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***HPS Centurion S***

**SineWave Motor Protection Filter**

**Typical Specifications**

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1. **GENERAL**
	1. SCOPE
		1. This section defines the Centurion S SineWave motor protection filter with three-phase inductor and capacitors. The filter is designed to attenuate PWM (Pulse Width Modulation) carrier components present in the output waveform of the inverter.
	2. BACKGROUND
		1. Large voltage spikes can be imposed on motor windings due to a long cable distance between a Variable Frequency Drive (VFD) and the motor. This is caused by PWM switching, high carrier frequencies and a mismatch in impedance between the cable and the motor. The SineWave filter shall produce a sinusoidal output voltage waveform that has less than 5% THD(v) (total voltage harmonic distortion). The filter shall be designed to reduce motor and cable heating, reduce motor noise and eliminate the effects of reflected wave phenomenon.
	3. RELATED DOCUMENTS
		1. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.
	4. REFERENCES
		1. NEMA ST-20 Dry-Type Transformer for General Applications
		2. IEEE C57.110 Recommended Practice for establishing transformer capability when feeding non-sinusoidal load currents.
		3. UL 508, CSA C9 & C22.2 No. 47.
		4. IEC 61558-1, IEC 61558-2-20
2. **PRODUCTS**
	1. General construction:
3. The SineWave filter shall be LV low pass circuit consisting of three-phase inductor and capacitors.
4. The three-phase inductor shall be designed to attenuate high frequency components in the range of the PWM inverter switching frequency.
5. The three-phase inductors shall be designed, constructed and rated in accordance with UL, CSA and NEMA standards.
6. The inductor shall be gapped to control magnetic saturation. Inductance shall be measured and shall be within +/- 5% of design value for the tuning inductor.
7. The three-phase inductors shall have 180 degrees C class insulation with maximum temperature rise of 115 degrees C for up to 16A, and 220 degrees C class insulation with maximum temperature rise of 130 degrees C above 16A units. Coil conductors shall be copper windings.
8. The terminations shall be terminal blocks or copper pads. Terminals shall be marked with A1, B1, C1, A2, B2, and C2.
9. Inductor winding shall be suitable for 150% RMS overload for 60 seconds once every 10 minutes.
10. Capacitors shall be rated to handle nominal system voltage plus 10% continuously. Capacitors shall be AC rated, polypropylene film material, and self-healing technology. They shall be connected in Y (wye) or delta configuration.
11. Capacitors shall discharge to reduce residual voltage to less than 50V within one minute of de-energization (NEC article 460-6).
12. The Centurion S SineWave filter shall be provided in a Type 3R enclosure or in open style format. All units shall be provided with a grounding lug.
13. Enclosure Finish: ANSI 61 Grey suitable for UL50 outdoor applications
	1. Voltage Requirements:
		1. The SineWave filter shall be rated for nominal system voltage 380V to 480V or 600V, +/- 10% and full load current 9A to 600A at 380 to 480V or 7A to 500A at 600V
	2. DESIGN SPECIFICATIONS:
		1. The SineWave filter shall support drive fundamental (output) frequencies ranging from 10Hz to 90Hz.
		2. The SineWave filter shall be suitable for applications with PWM inverters switching frequencies between 2kHz and 8kHz.
		3. The SineWave shall have an average of 5% THD(V) (voltage total harmonic distortion) or less for switching frequencies in the range of 2kHz to 8kHz.
		4. The SineWave filter shall have a maximum insertion loss (i.e. voltage drop) of 5% at 60Hz rated voltage.
		5. The SineWave filter shall be suitable for applications with PWM inverters with an output cable length (motor lead) up to 15,000 feet (4572 meters).
		6. The SineWave filter shall be capable of operating at 150% of rated current for one (1) minute every ten (10) minutes.
		7. The SineWave filter shall have efficiency of no less than 98%.
		8. The filter shall be suitable for operation in an ambient temperature of 50 degrees C.
		9. Altitude: <1000m
		10. Maximum humidity 95%, non-condensing.
		11. cULus listed
		12. Built to NEMA ST-20 and in accordance with all applicable UL, CSA and ANSI/IEEE standards.
	3. Acceptable Product and Manufacturer:
		1. Hammond Power Solutions Inc. (Canada: 1-888-798-8882 / U.S.: 1-866-705-4684).
		2. Substitutions are permitted, subject to meeting all requirements of this specification and having written approval by engineering 10 days prior to bid closing.

##### EXECUTION

* 1. Installation
		1. The installing contractor shall install the SineWave filters per manufacturer's recommended installation practices as found in the installation, operation, and maintenance manual and comply with all applicable codes.

B Install SineWave filter in accordance with the NEC and applicable local codes.

* 1. SUBMITTALS

		1. Action Submittals
			1. Submit drawing and product data for approval and final documentation in the quantities listed according to the Conditions of the contract. Customer name, customer location and customer order number shall identify all transmittals.
	2. QUALITY ASSURANCE
		1. Third Party Certification: The SineWave filter shall have the third-party certification by Underwriters Laboratories (UL listing)
		2. Manufacturer Qualifications: The manufacturer shall have been engaged in the production of low voltage magnetic components for a minimum of 10 years.
	3. STORAGE AND HANDLING

		1. The SineWave filter is to be delivered to the project site in the supplier’s or manufacturer’s original containers, labeled with the supplier’s or manufacturer’s name or product brand name.
		2. Store the SineWave filter and accompanying materials in their original, undamaged packages and containers, inside a well-ventilated area, which is protected from weather, moisture, extreme temperatures, and humidity.
		3. Storage Temperature: -20ºC to 60ºC.
	4. SOURCE QUALITY CONTROL

		1. Field inspection start up and testing shall be performed by a qualified technician from the owner, the contractor or the manufacturer.
		2. Perform equipment start up and testing in accordance with the manufacturer’s instruction manual using qualified personnel.
		3. Document equipment nameplate information and startup/testing data on the manufacturer’s recommended startup/test report including insulation resistance for future reference.
	5. WARRANTY

General: Standard factory warranty shall be at least 3 years from the date of shipment. This warranty covers defects in material and workmanship