

Section 16420

Harmonic Trap Filters

1.0 SCOPE

1.1 Provide Harmonic Trap Filters for each electrical sub-system as needed to raise the power factor in a harmonic rich environment or to meet IEEE 519. Harmonic Trap Filters shall be sized at a minimum to trap/filter the harmonics present in the system as well as raise the system power factor to 0.____ or sized as shown on the 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.

2.0 GENERAL

- 2.1 The sub-systems in this project are ____ volt, 3 phase and ____ Hz.
The HARMONIC TRAP FILTER(s) should be rated ____ volt, 3 phase and ____ Hz.
- 2.2 HARMONIC TRAP FILTER(s) shall be installed for all variable speed drives ____ Hp and larger.
- 2.3 For each drive the KVAR rating of the HARMONIC TRAP FILTER shall be determined by the manufacturers suggested sizing. HARMONIC TRAP FILTERS should be sized to handle all harmonic currents possible (not simply enough to correct power factor) so that they do not become over-loaded with harmonic currents.
- 2.4 The HARMONIC TRAP FILTER shall be connected on the load side of the drive disconnect switch and on the line side of the drive itself unless it is applied as a system power factor and power quality device.
- 2.5 Contractor or OEM shall wire the control circuit of the drive to energize the HARMONIC TRAP FILTER when the drive is energized. This shall be accomplished using the remote contact inputs to the HARMONIC TRAP FILTER.
- 2.6 Automatic banks, as required, shall be switched in steps of 50 KVAR.
- 2.7 Fixed banks, as required, shall be built in modules of 50 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 HARMONIC TRAP FILTER 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 HARMONIC TRAP FILTER Assembly is the complete package of all components listed below as shipped from the manufacturer.
- 5.1.3 HARMONIC PRODUCING LOADS would include those that change AC to DC. Some examples are VFD (Variable Frequency Drives), DC Motors and Drives, Plating Rectifiers and large computer UPS systems.

5.2 Capacitor cells

- 5.2.1 Capacitor cells shall be individually replaceable with a 3-phase design. HARMONIC TRAP FILTER 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 include a 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 shall have lockable door handles and lifting eyes for free-standing construction types.

5.3.5 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.

5.3.6 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 trap filter assemblies. It shall detect the action of the pressure-actuated interrupter.

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

5.5.4 The monitoring device shall monitor all three phases for over-current, under-current or phase imbalance.

5.5.5 If the monitoring device detects that the trap filter is in a fault condition shall automatically disconnect the trap filter from the line.

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 Inductors

- 5.7.1 Inductors shall be 3 phase, specially designed for harmonic service.
- 5.7.2 Inductors shall be wound on iron cores with 100% copper wire.
- 5.7.3 Inductors shall use Class H (180°C), 600 volt insulation.
- 5.7.4 Inductors shall be Hi-Pot tested.
- 5.7.5 Inductors shall be designed and built with an embedded thermistor wired to a relay for an over-temperature light indication.

5.8 VAR controller

- 5.8.1 The VAR-controller shall be a solid state device.
- 5.8.2 The VAR-controller shall have a built-in power factor meter.
- 5.8.3 The VAR-controller shall have manual as well as automatic modes.
- 5.8.4 The VAR-controller shall have indication of steps and power factor.
- 5.8.5 The VAR-controller shall have a target power factor setting range of 0.80 inductive to 0.95 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.