

Section 16410

Power Factor Correction Capacitors

1.0 SCOPE

1.1 Provide PFCC (Power Factor Correction Capacitors) for each electrical sub-system as needed to raise total system Power Factor to 0.____ or as shown on drawings. Each electrical sub-system shall be defined as each medium-to-low voltage (e.g., 13,200/480Y277 volt) transformer and every load it feeds. Note that this project may consist of only one electrical sub-system. If any harmonic producing (non-linear) loads are connected to a sub-system refer to section 16420 – Harmonic Trap Filters.

2.0 GENERAL

2.1 The sub-systems in this project are ____ volt, _ phase and ____ Hz. The PFCC(s) should be rated ____ volt, _ phase and ____ Hz.

2.2 PFCC(s) shall be installed for all motors ____ Hp and larger.

2.3 For each motor the KVAR rating of the PFCC shall be determined by the manufacturers suggested sizing chart.

2.4 The PFCC shall be connected on the load side of the motor starter contacts and on the line side of the overloads (heaters) unless the motor is used in the following applications:

- Reversing
- Two-Speed
- Jogging
- Plugging
- Inching

Refer to the PFCC manufacturer's recommendations for any of these applications.

If the circuit is not accessible between the contacts and overloads the PFCC may be connected below the overloads but the overloads should then be re-sized.

2.5 Contractor or OEM shall remove fuses of PFCC when checking for motor rotation (or bumping motor) so as to prevent nuisance fuse blowing due to energizing a capacitor that has not yet discharged.

2.6 Automatic banks, as required, shall be switched in steps of up to 60 KVAR.

2.7 Fixed banks, as required, shall be built in modules of up to 60 KVAR.

3.0 APPLICABLE STANDARDS

1. NEMA CP1
2. ANSI / IEEE Standard 18
3. U. L. Standard 810
4. CSA Standard C22.2 No. 190
5. National Electrical Code (NEC)

4.0 SUBMITTALS

- 4.1 Submit manufacturers installation instructions
- 4.2 Submit manufacturers operation and maintenance manual
- 4.3 Submit manufacturers catalog cut-sheets

5.0 COMPONENT SPECIFICATIONS

5.1 Definitions

- 5.1.1 CAPACITOR CELL – Capacitor cells are the smallest elements of a complete Power Factor Correction Capacitor Assembly. A cell consists of a dielectric material and two separate conductive surfaces all sealed in a case. This case has external connections that are wired to a connection point within the assembly.
- 5.1.2 ASSEMBLY – A Power Factor Correction Capacitor Assembly is the complete package of all components listed below as shipped from the manufacturer.

5.2 Capacitor cells

- 5.2.1 Capacitor cells shall be individually replaceable with a 3-phase design. PFCC Assemblies made up of single-phase cells connected together to form a three-phase assembly shall not be acceptable.
- 5.2.2 Capacitor cells shall have a UL listed pressure-actuated interrupter, which shall disconnect all three phase at the same time to maintain a balance circuit and prevent cell case rupture. Single-phase cells with a single-phase interrupter shall not be acceptable.
- 5.2.3 Capacitor cells shall have 3 threaded, insulated terminal studs for positive sta-kon type wire terminal connections. Slip-on terminations shall not be acceptable. All connections shall be by wire and not bus bar so that cells and wire may be easily replaced in the field.
- 5.2.4 Capacitor cell construction shall be a hermetically sealed case.
- 5.2.5 Capacitor cell shall be rated for operating in ambient temperatures between -40 and +46 degrees Celsius. (-40 and +115° F)
- 5.2.6 Each capacitor cell shall be provided with 3-phase delta connected discharge resistor network. The resistors shall be sized to reduce residual voltage to less than 50 volts within one minute of de-energization (per

NEC article 460-6). Resistors mounted internal to the cell shall not be acceptable.

5.2.7 Capacitor cells shall be designed with a self-healing, metalized polypropylene construction.

5.2.8 Capacitor cell shall be rated at ½ Watt loss per KVAR.

5.2.9 Capacitor cells shall be life tested and designed for 20-year life. Individual cells shall be covered by a two-year warranty.

5.3 Enclosures

5.3.1 Enclosures shall be steel with no knockouts and ground lug.

5.3.2 Enclosures shall be gasketed and NEMA 12 rated.

5.3.3 Enclosures shall be equipped with built-in mounting brackets for wall or shelf mounting unless it is of the free-standing construction.

5.3.4 Enclosures for capacitors used on individual motors shall be designed for bottom or back conduit entry.

5.3.5 Enclosures shall have lockable door handles and lifting eyes for free-standing construction types.

5.3.6 If fuse lights are not mounted through the door then a window shall be provided in the door to view fuse lights inside the enclosure.

5.3.7 Enclosures shall not contain any fillers (such as Vermiculite) so that all capacitor cells can be accessed for visual inspection and replacement.

5.4 Fuses

5.4.1 Fuses shall be current-limiting, fast-acting with 200,000 ampere interrupting capacity to provide short circuit protection in the capacitor assembly.

5.4.2 Only industry standard brand fuses that are completely accessible and replaceable shall be accepted. Non-industry-standard, internal, inaccessible fuse links shall not be acceptable.

5.4.3 All three phases shall be fused. Two-line fusing shall not be acceptable.

5.5 Monitoring system

5.5.1 All fuses shall have blown fuse indication (lights), which shall be visible by exterior indication or through a window so that no physical entrance into the enclosure is required.

5.5.2 Loss of capacitance monitoring shall be supplied for all capacitor assemblies. It shall detect the action of the pressure-actuated interrupter or end of cell life.

5.5.3 The monitoring device shall provide an indicating light warning that a cell is no longer functioning.

5.6 Contactors

5.6.1 Contactors shall be rated for capacitor switching.

5.6.2 Contactors shall be UL rated A-191 and IEC rated 158-1.

5.7 VAR controller

- 5.7.1 The VAR-controller shall be a digital microprocessor device.
- 5.7.2 The VAR-controller shall have a built-in power factor meter.
- 5.7.3 The VAR-controller shall have manual and automatic modes as well as RS232 communication for remote monitoring.
- 5.7.4 The VAR-controller shall have indication of steps and power factor.
- 5.7.5 The VAR-controller shall have a target power factor setting range of 0.80 inductive to 0.80 capacitive.

6.0 MANUFACTURERS

6.1 Approved Manufacturers

- 6.1.1 Myron Zucker, Inc., www.myronzucker.com
Series... (e.g. "Calmount® brand capacitor series")
- 6.1.2 Other manufacturers must submit in writing all exceptions to the above specification for review.

7.0 START-UP

- 7.1 Any banks used shall have start-up assistance from the manufacturer. Supervision of energizing the bank as well as performance tests as determined by the manufacturer shall be performed. This should be a separate line item on quotes and purchase orders.