

	<b>Matrix AP Harmonic Filter Specification</b>	<b>ES-021</b>
	Responsibility: Engineering Approved By: ISO Section: 7.2.3	Rev 002 1/22/13

## Matrix Harmonic Filter Specification

- 1.0 The harmonic filter shall be a Matrix AP Filter as manufactured by MTE Corporation.
- 2.0 The harmonic filter shall treat all characteristic low frequency harmonics generated by a three phase full wave converter load (5<sup>th</sup>, 7<sup>th</sup>, 11<sup>th</sup>, 13<sup>th</sup>, etc.)
- 3.0 The characteristic harmonics shall be suppressed without need for individual tuning or the requirement to phase shift against other harmonic sources.
- 4.0 The harmonic filter shall be an adaptive passive series connected low pass filter consisting of an inductor capacitor network. Active electronic components shall not be used.
- 5.0 The harmonic filter model supplied shall be capable of feeding a three phase input rectifier with or without line reactors, with or without a DC link choke, with or without a combination line reactor and DC link choke.
- 6.0 The harmonic filter model supplied shall be capable of feeding a rectifier composed of diodes, thyristors or any combination thereof.
- 7.0 The harmonic filter shall meet the harmonic performance specification with a three percent phase voltage unbalance as defined in ANSI C-84.1-1995.
- 8.0 The harmonic filter shall not resonate with the power distribution system nor attract harmonics from other sources.
- 9.0 The filter shall be suitable for use with either a single nonlinear load or multiple nonlinear loads
- 10.0 The filter shall be listed per UL-508.
- 11.0 In the operating range from full load to 30% load the power factor shall be .98 lagging to .85 leading.
- 12.0 The harmonic filter in combination with the adjustable frequency drive shall meet all requirements specified in the 1992 edition of IEEE standard 519 for individual and total harmonic voltage and current distortion. The Point of Common Coupling (PCC) for all voltage and current harmonic calculations and measurements shall be the input terminals of the harmonic filter.
- 13.0 Total Demand Distortion (TDD) of the current at the input terminals of the harmonic filter shall not exceed the limits defined in Table 10-3 of IEEE-519.

- 14.0 Total Harmonic Voltage Distortion (THVD) shall meet the requirements of Table 10-2 of IEEE-519. The harmonic filter supplier shall not be responsible for pre-existing voltage distortion caused by other harmonic sources.
- 15.0 The harmonic filter shall suppress the characteristic harmonics to the levels specified in paragraph 13.0 provided that the line voltage unbalance is between 0% and 1%. If the line voltage unbalance is between 1% and 3% per ANSI C84.1-1995 the total harmonic input current distortion at any reduced load or speed condition shall not exceed the full load THID by more than 50% (i.e. if 5% THID required at full load, then not more than 7.5% THID at reduced load when voltage unbalance is more than or equal to 1% and less than or equal to 3%.)
- 16.0 The full load efficiency of the harmonic filter shall be greater than 97 percent.
- 17.0 When fed from a power distribution system operating at the nominal distribution voltage, the harmonic filter output voltage at no load shall not be more than 4.6 percent of the nominal RMS and peak distribution voltage.
- 18.0 When fed from a power distribution system operating at the nominal distribution voltage, the harmonic filter output voltage at full load shall not be less than the nominal RMS utilization voltage.
- 19.0 All wiring shall be copper.
- 20.0 To assure that voltage source PWM inverters do not experience over voltage trips, the harmonic filter shall not cause the inverter bus voltage to increase by more than 5% when the filter is operating from the nominal distribution voltage.
- 21.0 To assure that the filter will not reduce the life of a voltage source inverter's bus capacitor, the output current waveform of the harmonic filter and the input current waveform of the inverter shall be consistent with the input waveform of an inverter fed from a drive equipped with a 3% minimum impedance line reactor.
- 22.0 The harmonic filter shall be handled, stored and installed in accordance with the manufacturer's recommended installation practices as found in the manufacturer's User Manual. Installation shall comply with all applicable local codes.
- 23.0 To assure quality control and proper performance, the filter shall be manufactured by an ISO9001 supplier in the supplier's own manufacturing facility, and not by a contract manufacturer. Filters shall be subject to rigorous quality control checks prior to shipment.
- 24.0 The harmonic filter shall be warranted to be free of defects in materials and workmanship for a period of three years from the date of shipment when applied in accordance with the manufacturer's recommended installation procedures.
- 25.0 An integrated series and shunt reactor shall be used in the construction of the harmonic filter.

- 26.0 To ensure generator compatibility, the harmonic filter must never introduce a capacitive reactive power (KVAR), which is greater than 20% of its KVA rating.
- 27.0 THiD shall be less than 5% at full load and less than 8% at 30% load.
- 28.0 Harmonic filters 320A and above shall be temperature rated to 45 degrees C ambient without performance derating.
- 29.0 NEMA 3R enclosures to be RAL 9003 White with available rodent screens to minimize the effect of solar heating.