

I. GENERAL

A. All PWM AC Variable Frequency Drives shall be equipped with Sinewave Filters to prevent voltage overshoots, high dV/dt steep edges, cable and motor winding insulation failures.

1. The Sinewave Filter and all of its components shall be manufactured and tested in accordance with the latest applicable standards of UL, CSA and NEMA.
2. The Sinewave Filter shall be warranted to be free of defects in materials and workmanship for a period of 3 years from the date of shipment.
3. Factory Performance Testing: Manufacturer must be capable of factory testing for Sinewave Filter performance and energy efficiency under actual variable frequency drive operation.
4. Subject to compliance with all of the contract documents and specifications, the acceptable product and manufacturer is the INVERSINE™ Advanced Universal Sinewave Filter, by MIRUS International Inc. (905) 494-1120, Toll Free: (888) 866-4787.

II. PRODUCT

A. Key Requirements:

1. The Sinewave Filter shall be designed to attenuate the carrier component and its harmonics present in the output waveform of a typical PWM frequency converter (inverter) and produce sinusoidal output voltage waveform that has less than 5% THD(V) (voltage total harmonic distortion) measured to the 100th harmonic.
2. Output voltage waveform dV/dt stress and voltage overshoots characteristic for PWM inverter must be completely eliminated and suppressed without the need for snubber resistors, or auxiliary power electronic circuits.
3. The Sinewave Filter shall eliminate the effects of reflected wave phenomenon. The need for VFD rated cables shall also be eliminated when common-mode option is included.
4. Application of the Sinewave Filter shall allow for the use of standard motors eliminating the need for NEMA MG-1, Part 31 compliance, when the common-mode option is selected.
5. The general Sinewave Filter topology shall be LC low pass circuit.
6. The Sinewave Filter circuit input shall be of a three-phase inductor of sufficient impedance to control the capacitor charging below the PWM inverter peak current fault point.
7. The Sinewave Filter cut-off frequency shall be set approximately three (3) times the max allowed fundamental frequency of the PWM inverter to attenuate the carrier components at the rate of >40db per decade while minimizing the absorption of fundamental current by the filter.
8. The Sinewave Filter shall have efficiency of no less than 99%.
9. The capacitive reactance of the Sinewave Filter at the load shall compensate for motor inductive reactive power such that power factor at the PWM inverter output is improved to 0.97 or better. This shall lower overall filter insertion loss (ie. voltage drop) to < 3%.
10. The Sinewave Filter shall be suitable for application with PWM inverters that have carrier frequencies between 1.5 kHz to 8 kHz and motor leads up to 15,000 feet.

B. Basic Requirements:

1. The three-phase inductor shall be designed for low pass filtering service and to attenuate voltage high-frequency components in the range of the PWM inverter switching frequency.
2. Construction shall be of copper wire or copper foil wound on magnetic core.
3. The design maximum operating temperature rise shall be 130 deg C above maximum ambient temperature of 40 deg C.
4. Inductors shall be air-gapped to control magnetic saturation. The inductance shall remain above 50% of its nominal value for any overload not exceeding 200% of rated current.
5. The Sinewave Filter shall not sustain any thermal damage from overloads of up to 150% of rated current for minimum periods of sixty (60) seconds every ten (10) minutes.

6. Capacitors shall be AC rated, polypropylene film material, and self-healing technology. They shall be connected in ungrounded neutral Y (wye) or delta configuration.
7. Enclosure shall be ventilated, sprinkler proof to conform to NEMA-3R standard.

C. Options:

1. Submit for approval before shipment certified production test results with serial numbers for harmonic mitigation performance under actual variable frequency drive operation.
2. Include common-mode choke option to reduce the effects of common-mode currents on motor bearings and cable insulation.

EXECUTION**D. Installation**

1. The Sinewave Filter shall be handled, stored and installed in accordance with the manufacturer's recommended installation practices as found in the installation, operation, and maintenance manual. Installation shall comply with all applicable codes.