

**READ THIS FIRST**

Notice to the Design Engineer, this document is part of Facilities and Infrastructure standards for Electrical Systems. Designers are advised to NOT use this template (\*.doc) document as part of any project contract documents. Designers shall use the Port of Seattle MasterSpec specifications from the following link:

**<https://www.portseattle.org/page/guide-specifications>.**

Designers shall edit the corresponding Port's MasterSpec specification to meet the F&I Electrical Standard outlined in this specification. Note that Port's MasterSpec specifications contain specifications and languages for both Aviation and Maritime Divisions. F&I Standards are strictly for Aviation Division, and any Maritime related specs or languages should be removed from the project specifications.

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY AND NOTES TO DESIGNER**

- A. Section includes power factor correction equipment rated 600 V and less.
- B. Minimum Motor Size Application: Provide power factor correction capacitors on all single speed motors continuously run 25 HP and above to a P.F. of 0.95, except two-speed motors and motors fed by variable frequency drives and areas subject to THD of greater than 10%.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Power factor correction equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 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."

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include dimensions, operating characteristics of multiple capacitor cells or elements, and data on features, ratings, and performance.

- B. Shop Drawings: For automatic power factor correction units.
  - 1. Detail equipment assemblies and indicate dimensions, weights, method of field assembly, components, and location and size of each field connection. Show access and workspace requirements and required clearances.
  - 2. Wiring Diagrams: For power, signal, and control wiring.

### **1.5 INFORMATIONAL SUBMITTALS**

- A. Seismic Qualification Certificates: For capacitors, accessories, and components, from manufacturer.
  - 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment: 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.
- B. Field quality-control reports.
- C. Warranty: Sample of special warranty.

### **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For equipment to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - 1. Lists of spare parts and replacement components recommended for storage at Project site.
  - 2. Detailed instructions covering operation under both normal and abnormal conditions.

### **1.7 QUALITY ASSURANCE**

- A. 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.
- B. Comply with IEEE 18 and NEMA CP 1.
- C. Comply with NFPA 70.

**1.8 COORDINATION**

- A. Coordinate sensor-communication module package with data network and with monitoring equipment specified in Section 260913 "Electrical Power Monitoring and Control" for successful transmission and remote readout of remote monitoring data specified in this Section.

**1.9 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace capacitor-bank components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 2 years from date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.1 CAPACITORS, GENERAL**

- A. Comply with UL 810, NEMS CP1 "Shunt Capacitors", IEEE 18 "Shunt Power Capacitors" and the NFPA 70.
- B. Provide capacitors which are UL listed and labeled for the location and environment in which they are installed.
- C. Designed for 180,000 hours or 20 years of continuous industrial use.
- D. Service Conditions: Capacitor equipment suitable for the following conditions:
  - 1. Operating Temperature: Minus 40 to plus 104 deg F.
  - 2. Maximum Altitude: 1000 feet.
  - 3. Humidity: 0 to 95 percent, noncondensing.
- E. Construction: Multiple capacitor cells or elements, factory wired in three-phase internal delta connection groups and mounted in metal enclosures.
- F. Ratings: 240V to 600V, 1 to 100kVAR, one, two and three phase.
- G. Cells: Dry metallized-dielectric, self-healing type. Each cell shall be encapsulated in thermosetting resin inside plastic container.
- H. Rupture Protection: Pressure-sensitive circuit interrupter for each cell. Turns on an amber warning light after action of pressure actuated interrupter.
- I. Provide units suitable for floor mounting OR wall mounting with an optional wall mounting bracket.

## **2.2 FIXED CAPACITORS**

- A. Description: Factory wired, ready for field connection to external circuits at a single set of pressure terminals. Comply with UL 810.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Myron Zucker.
    - b. General Electric Co.
    - c. Square D.
    - d. EEG/Gilbert Electrical Systems
- B. Capacitor Cells: Low-loss, self-clearing, dry metallized polypropylene, industrial grade, hermetically sealed steel case, three phase, with threaded insulated terminals.
- C. Fuses: Fast acting current-limiting, non-interchangeable type; factory installed in each phase and located within the equipment enclosure. Features include the following:
  - 1. Interrupting Capacity: 200,000 A or as otherwise specified for specific voltage.
  - 2. Fuse Ratings and Characteristics: As recommended by capacitor manufacturer.
  - 3. Indicator Lamp for Each Fuse: A red light shall turn on when a fuse blows.
- D. Discharge Resistors: Factory installed internal or external discharge resistors to reduce residual voltage to 50 Volts, nominal or less within one minute after the capacitor is disconnected from the source of supply.
- E. Enclosure: NEMA 250, Type 12 steel, for indoor use, gasketed, no knockouts, adequate wiring space, easy installation, no special brackets needed
  - 1. Factory Finish: Manufacturer's standard enamel over corrosion resistant treatment or primer coat.
- F. Internal Wiring: Factory wired, ready for field connection to external circuits at a single set of pressure terminals.

## **2.3 SOURCE QUALITY CONTROL**

- A. Factory test power factor correction equipment before shipment. Comply with NEMA CP 1. Include the following:
  - 1. Routine capacitor production tests, including short-time overvoltage, capacitance, leak, and dissipation-factor tests.

**3.1 EQUIPMENT INSTALLATION**

- A. Install freestanding equipment on concrete bases. Concrete shall be rated for 3000 psi minimum.
- B. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Maintain minimum workspace according to manufacturer's written instructions.
- D. Identify components according to Section 260553 "Identification for Electrical Systems."

**3.2 FIELD QUALITY CONTROL**

- A. Tests and Inspections: Perform each visual and mechanical inspection and electrical tests including features, functions, operations, and protective devices according to manufacturer's instructions and NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 1. Current Transformers.
  - 2. Capacitors and Reactors, Capacitors.

**3.3 STARTUP SERVICE**

- A. Perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Connect and run installed motors and equipment to verify the automatic switching of the capacitors. Verification shall include automatic switching of the total capacity of installed capacitors.
    - a. Provide sufficient inductive/reactive load banks, in combination with resistive load banks, for the test.

**3.4 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain automatic power factor correction units.

**3.5     CLEANING**

- A.    On completion of installation, inspect system components. Remove paint splatters and other spots, dirt and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION 263533