HarmonicShield Passive Harmonic Filter (HSD)

SAMPLE BID SPECIFICATION

1 GENERAL

1.1 The passive harmonic filter (hereafter called the filter) shall be designed to filter all characteristic low frequency harmonics (5th, 7th, 11th, 13th, etc.), generated from three phase diode rectifier loads such as variable frequency drives (VFD), while improving the system power factor.

1.2 The filter shall consist of inductive element(s) in series with the load and an inductive-capacitive network in parallel with the load (shunt).

1.3 The filter shall not adversely react with or resonate with the power system or attract harmonics from other sources.

1.4 The filter shall be UL- and cUL-Listed under UL 508.

1.5 The harmonic filter shall be warranted free from defects both in materials and in workmanship for a period of three years from the date of shipment, when applied in accordance with the manufacturer's recommended procedures.

1.6 The filter shall be manufactured by TCI, LLC. Telephone (800) 824-8282

1.7 The filter described in this specification shall be used on a _____V, 3-phase, 60 Hz system. The filter HP rating(s) shall be determined in accordance with the VFD Schedule.

1.8 Submittals shall include the following information:

- Outline dimensions, conduit entry locations and weight.
- Customer connection and power wiring diagrams.
- Complete technical product description.

2 PRODUCT REQUIREMENTS

2.1 The filter shall filter and suppress all characteristic low frequency harmonics (5th, 7th, 11th, 13th, etc.) generated from three phase diode rectifier loads, such as variable frequency drives (VFD).

2.2 The filter shall consist of inductive element(s) in series with the load and an inductive-capacitive network in shunt with the load. The shunt circuit shall be tuned to 4.7 times the fundamental frequency.

2.3 The Total Demand Distortion (TDD) of the current at the input terminals of the filter, in combination with the variable frequency drive, shall not exceed 5% THID at full rated load and given the filter is correctly applied.

2.4 The Total Harmonic Voltage Distortion (THVD) at the input terminals of the filter in combination with the variable frequency drive shall not exceed the limits defined in Table 10-2 of IEEE-519 (1992). The filter supplier shall not be responsible for pre-existing voltage distortion caused by other harmonic sources.

2.5 The full load efficiency of the filter shall not be less than 97% for filters larger than 5 HP or less than 98.5% for filters larger than 25 HP.

2.6 The filter may produce a capacitive reactive power (KVAR) less than or equal to 40% of its HP rating over the full load range.

2.7 To control leading VARs on the power system or to enhance compatibility, a contactor option shall provide the disconnect means for the filter capacitors. The contactor shall be controlled by an external 120V dry contact.

2.8 Voltage Regulation: The voltage regulation at the VFD terminals and attributable to the filter shall not exceed 5%. Filters with greater than 10% voltage drop, and/or filters that have capacitors in series with the VFD, are not acceptable.

2.9 The filter shall suppress characteristic harmonics without the requirement to phase shift against other harmonic sources or without the need for individual tuning.

2.10 When the VFD is in bypass, the motor is connected across the line. In this line connected arrangement, the filter will improve the power factor by at least 0.05 for motors with poor power factor (<0.85).

3 OPTIONS (if the option is also discussed above, this section provides additional spec information)

3.1 The filter shall have a contactor option to control the insertion of the shunt capacitor in the circuit and control the capacitive VARS on the power system. The contactor shall be controlled by an external 120V dry contact. 120V power shall be provided internal to the filter.

3.1.1 The contactors shall be UL Listed and designed for 3-phase applications and rated for 600 volts

4 COMPONENTS

4.1 ENCLOSURE

4.1.1 The filter shall be offered in a stand-alone UL Type 1 enclosure or UL Type 3R enclosure.

4.2 HIGH-ENDURANCE CAPACITOR CELLS

4.2.1 Only standard, non-custom capacitors shall be used for availability.

4.2.2 High-endurance capacitor cells shall have a voltage rating capable of handling continuously the nominal system voltage plus 10% of the over voltage tolerance. These capacitor cells shall also operate under the worst case voltage gain due to the leading nature of the capacitive current. Dielectric material shall be low-loss (less than 0.25 watts per kVAR). High-endurance capacitor cells themselves shall be rated to operate at a temperature of 65°C on the capacitor case.

4.2.3 High-endurance capacitor cells shall be contained in hermetically sealed metal cans.

4.2.4 High-endurance capacitor cells shall have a UL mandated, pressure-sensitive interrupter which, in case of a hazardous internal pressure increase, will disconnect all three phases simultaneously. And shall be recognized or listed under UL810.

4.2.5 Individual high-endurance capacitor cells, or groups of cells, shall be provided with a 3-phase, discharge resistor network. The resistors shall be sized to reduce residual voltage to less than 50V within one minute of de-energization (NEC article 460-6).

4.2.6 The RMS current in each capacitor cell at full load shall not exceed 150% of the current at no load to limit the stress on the capacitors.

4.3 INDUCTORS

4.3.1 Both shunt circuit inductors and series line reactors shall be designed for harmonic filtering service and for slowing the rate of rapid current changes. The inductors shall be UL component-recognized or listed and shall be built to comply to UL 508. Construction shall be of copper wire-wound on magnetic steel cores. Inductors shall be three-phase. Series line reactors shall be sized appropriately for the total connected load. Design maximum temperature rise for inductors shall be 115°C on bobbin wound and 155°C on form wound devices at rated current.

4.3.2 Windings shall consist of copper wire or of copper foil. Terminations shall be copper alloy ring lugs, UL-recognized terminal blocks, or solid copper bus. Aluminum alloy mechanical lugs may be applied.

4.3.3 Completed inductors shall be impregnated, using 100% solid epoxy resin. All insulation varnish systems shall be rated class H (180°C) or class R (220°C), 600V. Inductors shall be Hi-Pot tested (2,500V, 60 Hz, 1 minute) line-to-line and line-to-ground.

5 FACTORY TESTING

5.1 All reactors shall be functionally tested to verify inductance and the filter assembly shall be functionally tested for proper connections and wiring configuration.

5.2 Every filter shall be tested at the factory with a minimum of 60% of full load RMS current in the shunt circuit – capacitors and tuning reactor.

5.3 Manufacturing facilities shall have harmonic performance testing capability with VFD loads.

6 INSTALLATION

6.1 The harmonic filter shall be handled, stored and installed in accordance with the manufacturer's User Manual. Installation shall comply with all applicable local codes.