HG7 XM DRIVE-APPLIED HARMONIC FILTER
POWER MODULE PACKAGE SAMPLE BIDDING SPECIFICATIONS

1.0 GENERAL

1.1 The HG7 XM DRIVE-APPLIED HARMONIC FILTER (hereafter called an "HG7") shall contain a tuned circuit designed to remove harmonics generated within a power distribution system while improving the system power factor. The HG7 is designed to minimize the possibility of system problems associated with power factor correction in the presence of harmonic distortion.

1.2 HG7 consists of inductive and capacitive elements arranged in a series configuration and are tuned to resonate just below the harmonic frequency for which they are designed to filter. The HG7 has its minimum impedance at the tuning frequency. At frequencies above the tuning frequency, the HG7's impedance is inductive; therefore, it cannot adversely react with the parasitic inductance of the power system. The inductance in the HG7, combined with the series line reactor, acts to limit current surges between the capacitor and other plant electrical equipment and shall minimize the possibility of equipment or capacitor damage due to such surges.

1.3 The fusing, tuning reactor and capacitor shall be in parallel with the VFD. The VFD shall remain operational in the event of a failure of the capacitors or other condition causing the fuses to open. 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.

1.4 The HG7 described in this specification shall be used on a _____V, 3-phase, 60 Hz system. The HG7 shall be rated in accordance with the VFD Schedule and shall be tuned to 4.7 times the fundamental frequency. The HG7 shall be UL- and cUL-Listed.

1.5 The HG7 shall be manufactured by TCI (TCI, LLC).

1.6 Submittals shall include the following information:

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

2.0 COMPONENTS

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

2.1.2 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.

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

2.1.4 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.

2.1.5 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).

2.1.6 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.

2.2 INDUCTORS

2.2.1 Both tuning 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 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 circuit.

2.2.2 The core shall be made of laminated, grain-oriented magnetic steel (grade M36 or better). Brackets shall be ASTM structural steel or structural aluminum. Coils shall be wedged in place and the core shall be locked in place using vertical ties or rods.

2.2.3 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. Sheet insulation shall be DuPont Nomex 410, or IPT Cequin of the thickness as required for UL insulation systems.

2.2.4 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.

2.2.5 Inductors shall be air-gapped to avoid control point saturation. Inductance shall be measured under full load and shall be within -2% to +8% for the tuning reactor and +/- 20% for the series line reactor, of the design value.

2.3 CONTACTORS

2.3.1 Contactors shall be provided in the capacitor circuit. Contactors, when used in conjunction with the Variable Frequency Drive’s relay, remove the capacitors from the circuit, reducing the opportunity for “leading” power-factor condition. The contactors shall be UL-Listed and designed for 3-phase applications and rated for 600 volts.

2.4 CONNECTION

2.4.1 Unless otherwise specified, crimpless, UL-recognized, field-wiring terminal lugs shall be provided for electrical connection of the harmonic filter to the 3-phase line. An internal grounding lug shall also be provided.

2.5 DISTRIBUTION BLOCKS

2.5.1 Distribution blocks, when necessary, shall be rated for copper wire and shall be UL-recognized and CSA-certified. All capacitor current-carrying wires shall be mechanically fastened with nuts or screws.

2.6 LUGS

2.6.1 Lugs shall be one-piece construction of cold-forged, pure electrolytic copper with 99% conductivity or of plated high-strength aluminum alloy. They shall be rated for copper wire and shall have screws of plated steel. Lugs shall be UL-listed.

2.7 TERMINALS

2.7.1 Terminals shall be pure copper or copper alloy which shall be crimped to the wire. All connections shall be mechanically fixed using nuts, bolts, or screws.

2.8 WIRE

2.8.1 Capacitor current-carrying wire shall consist of copper with thermoplastic insulation that is rated at 600V and for a minimum of 90°C. Wire shall be: NEC-rated, MTW 1337, CSA type TEW, and UL style AWM. Control wire shall be copper wire that is rated at 600V for 90°C. Signal wire shall be multiconductor-jacketed wire that is rated at 300V for 80°C.

3.0 PROTECTION

3.1 FUSES

3.1.1 Internal wiring, including that for the tuning reactors, shall be protected by three fuses, one for each phase. Fuses shall be current-limiting at 200,000 symmetrical amperes, interrupting at 600V AC, 60Hz. Fuses shall be UL-listed, class T, and CSA-rated, HRC-1. Fuses shall be sized to a minimum of 150% of nominal capacitor rating. Fuses internal to the capacitor cell shall not be acceptable as the primary means of protection.

3.2 OPERATION MONITOR AND PROTECTION

3.2.1 Each filter shall be protected by a 3-phase protection circuit which will continuously monitor operating parameters. The monitor shall receive signals from all three phases of the trap reactor and shall be set to detect potentially hazardous operating conditions.

3.2.2 Protection shall be provided against reactor or capacitor overload, phase imbalance, and continued operation with blown fuses. Should the operating parameters fall outside the normal range, the monitor circuit shall break the control current to the contactors, thus removing the trap from the line and safeguarding both the power system and the trap.

3.2.3 A continuously illuminated green panel light shall indicate that the protection circuit is enabled. A red panel light, marked “reset” shall come on to signal that the monitor protection circuit has operated. Pressing this light shall momentarily reconnect the filter to the circuit. If the signaled condition still exists, the protection circuit shall operate again within ten seconds. Yellow “overcurrent” and “undercurrent” panel lights shall indicate the reason for operation of the protection device and can provide information for trouble shooting. In the event that an internal fuse has blown, the undercurrent light shall come on and lights shall indicate which fuse has operated. An independent form C relay contact, rated at 5 amperes, 120 VAC,

shall be provided for remote signaling and computer monitoring of the filter status.

3.3 ENCLOSURE

3.3.1 The enclosure shall be designed to conform to UL Type 1 standards. Enclosure shall be constructed from steel with a protective coating finish and with no knockouts. Provisions shall be made to allow for permanent conduit entry sites. Enclosure shall have a hinged, lockable cover that shall not at any time disrupt the conduit connections. Screened openings shall be provided to allow for enclosure ventilation. Air flow shall be provided by natural convection where possible. Fan cooled models shall have cooling fans sized to provide at least six enclosure volumes of air change per minute.

3.3.2 The HG7 shall be in either a stand alone UL Type 1 enclosure or incorporated in the VFD's enclosure.

3.3.3 The HG7 shall be built with integral mounting brackets for platform or for wall mounting.

4.0 TESTING

4.1 The HG7 shall be circuit tested for proper connections and wiring configuration before leaving the factory. All series and tuning reactors are also tested for proper inductance before being assembled into the HG7 panel.

5.0 WARRANTY

5.1 The HG7 HarmonicGuard Drive-Applied 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.