

SECTION 26 20 00 - LOW VOLTAGE ELECTRICAL DISTRIBUTION

PART 1 - GENERAL

1.1 DESIGN REQUIREMENTS

- A. Motors, Starters and Protection: Electrical contractor will supply and install all motor controllers and disconnect switches.
- B. Panelboards:
 - 1. Provide a minimum of four (4) – 3/4” spare conduits out of panels. Run empty conduit to accessible spaces and label conduits as spare.
 - 2. All lighting and power panels will be specified to provide minimum of 30% spare capacity and spare breaker space.
 - 3. A/E will provide panel indexes on contract drawings. Final indexes to be provided and installed by the Contractor will correspond to final university room number schedule.
 - 4. The switching of lights from lighting panels is acceptable only if specifically approved by the university CBO, through the University Project Manager; and if approved, a separate panel will be provided for circuits, which are to be controlled. No circuits other than lighting will originate in the panel thus provided. In the rare instance of lights being switched by breaker, provide switch-rated breakers.
- C. Grounding and Testing: Transformer neutrals of separately derived systems secondaries will be grounded by way of a grounding conductor between the secondary neutral and grounding buss at the main service entrance equipment. Size determined in accordance with NEC.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Cartridge Fuses:
 - a. Bussmann Div., Cooper Industries, Inc.
 - b. Littelfuse Inc.
 - c. Or equal
 - 2. Fusible Switches:
 - a. Square D Co.
 - b. Allen-Bradley Co.
 - c. General Electric Co.
 - 3. Eaton-Cutler HammerMolded-Case Circuit Breakers:
 - a. Square D Co.
 - b. General Electric Co.
 - c. Siemens Energy & Automation, Inc.
 - d. Eaton-Cutler HammerABB Power Distribution, Inc.
 - 4. Combination Circuit Breaker and Ground Fault Circuit Interrupters:
 - a. Square D Co.
 - b. General Electric Co.
 - c. Siemens Energy & Automation, Inc.
 - 5. Eaton-Cutler HammerSafety Switches:
 - a. Siemens – Energy Automation Or equal
 - 6. Motor Starters:
 - a. Allen-Bradley Co.
 - 7. Panelboards:
 - a. General Electric Co. Siemens – Energy Automation

- b. Square D
 - c. Eaton-Cutler Hammer
 - d. Panelboards shall match existing throughout facility in remodel situations.
8. Motor Control Centers:
- a. Allen - Bradley
 - b. ITE
 - c. GE
 - d. Square D
 - e. Westinghouse/Cutler Hammer

2.2 MATERIALS, GENERAL

A. Motor Starters:

1. Shall be combination circuit breaker (magnetic only) full voltage magnetic type with 3-leg overload protection in NEMA I enclosure. Provide 2 interlock contacts of interchangeable open-close type. Provide hand-off automatic selector, motor running transformer type red LED pilot light and reset button in cover. Control circuits shall be provided with individual 120-volt control transformers. Starters shall be furnished under electrical contract. Size starts as required by NEC.
2. Starters for fractional horsepower (1/2 HP or less) 120-volt motors shall be manual type, unless shown otherwise, equipped with built-in overload protection. All magnetic starters shall be of one manufacturer. For all thermal overload switches provide General Electric type CR101 or equal of other acceptable manufacturer.
3. All motors larger than 1/2 HP shall be 3 phase.
4. Motors above 25 HP will require step starting or VFDs to limit starting current.
5. All motors to be provided with external overload running protection. This is in addition to any 'built-in' protection inherent in the motor.
6. All motors of 1-1/2 HP and larger shall be of a high or premium efficient type and have an efficiency of not less than those values as stated in the IEEE test procedures, 112A Method B.

B. Panelboards:

1. Panelboards shall be bolt on, circuit breaker type. Panelboard bus shall be copper and shall be size to meet the continuous and short circuit rating as shown on the drawings.
2. All panel covers will be factory painted with low gloss enamel (not flat wall paint) suitable for metal. No field painting will be permitted. Toggle type covers not acceptable.
3. Panelboards shall be of door-in-door construction.
4. Panelboards shall be fully rated. The use of Series rated panelboards is prohibited.
5. Non linear land panelboards shall be provided in areas with heavy computer boards or laboratory equipment leads. These panelboards shall be provided with 200% neutrals.

C. Power Factor Correction: All motors 20 HP and larger will be power factor corrected to a minimum of 95% at design load. HVAC systems may be corrected at the motor control center.

D. Over current Protective Device:

1. General: Provide OCPDs in indicated types, as integral components of panelboards, switchboards, motor control centers, and other related equipment; and also as individually enclosed and mounted single units.
2. Where OCPDs are to be installed in existing panelboards, switchboards, and motor control centers, they shall be of the same manufacture and type as those existing in the equipment.

E. Cartridge Fuses:

1. General: Unless indicated otherwise, provide nonrenewable cartridge fuses of indicated types, classes, and current ratings that have voltage consistent with the circuits on which used.
2. All fuses used for main, feeder, or branch-circuit protection shall be UL listed, current limiting fuses with 200,000 ampere interrupting rating and shall be so labeled. Fuses used for supplementary protection (other than branch circuit protection) shall be as specified above or shall be UL approved or component recognized for such purposes. The same manufacturer shall furnish

all fuses provided. Should equipment provided require a different UL class or size of fuse, the engineer shall be furnished sufficient data to ascertain that system function will not be adversely affected.

3. Fuses over 600 amperes shall be UL Class "L" fuses; and shall have minimum time-delay of 10 seconds at 500% rating.
4. To simplify fuse replacement, reduce spare fuse inventory and insure adequate thermal protection, all fuses 600 amperes and below shall be true dual-element time-delay fuses with separate spring-loaded thermal overload elements in all ampere ratings. All ampere ratings shall be designed to open at 400 degree F or less when subjected to a non-load oven test.
5. To eliminate induction heating, all fuse ferrules and end caps shall be non-ferrous and shall be bronze or other alloy not subject to stress cracking.
6. Class L Fuses: UL 198C, "High-interrupting Capacity Fuses, Current-limiting Type."
7. Class RK1 and RK5 Dual Element Time-delay Fuses: UL 198E, "Class R Fuses."

F. Fusible Switches:

1. General: UL 98 "Enclosed and Dead Front Switches" and NEMA KS-1 "Enclosed Switches," quick-make, quick-break, heavy-duty units.
2. Rating: Load-breaking capacity in excess of the normal horsepower rating for the switch.
3. Withstand Capability: In excess of the let-through current permitted by its fuse when subject to faults up to 100,000 RMS symmetrical amperes.
4. Operation: By means of external handle.
5. Interlock: Prevents access to switch interior except when in "off" position.
6. Fuse Clips: Rejection type.
7. Padlocking Provisions: For 2 padlocks whether open or closed.
8. Enclosure for Switchboard or Panel board Mounting: Suitable for panel mounting where indicated.
9. Enclosure for Switchboard Mounting: Provide individual mounting where indicated.
10. Enclosure for Independent Mounting: NEMA Type 1 enclosure except as otherwise indicated or required to suit environment where located.
11. Contacts shall be NEMA rated 75 degree C.
12. Provide fuses for safety switches and other equipment of classes, types, and rating needed to fulfill electrical requirements for services indicated.
13. Provide auxiliary contacts for disconnects supplied from variable frequency drives.

G. Safety Switches:

1. Heavy-duty type, horsepower rated for motors. Quick-make, Quick-break, load interrupter enclosed knife switch with externally operable handle. Handle shall be lockable in the "off" position.
2. Standard enclosure NEMA 1 indoors and NEMA 3R weather-tight outdoors.

H. Molded-case Circuit Breakers:

1. General: UL 489, "Molded Case Circuit Breakers and Circuit Breaker Enclosures," and NEMA AB 1, "Molded Case Circuit Breakers."
2. Construction: Bolt-in type breakers.
3. Characteristics: Indicated frame size, trip rating, number of poles, and a short-circuit interrupting capacity rating of 10,000 amperes symmetrical for 120 and 208 volt devices and 14,000 amperes symmetrical for 277 and 480 volt devices, unless a greater rating is indicated or required to match existing devices or equipment.
4. Tripping Device: Quick-make, quick-break toggle mechanism with inverse-time delay and instantaneous over current trip protection for each pole.
5. Solid State Molded Case Circuit Breakers: Provide with electronic sensing, timing and tripping circuits for adjustable current settings; ground fault trip, instantaneous trip and adjustable short time and long time. The instantaneous shall be capable of being turned on and off on the main service breaker only.
6. Enclosure for Switchboard or Panel board Mounting: Suitable for panel mounting in switchboard or panel boards where indicated.

7. Enclosure for Switchboard or Motor Control Center Mounting: Provide individual mounting where indicated.
 8. Enclosure for Independent Mounting: NEMA Type 1 enclosure, except as otherwise indicated or required to suit environment where located.
- I. Combination Circuit Breakers and Ground Fault Circuit Interrupters: UL 943, “Ground Fault Circuit Interrupters,” arranged for sensing and tripping for ground fault current in addition to over current and short-circuit current. Provide features as follows:
1. Match features and module size of panel board breakers and provide clear identification of ground fault trip function.
 2. Trip Setting for Ground Fault: Recalculate / reset as required by additional loads in excess of 100A @ 480v 3-phase.
- J. Distribution Switchboard:
1. NEMA PB 2 with electrical ratings and configurations as indicated. Main section shall be individually mounted. Distribution devices shall be group mounted. Provide for future provisions.
 2. Bus material shall be copper and shall be fully insulated. Bus connections shall be bolted and shall be accessible from the back. Ground bus shall run the entire length of the switchboard.
 3. Line and Load Terminations: Accessible from the front. Suitable for the conductor size and type shown.
 4. Ground Fault Sensor: Zero sequence type.
 5. Align sections in front. Switchboard height shall be 90 inches. Finish shall be manufacturer's standard light gray. Mimic bus shall be provided.
- K. Motor Control Center
1. NEMA ICS 2, Class II Type A, B or C. Voltage and current ratings shall be as shown on the drawings. Enclosure shall be NEMA ICS 6 Type 1 or 2.
 2. Main over current protection shall be molded case circuit breaker sized as shown on the drawings.
 3. Vertical and horizontal bus shall be copper and rated as shown on drawings.
- L. Secondary Substation: Secondary substations are prohibited without prior approval from the university facilities.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Maintenance Stock Fuses: Refer to Section 01 78 46 – Extra Stock Materials.
- B. Independently Mounted OCPDs: Locate as indicated and install in accordance with manufacturer’s written installation instructions.
- C. OCPDs in distribution and branch circuit equipment shall be factory installed.
- D. Connections: Check connectors, terminals, bus joints, and mountings for tightness. Tighten field-connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer’s published torque tightening values. Where manufacturer’s torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.
- E. Grounding: Provide equipment-grounding connections for individually mounted OCPD units as indicated and as required by NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.
- F. Panel boards:

1. Except as otherwise noted, locate panel boards as follows: Dimensions given are from finished floor.
 - a. 6'-6" to top of trim.
 2. Contractors who are modifying or installing new electrical panels must redo the panel directory making the directory current. In the case of a new panel, the panel directory must coincide with actual (correct) building room numbers. Panel schedules need to be updated when extra circuits are added or when the entire panel is upgraded, such as with remodel jobs. Final directory shall be typed, hand written directories are not acceptable.
 3. Only one wire per breaker will be allowed.
 4. Wire shall be neatly formed to contour with the panel box. Remove all excess wire lengths.
 5. Every panel shall have a grounding bar installed in its interior. Attached to the grounding bar shall be a grounding conductor taken to earth ground and/or a domestic water copper or metal pipe when appropriate as required by NEC.
 6. An energized panel shall not be left exposed or unlocked to the general public, such as in a hallway, office, or other pedestrian walkway. Panel covers shall be reinstalled at the end of the workday.
 7. Attach panel boards to concrete walls or floors with a concrete type anchor approved for the purpose that requires drilling of the concrete and manually driving in the anchor by force. Do not use powder-actuated or plastic anchors to secure panel boards. Do not use horizontally approved anchors for vertical applications.
 8. Panel identification is imperative. The panel shall be identified on the outside of the panel cover per Section 26 05 53.
 9. Panel cover hardware shall be replaced if broken or not operating properly.
 10. Breakers shall be labeled odd numbers on left side; even numbers on right side.
 11. Match existing building equipment wherever possible and/or coordinate with the University Project Manager.
 12. Provide externally mounted TVSS units for all Information Technology panels.
- G. Switchboards:
1. Install switchboard on 4-inch housekeeping pad. Install switchboards in accordance with manufacturer's recommendations. Tighten bus connections after placing switchboard.
 2. Coordinate size of switchboard with door openings and access corridors to assure that switchboards can be moved after structure is complete.
- H. Motor Control Centers (MCC): Install MCC on 3-inch housekeeping pad. Install MCC in accordance with manufacturer's recommendations.
- I. Electrical panels, switchgear, and any kind of electrical distribution boards shall not be worked hot.
- J. All mechanical ductwork and piping not directly serving the electrical room shall be prohibited in electrical room. All plumbing piping, and storm drains are prohibited to be routed through electrical rooms.
- K. Provide a framed record drawing of the complete and final electrical distribution one-line. Mount in the main electrical room.
- L. Secondary Unit Substation:
1. Install 3-inch housekeeping pad for unit substation.
 2. Install in accordance with drawings and manufacturer's instructions.

END OF SECTION 26 20 00