



Low Voltage Filter Equipment Specifications

Active Harmonic Filters

Part 1 - General Scope

1.0 This specification contains the minimum design and manufacture requirements, standards, general equipment type, warranty and installation for active harmonic filter equipment. Equipment shall be intended for the mitigation of harmonics, for low voltage AC electrical power distribution systems.

1.1 Exception to any part of this specification shall be indicated by reference to each item number, when providing a project bid.

1.2 Manufacturer of the active filter equipment shall have been engaged in the application, design and use of such equipment for a minimum of ten years. Manufacturer specified shall be ISO 9001 certified.

1.3 Active filter equipment shall be suitable for indoor or outdoor (NEMA rated) environments. Finished design may be stand-alone type, or integrated with other electrical equipment. Equipment shall be provided for low voltage classifications, with a range from 240vac to 690vac. In general, equipment shall be used on three phase, 3-wire, or 4-wire, power systems at 50 or 60 Hz

1.4 A power system analysis may be required to determine the harmonic content and requirement for mitigation, as part of the active filter equipment. It will be the responsibility of the owner, consultant, contractor or power quality service company to provide the manufacturer, at the time of request for quote, such data.

1.5 The finished active filter equipment shall be UL listed to 508 and cUL.

Part 2 - Standards and References

2.0 American National Standards Institute (ANSI)

2.1 Institute of Electrical and Electronic Engineers (IEEE)

2.2 National Electrical Manufacturers Association (NEMA)

2.3 Underwriters Laboratories, Inc. (UL)

- 2.4 National Electrical Code (NEC)
- 2.5 Canadian Standards Association (CSA)
- 2.6 International Electrotechnical Commission (IEC)
- 2.7 European Standards, EN

Part 3 - System Ratings

- 3.0 System Voltage: [200-240, 380-480, 600-690]. Units rated 600 volts and higher shall use an auto-transformer.
- 3.1 Line voltage tolerance: +/- 10%
- 3.2 System Frequency: [50 / 60 hertz], +/- 3Hz.
- 3.3 Frequency tolerance: +/- 5hz
- 3.4 Harmonic Cancellation Current: [25, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 750, 800, 900, 1000, 1100, 1200 amperes]. Multiple filter units for parallel connection may be used to achieve total current requirements for combined power factor correction and harmonic cancellation.
- 3.5 Maximum units connected in parallel: Up to six (6) with independent controllers.
- 3.6 Over current protection included: Current limiting, semi-conductor fuses
- 3.7 Fuse Interruption rating: 200,000 amps
- 3.8 Current transformers (2) split-core type shall be included and be rated for 2000:1, 20VA, 400Hz, 600 volt class. Higher ratings shall be made available as an option.
- 3.9 Remote indication contacts: 3 x dry contacts with common (2A / 24V)
- 3.10 Harmonic distortion shall be less than or equal to 5% THD-i for the 3rd through 51st order harmonics.
- 3.11 Reactive current compensation shall target up to 0.95 lagging. Filter shall automatically reduce the reactive current compensation when the current limit is approached, to favor harmonic compensation.
- 3.12 Control power: 120/240VAC, single phase, 50/60hz.
- 3.13 Power factor compensation (amps) shall be available up to the ampere rating of the unit.
- 3.14 Surge withstand capability per ANSI/IEEE std C62.41-1991.

Part 4 - General Product Description

- 4.0 The Active Harmonic Filter (Type AHF) is intended to remove harmonic distortion from the phase conductors in a 3-phase, 3-wire electrical system resulting in reduced phase current, reduced current distortion and reduced upstream electrical system harmonic voltage distortion.
- 4.1 The active harmonic filter shall mitigate odd order harmonics from the 3rd harmonic up to the 51st harmonic and limit harmonic distortion at their point of connection to within the harmonic limits specified herein.
- 4.2 The active filter shall connect in parallel (shunt) with each of three phase conductors three-phase electrical power system.
- 4.3 The active filter shall be suitable for connection at an electrical distribution panel, transformer secondary or at an individual load.
- 4.4 The active filter shall be suitable for use within a motor control center and other integrated electrical equipment, or as wall mounted or free-standing equipment.
- 4.5 The active filter shall provide harmonic cancellation current up to its maximum current rating with inherent current limiting so as not to experience an overload condition.
- 4.6 The active filter shall be suitable for connection to a distorted voltage source and its operation shall not be adversely affected by pre-existing voltage distortion of up to 10% THD-v.
- 4.7 The active filter shall be suitable for operation on an electrical system having a generator as its power source.
- 4.8 The active filter shall be suitable for operation with a 3% or 5% line reactor, when recommended for use with a variable frequency drive.
- 4.9 Active filter shall be capable of supplying reactive power for power factor correction when full capacity of filter is not utilized for the purpose of mitigating harmonics, to improve power factor up to 0.95 lagging.
- 4.10 Active filters shall include an input EMI filter.
- 4.11 Active filters shall include a forced air cooling system.
- 4.12 The active filter shall include a charging circuit to avoid inrush current upon energization.
- 4.13 Active filters shall utilize a high speed response digital signal processor (DSP).

4.14 An LCD graphic display, analyzer and keypad shall be provided for user control and shall be located on the front panel of the active filter. Standard communications port shall be RS232 with optional ports available for, RS422/485, USB, TCP/IP, and Ethernet RJ45.

4.15 The active filter shall be a standard catalog item for the manufacturer.

4.16 IGBT modules shall be self protected for maximum reliability.

4.17 Each power module shall have its own independent set of fuses.

4.18 Logic circuits must have ride through capability for momentary loss of control voltage.

4.19 A resonance condition on the electrical system, shall not cause the active filter to stop operating or to properly function.

Part 5 - General Construction

5.0 Active filter shall be supplied in metallic enclosure or as optional open chassis. [Indoor (NEMA 1), Outdoor (NEMA 3R), industrial (NEMA 12), open chassis]

5.1 Active filter shall be suitable for operation within an ambient temperature between 0°C and 40°C.

5.2 Active filter shall accommodate storage temperature from -10°C to 50°C.

5.3 Temperature rise shall be 50°C [80°C, other]

5.4 Efficiency shall be 97% minimum at full load at 25°C ambient temperature.

5.5 Active filters shall be suitable for operation in relative humidity not to exceed 95% non-condensing. When humidity will exceed this, an optional space heater shall be available.

5.6 Construction shall be in accordance with UL-508, cUL and IEEE-519.

5.7 Enclosure color shall be [RAL 9001 grey, other].

5.8 Audible noise shall not exceed 45dBA at full load when properly mounted in a suitable floor standing enclosure.

5.9 Active filter shall be suitable for altitude up to 1000 meters. Derating is required whenever this altitude is exceeded.

5.10 Active filters shall be suitable for use in seismic zone 4.

5.11 Active filters shall include lifting lugs for transport.

5.12 Cable entry shall be from the bottom of the active filter.

Part 6 - Testing, Safety and Documentation

6.0 The active filter equipment shall be production tested for proper operation, prior to shipment. This shall include, at a minimum: wire connections, torque connections, mechanical functional operation, controller operation, visual inspection.

6.1 Nameplates, labels, and other decals, providing safety, general operation instruction and manufacturer data, shall be included with the equipment. Such markings shall be visually accessible and conveniently located, both internally and externally on the equipment.

6.2 A manual for the purpose of operation, maintenance, and service instruction shall be included with the finished equipment. A general bill-of-material list, external and internal outline mechanical and electrical drawings shall be included with the equipment. Documentation shall be provided in a CAD format for approval or reference, where applicable.

Part 7 - Installation and Service

7.0 Installation and operation of equipment is intended for general business, commercial, industrial, government and energy service providers.

7.1 Correct installation is required for proper performance and function of the equipment. Physical inspection of equipment for damage is suggested, prior to any installation. Indoor storage shall be in a clean, dry environment.

7.2 National Electrical Code (NEC), electric utility company or service provider codes shall be adhered to during the installation. Electrical connections shall also be in compliance with required codes

7.3 Installer/Contractor shall inspect and verify proper alignment, anchorage, leveling and grounding, proper connections and tightness of connections, prior to any start-up procedures.

7.4 Appropriate personnel shall start-up and operate equipment upon installation approval.

7.5 All maintenance and inspection of the active filter equipment shall be done with the appropriate power system disconnect device in the open position.

Part 8 - Equipment Warranty

8.0 The manufacturer shall provide its standard warranty for equipment of this type. The warranty shall provide for repair or replacement of the equipment, should it be found to be defective within twelve months from the date of being first energized, or eighteen months from date of shipment, or whichever occurs first.

Approved Manufacturer

Active harmonic filter equipment shall be:

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