by the Engineer at that time.
- D. All service equipment shall be marked with the maximum available fault current and the date of the calculation. This information shall be obtained in writing from the serving utility. Provide label adjacent to the service disconnecting means. Document action of the fault current shall be included in the operation and maintenance manual. This labeling shall be provided for all new service installations, service upgrades, and any project that adds or replaces distribution panels or branch panel boards.
- E. Where applicable - Provide a warning sign on the service entrance equipment indicating type and location of all on-site emergency power sources in accordance with the NEC.
- F. Where applicable – Provide warning sign(s) for alternative power devices (photovoltaic, wind, fuel cell, etc.) on all equipment in accordance with the NEC.
- G. All emergency system switchgear, distribution panels and branch panelboards shall be provided with surge protection devices in accordance with the NEC. Refer to Section 264313 Surge Suppression Systems.

## 6. SAFETY SWITCHES

- A. Provide heavy duty safety switches as a final disconnecting means as required by NEC and/or as indicated on the Contract Drawings.
- B. All safety switches shall be NEMA Type 1, NEMA 3R, NEMA 4 stainless steel, NEMA 12, or as required by the operating environment, Heavy Duty Type HD, UL listed.
- C. All safety switches shall have switch blades that are fully visible in the "OFF" (open) position with the door open.
- D. All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.
- E. Switch mechanism shall be quick-make, quick-break, load break rated, such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing and opening action of the contacts has started. The handle and mechanism shall be an integral part of the box (not cover) with facilities for pad locking in the open or closed position with up to three padlocks. Switch doors shall be interlocked with switch handle so that the door can only be opened when the switch is in the "OFF" (open) position.
- F. Arc Flash Hazard warning labels shall be affixed to all switches in accordance with Article 110.16 of the National Electrical Code. All components protected by a manually-operated arc energy

reduction means shall have an additional label affixed that describes the location of the energy reduction means.

- G. Switches shall be as manufactured by Square D., G.E., Siemens, Eaton/Cutler-Hammer or approved equivalent.

## 7. FUSES

- A. Upon completion of the building, the Contractor shall provide the owner with spare fuses as shown below. All fuses shall be Bussmann, Shawmut, Gould or Reliance.

(1) 10% (minimum of 3) of each type and rating of installed fuses shall be supplied as spares:

(2) Bussmann spare fuse cabinets - Catalog No. SFC - shall be provided to store the above spares.

- B. No fuses shall be installed in the equipment until the installation is complete, including tests and inspections required prior to being energized. All fuses shall be of the same manufacturer to insure retention of selective coordination, as designed.

- C. Circuits 601 to 6000 amperes shall be protected by current limiting BUSSMANN HI-CAP TIME DELAY FUSES KRP-C. Fuses shall employ "O" rings as positive seals between the end bells and the fuse barrel. Fuses shall be a time-delay type and must hold 500% of rated current for a minimum of 5 seconds, clear 20 times rated current in .01 seconds or less and be listed by Underwriter's Laboratories, Inc., with an interrupting rating of 200,000 amperes R.M.S. symmetrical. The fuses shall be UL Class L.

- D. Circuits 0 to 600 amperes shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses, LPN-RK (250 volts) or LPS-RK (600 volts). All dual element fuses shall have separate overload and short circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284°F melting point alloy and shall be independent of the short-circuit clearing chamber. The fuse shall hold 500% of rated current for a minimum of 10 seconds and be listed by Underwriters Laboratories, Inc. with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK1.

- E. Motor Circuits - All individual motor circuits rated 480 amperes or less shall be protected by BUSSMANN LOW PEAK DUAL-ELEMENT FUSES LPN-RK (250 volts) or LPS-RK (600 volts). The fuses for 1.15 service factor motors shall be installed in rating approximately 125% of motor full load current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the Type KRP-C HI-CAP Time Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts) installed in rating approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class RK1 or L.

- F. Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual Element fuses LPN-RK (250 volts) or LPS-RK (600 volts) as shown on the drawings. The fuses shall be UL Class RK1.

## 8. DISTRIBUTION TRANSFORMERS

- A. The Contractor shall provide dry-type transformers as manufactured by Square "D", G.E., Siemens, Eaton/Cutler-Hammer or equivalent. KVA ratings shall be as indicated on the electrical plans and shall have copper windings.
- B. Three phase transformers are to have 480 volt Delta primary and 120/208V/30/4W secondary. 30 KVA transformers and larger are to be supplied with 2-22% full capacity taps above and (4) 2-1/2% full capacity taps below primary voltage. Exceptions to the above will be shown on the electrical plans.
- C. Transformers 30 KVA and above shall be Class H, 115°C. and shall have the ability to carry a continuous 15% overload without exceeding a 115°C rise above 40° ambient.
- D. Transformer coils shall be vacuum impregnated with non-hygroscopic, thermosetting varnish. Each layer shall have end fillers or tie downs to provide maximum mechanical strength. Insulation systems and their construction techniques shall be listed by Underwriters Laboratories.
- E. Transformer coils shall have a final wrap of electrical insulating material designed to prevent injury to the coil wire. Transformers having coils with magnet wire visible will not be acceptable.
- F. All cores to be manufactured from a high grade, non-aging, silicon steel with high magnetic permeabilities, low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below saturation to allow for a minimum of 10% over voltage excitation. The cores shall be clamped with structural angles (formed angles not acceptable) and bolted to the enclosure to prevent damage during shipment or rough handling.
- G. The core and coil unit shall be completely isolated from the enclosure by means of a vibration isolating system and shall be so designed as to provide for continual securement of the core and coil unit to the enclosure. Sound isolating systems requiring the removal of all tie down facilities will not be acceptable.
- H. Transformers 15 KVA thru 45 KVA shall be provided with interchangeable mounting for floor or wall.
- I. The maximum top of case temperature shall not exceed 35°C above ambient.
- J. The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed and finished with baked enamel.
- K. The core and coils shall be visibly grounded to the frame of the transformer cubicle by means of a flexible grounding strap of adequate size.
- L. Sound levels shall be guaranteed by the manufacturer and substantiated by certified tests on each unit furnished. The sound levels are not to exceed the following values: 10 to 45 KVA, 42 D.B. to 150 KVA; 45 D.B., 225 to 300 KVA; 50 D.B. and 500 KVA, 54 D.B.
- M. If a particular "K" rating is specified for a dry-type transformer, that rating shall be provided.

- N. Transformers shall be as manufactured by Square D, G.E., Eaton/Cutler-Hammer, Siemens, Niagara or approved equivalent.

## 9. CONTACTORS

### A. General

- (1) Contactors shall be continuously rated at the specified amperes per pole for all types of ballast and tungsten lighting, resistance and motor load. Contactors shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts will not be acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring. Contactors shall have straight-through wiring with all terminals clearly marked. Contactors shall have a gasketed NEMA Type 1 (NEMA 12 for electrically-held) enclosure, unless otherwise noted or required.
- (2) Contactors shall be approved per UL 508 and/or CSA, and be designed in accordance with NEMA Standards. They shall be industrial-duty rated for applications to 600 volts maximum. I.E.C.-style contactors are not acceptable.
- (3) Contactors shall have provisions for factory or field addition of:
  - a. Four N.O. or N.C. auxiliary contacts rated 6 amperes continuous at 600 volts.
  - b. Single or double circuit, N.O. or N.C., 30 or 60 ampere 600 volt power-pole adder.
  - c. Control-circuit fuse holder, one or two fuses.
  - d. 0.2-60 second adjustable interval timer attachment, if so indicated on plans.
  - e. Transient-suppression module for coil control circuit. Coil control to be 120 volts. Provide circuit or step-down transformer.

### B. Electrically Held Lighting Contactors

- (1) Contactor coils shall be continuously rated and encapsulated, 120 volt rated. Enclosures shall be NEMA 12, to minimize noise transmission.

### C. Mechanically Held Lighting Contactors

- (1) Coil-clearing contacts shall be supplied so that the contactor coils shall be energized only during the instance of operation. Both latch and unlatch coils shall be encapsulated. Coils shall be rated for 120 volt operation.
- (2) Lighting contactors shall be Square D Class 8903 or equivalent by G.E., Siemens, Eaton/Cutler-Hammer or Allen-Bradley.

END OF SECTION 262400