

PART 1 GENERAL

The requirements of the contract contained in either, Division 01, or Division 26 shall also apply to the work/requirements of this section.

1. SECTION INCLUDES

- A. This specification covers low voltage load centers with main circuit breakers or main lugs and plug-in circuit breaker feeders as specified below and as shown on the contract drawings.

2. RELATED SECTIONS

- A. Not Applicable – No related sections

3. REFERENCES

- A. As applicable to the specifics of the project drawings and the specifics of the equipment design for this project, the low voltage load centers, installed protective devices and other installed components in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted on the project drawings or annotated in any sections below).
 - 1. NFPA 70, National Electrical Code
 - 2. UL 67, Standards for Panelboards
 - 3. UL 50, Standards for Cabinets and Boxes
 - 4. UL 489, Molded Case Circuit Breakers
 - 5. UL 869, Standards for Service Equipment
 - 6. Federal Specification W-C 375B, Circuit Breakers

4. DEFINITIONS

- A. Overcurrent Protective Device = a circuit breaker pole. Example: a 2-pole device is considered 2 protective devices.
- B. Short Circuit Rating = shall be the interrupting rating of the lowest rated device in the load center or applicable UL/cUL series rating for proper main and branch device combinations.
- C. Protective Devices = molded case circuit breakers.
- D. Fully Rated System = The short-circuit ratings of all protective devices are equal to or exceed the available short-circuit current of the system.
- E. Series-Connected System = The short-circuit rating of the upstream device is fully rated at its location, but the downstream devices are not fully rated. The downstream device has lower interruption rating than the available fault current at its location.
- F. Series-Connected Rating = UL/cUL permits assigning a short-circuit rating to a combination of devices (molded-case circuit breakers and/or fuses) connected in series that is higher than the lowest rated protective device in the combination. Note:
 - 1. Series ratings are applicable only when the end-use equipment is so marked.
 - 2. The combination rating cannot exceed the rating of the protective device furthest upstream.
 - 3. Upstream device can be a molded-case circuit breaker or fuse.
 - 4. Device combinations are not limited to those in the same equipment. They can be in different equipment, such as the combination of a meter stack tenant feeder

breaker or panelboard feeder breaker and a downstream load center main versus a load center main and its branches.

5. Any distance between devices in different equipment is permitted.
6. Total fault current magnitude must flow through all protectors. Thus, fault current contribution from motors, as well as power source fault current, must flow through upstream and downstream protectors.

5. SUBMITTALS

- A. The contractor/installer shall provide electronic copies of the following documents in PDF format as SUBMITTAL drawings to the engineer/owner for review and evaluation. It is preferred that the drawing format be provided in letter/size "A" (8.5" x 11") or tabloid/size "B" (11" x 17") format to facilitate easy copying. Manufacturing of the equipment will not begin until the submitted documents are stamped/noted "approved" or "approved as noted" by the engineer/owner and officially released for manufacturer by the contractor/installer/distributor/owner.
- B. APPROVAL documents for the specified product shall include:
 1. Load Center Information Drawing – by the equipment manufacturer. This "by each type" document shall contain at least the following information for each type of load center on the project. For exactly identical types, quantities of the load center shall also be indicated.
 - a. Panel Description – provide a dimensioned outline drawing, knockout configurations, ampere rating, voltage rating, aic value, bus material, enclosure rating, trim type and cable terminal data for the main lugs, neutral lugs and ground lugs.
 - b. Main Description – provide ampere rating, number of poles (for main device) or number of phases (for main lugs), type of main as breaker (with details of breaker style) or lugs, and the incoming lug range
 - c. Branch Devices – providing a listing of the quantity of each type of branch device and the branch breaker ampere value with number of poles
 2. Load Center Brochure – detailing the general construction of the product – by the equipment manufacturer
 3. Product Data Sheets for the breakers and any other components – by the equipment manufacturer
- C. The contractor/installer shall provide electronic copies of the following documents in PDF format as AS BUILT drawings to the engineer/owner for review and evaluation. It is preferred that the drawing format be provided in letter/size "A" (8.5" x 11") or tabloid/size "B" (11" x 17") format to facilitate easy copying. Manufacturing of the equipment will not begin until the submitted documents are stamped/noted "approved" or "approved as noted" by the engineer/owner and officially released for manufacturer by the contractor/installer/distributor/owner.
- D. AS BUILT documents for the specified product shall include:
 1. Load Center Information Drawing – by the equipment manufacturer. This "by each type" document shall contain at least the following information for each type of load center on the project. For exactly identical types, quantities of the load center shall also be indicated.

- a. Panel Description – provide a dimensioned outline drawing, knockout configurations, ampere rating, voltage rating, aic value, bus material, enclosure rating, trim type and cable terminal data for the main lugs, neutral lugs and ground lugs.
- b. Main Description – provide ampere rating, number of poles (for main device) or number of phases (for main lugs), type of main as breaker (with details of breaker style) or lugs, and the incoming lug range
- c. Branch Devices – providing a listing of the quantity of each type of branch device and the branch breaker ampere value with number of poles and cable terminal sizes

2. Load Center Installation Instructions – by the equipment manufacturer.

6. QUALITY ASSURANCE (QUALIFICATIONS)

- A. The manufacturer shall have specialized in the manufacture of low voltage load centers and associated circuit breakers for at least 15 years.
- B. The load centers shall be listed and/or classified by Underwriters Laboratories in accordance with standards listed in the "REFERENCES" section of this specification above

7. DELIVERY, STORAGE, AND HANDLING

- A. The contractor /installer shall receive, store, protect and handle the load centers and breakers in accordance with recommended practices listed in manufacturer's Installation Instructions and/or Maintenance Manuals.
- B. The manufacturer shall ship each load center in an individual carton for ease of handling.
- C. The contractor/installer shall inspect and if necessary, report any concealed damage to carrier within 48 hours of the load centers and breakers being delivered. The contractor/installer shall be responsible for all claims with the shipper.
- D. The contractor/installer shall store the load center and breakers in a clean, dry space and shall maintain factory protection and/or cover the components with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. The contractor/installer shall refer to the manufacturer's Installation Instructions and/or Maintenance Manuals for any and all requirements to keep the equipment in compliance with the warranty.
- E. The contractor/installer shall handle the load centers and breakers in accordance with all appropriate NEMA and manufacturer's written instructions to avoid damaging them.

8. PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)

- A. The contractor/installer shall follow all appropriate standards and service conditions before, during and after the load center installation.
- B. The load centers shall be located in well ventilated areas, free from excess humidity, dust and dirt and away from hazardous materials.
- C. Indoor locations shall be protected to prevent moisture from entering enclosure.

9. WARRANTY

- A. The Manufacturer warrants the load centers and breakers be free from defects in materials and workmanship for 1 year from date of installation or 18 months from date of shipment, whichever occurs first. The equipment must be received, stored and installed in accordance with the manufacturer's Installation Instructions and/or Maintenance

Manuals to avoid nullifying this warranty.

- B. In the event of that any warranty work needs to be performed, a representative of the manufacturer shall be notified in writing of the problem. The factory will then issue instructions and any materials to correct the problem. All warranty work must be performed by the manufacturer at the manufacturer's discretion in order to maintain the manufacturer's warranty.

10. FIELD MEASUREMENTS

- A. The contractor/installer shall make all necessary field measurements to verify that the load centers shall fit in the allocated space in full compliance with the minimum required clearances recommended by the manufacturer, specified in National Electrical Code and required by any applicable local/facility constraints.

PART 2 PRODUCTS

1. MANUFACTURER & DESIGN

- A. **General Electric products by ABB** have been used as the basis for design and is the *preferred provider for the equipment. Other possible acceptable manufactures are listed below. The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.
1. **GE by ABB** – PowerMark PRO/Gold/Plus Load Centers (basis of design)
 2. Eaton/Cutler Hammer –CH Load Centers
 3. Siemens – PL Series Load Centers
 4. Square D – QO Load Centers
- B. Request for acceptance as an approved equal manufacturer must be submitted to the engineer in writing (letter, fax or e-mail) at least 10 business days prior to the bid date. A written (letter, fax or email) response from the engineer/owner will then be issued determining the acceptance or rejection of the request.
- C. Any and all exceptions to the requirements detailed in this specification shall be included in the manufacturer's proposal so that the engineer/owner can easily make a comparison to this base specification document.
- D. If no exceptions or qualification are contained in the manufacturer's proposal, the manufacturer shall provide exactly what is detailed in this section of the specification. Failure to meet the requirements of the specification or to note any exceptions or qualifications will result in the technical rejection of the proposal.
- E. The first source of general information shall be these general specifications; however, detailed and specific information contained in the drawings will take precedent over these general specifications as the drawings contain project specific information. In the event of a conflict the owner/engineer will determine which is correct.

2. EQUIPMENT INFORMATION - **Item #9**

- A. Refer to the project drawings and load center schedules for the locations, layouts, breaker details and installed components. The drawings and schedules shall also include information about the current and voltage ratings of devices, the bus bars as well as other assemblies.
- B. Equipment Requirements
1. The low voltage load centers shall be designed to accept circuit breakers as the protective device. All feeder/branch breakers shall be plug-in type only [with plug-on neutral connection].
 2. The load centers shall be UL/cUL listed and shall bear the UL/cUL label.
 3. All load centers with a main breaker shall be supplied with a means to bond the neutral to the ground in the field; so that if desired, the panel may be suitable for use as a service entrance device.
 4. Boxes shall be made from galvanized steel having multiple knockouts on the top, bottom, sides and back to offer multiple locations for the conductors to enter the enclosure. The boxes shall also be of sufficient size to provide at least a minimum code gutter space on all sides. Outdoor units shall be provided in a high scratch resistant standard gray finish.
 5. Trims shall be shall be provided in a high scratch resistant standard gray finish. The finish paint shall be of a type to which field applied paint will adhere.

- 6. The cover shall self-adjust for flush applications.
- C. The supply voltage and the phase / neutral specifics of the load centers shall be as shown on the project drawings and the load center schedules.
 - D. Each load center assembly including breakers shall have a minimum short circuit rating of **10K RMS** symmetrical amperes at the voltage noted above. This value shall be equal to or greater than the short-circuit available from all sources. The load center shall also contain a label indicating this short circuit value at rated voltage.
 - E. The load centers shall be **fully** rated
 - F. Bussing Requirements
 - 1. **Given the superior performance of copper as a conductor, the bus bars for the main and cross connectors shall be of tin plated copper construction. Use of aluminum bus bars and cross connectors must be noted as an exception in all documents, bill of material, and approval drawings.**
 - 2. Bussing shall be braced throughout to conform to industry standard practice governing short-circuit stresses in load centers.
 - 3. Neutral bus shall have a suitable lug for each outgoing feeder requiring a neutral connection that is the same of same ampacity as the branch circuit.
 - G. All interiors shall be either factory assembled with main breaker, main lugs or have field convertible mains.
 - H. Interiors shall be designed so that while the bus is de-energized, branch circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors. Branch circuit should be able to be changed without machining, drilling or tapping the bus or connection straps.
 - I. A physical means must be provided to prevent the installation of more over-current devices than that number for which the enclosure was designed.
 - J. All wire connectors and terminals shall be of the solderless type and shall be suitable for copper or aluminum wire. All connectors shall meet the "Requirements for Wire Connectors and Soldering Lugs" UL 486B.
 - K. All load centers where marked shall be suitable for use with 60/75 degrees C rated wire.
 - L. Enclosure
 - 1. The overall unit enclosure shall be **NEMA 1** dead-front construction, intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment.
3. MAIN PROTECTIVE DEVICES
- A. Furnish molded case circuit breakers for all load centers as the main device. All circuit breakers shall have the breaker's ampacity printed on either the handle or breaker face. The ampere rating of the main breaker shall be as indicated on the project drawings or load center schedules.
 - B. The circuit breaker frame shall be constructed of a high-strength, molded, glass-reinforced polyester case. Breakers shall have an overcenter, toggle handle-operated, trip free mechanism with quick make, quick break action independent of the speed of the toggle handle operation.
 - C. An ON and OFF position shall be clearly marked on the breaker. All breakers shall have a means to provide handle trip indication when the breaker activates during a fault.

- D. The overload/short-circuit trip mechanism shall be a thermal and magnetic trip element trip unit. The breaker shall be UL/cUL listed for standard duty and shall be applied at 80% of its current rating.
- E. Factory installed CU/AL mechanical lugs are to be provided with the main breaker. These lugs shall be rated for use with either 60 degree C or 75 degree C wire.
- F. For convertible load centers, the factory main shall be field installable.

4. FEEDER PROTECTIVE DEVICES

- A. The feeder or branch circuit breakers shall be molded case type. It is preferred to have 1 inch per pole breaker construction; however, $\frac{3}{4}$ inch per pole and $\frac{1}{2}$ inch per pole alternatives will be allowed. This deviation from the 1" per pole must be noted on all submittal documents.
- B. Each pole of the circuit breaker will have inverse time delay overload and instantaneous short-circuit protection by means of both thermal and magnetic sensors.
- C. The circuit breaker calibration shall not be affected by environmental changes in relative humidity. Breakers shall be calibrated after assembly.
- D. All circuit breakers shall be operated by a toggle-type handle and multi-pole circuit breakers shall have an internal common trip mechanism. The circuit breakers shall incorporate trip mechanisms that are mechanically trip-free from the handle. The handle position shall provide good visual trip indication.
- E. All terminals shall be listed for use with copper or aluminum conductors. Terminals shall be of the box lug design. The terminals shall meet UL 486B requirements and shall be suitable for use with either 60 degree or 75 degree C wire.
- F. All single pole 15 ampere and 20 ampere breakers shall be switching duty rated (SWD) and shall be suitable for 120 volt ac fluorescent lighting loads.
- G. All breakers 15 ampere through 100 ampere shall be heating, air conditioning and refrigeration rated (HACR).
- H. All circuit breakers shall have the breaker's ampacity printed on either the handle or breaker face. They shall be UL /cUL listed for standard duty and are to be applied at 80% of their current rating.
- I. Standard branch breakers shall have a range of 15 amperes through 125 amperes.
- J. Special branch breakers shall be provided as indicated below
 - 1. Where indicated on the drawings, Arc-Fault protection circuit breakers shall be provided. These Combination AFCI breakers are compliant with 2008 NEC and later. These breakers are available from 15 amperes through 20 amperes in 1 pole units.

PART 3 EXECUTION

1. EXAMINATION

- A. The following examinations shall be performed by the contractor/installer.
 - 1. Verify that the field measurements of the lineup are the same as shown on factory drawings.
 - 2. Inspect the GE by ABB PowerMark PRO/Gold/Plus Load Centers and confirm that they are ready to be installed.
 - 3. Check walls or the mounting structure for uniformity and a level plumb surface.
 - 4. Examine the installation area to assure there is enough clearance to install the load centers such that it will fit in the allocated space in full compliance with the minimum required clearances recommended by the manufacturer, specified in National Electrical Code and required by any applicable local/facility constraints.
 - 5. Confirm that required utilities are available, in proper location and ready for use.

- B. Beginning of installation means that the contractor/installer accepts these conditions.

2. LOCATION

- A. Refer to the projects site layout drawings for details regarding the proper area to place the equipment.

3. INSTALLATION

- A. The contractor/installer shall furnish and completely install the load centers and breakers per manufacturer's installation instructions. All necessary hardware to secure the equipment in place shall be provided by the contractor/installer.

- B. The contractor/installer shall provide and install any required safety labels.

4. FIELD QUALITY CONTROL

- A. The following quality control checks shall be performed by the contractor/installer.
 - 1. Inspect the installed load centers for proper anchoring, alignment and grounding as well as inspecting for any internal and external physical damage.
 - 2. Confirm that all shipping and packing material has been removed.
 - 3. Check the tightness of all accessible mechanical and electrical connections with a calibrated torque wrench. The minimum acceptable values are specified in the manufacturer's instructions.
 - 4. Refer to manufacturer's instruction sheets for any other requirements applicable to the load center and breakers.
 - 5. Check each electrical bus for proper phasing and identification.
 - 6. Check and test each breaker for proper mechanical and electrical operation.

5. ADJUSTING

- A. The contractor/installer shall adjust all access doors and operating handles for free mechanical and electrical operation as described in the manufacturer's instructions.

- B. The contractor/installer shall refer to the manufacturer's instruction book to make adjustments to mechanisms, doors, handles, etceteras, as required.

6. CLEANING

SECTION 16442: LOAD CENTERS | SECTION 26 24 16.10: LOAD CENTERS

- A. The contractor/installer shall clean the interior and exterior of the load centers to remove construction debris, dirt, and shipping materials.
- B. The contractor/installer shall repaint scratched or marred exterior surfaces to match original finish.

7. TRAINING

- A. Not Applicable – no training on the load centers is required.