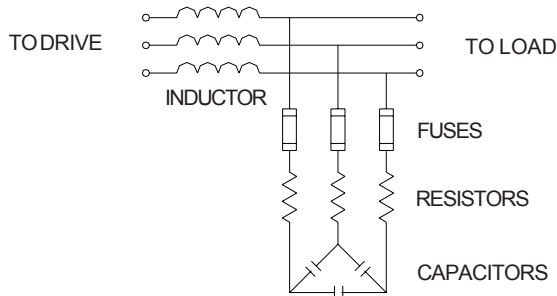


# Type SF Sinewave Output Filters

## APPLICATION

The Powerohm Type SF Sinewave Output Filter is used where variable frequency drives are installed that require extremely long motor leads, such as a submersible downhole pump motor. Since voltage wave reflection is a function of the voltage rise time and the length of the motor leads, there is an impedance mismatch at both ends of the cable. Due to the impedance mismatch, a portion of the waveform high frequency leading edge is reflected back in the direction from which it arrived. When the reflected leading edges encounter other waveform leading edges, their values add, and cause voltage overshoots. As the carrier frequency increases, there are more leading edges present, causing higher and higher voltage overshoots. This condition leads to premature motor failure, halting critical processes involving a downhole pump motor. The Type SF Sinewave Output Filter uses a specially designed RLC network to minimize and nearly eliminate these damaging voltage overshoots.



## BASIC CONSTRUCTION

The Type SF Sinewave Filter offers a standard compartmentalized design, with the resistor and inductor in one compartment, and the capacitors and other control components, such as cooling fans, relays, fuses and indicator lights in another. This compartmentalized design isolates the heat sensitive capacitors and control components from the heat generating resistor and inductor. There are slotted openings in the enclosure bottom to allow air to enter the enclosure. The cooling fans are mounted on the vertical barrier, which creates the two compartments. The fans pull air across the capacitors and control components, and push the air across the resistor and inductor. The air is then exhausted through openings in the resistor/inductor compartment. Each unit has special fuses with a N.O. and N.C. contact which allows monitoring of a blown fuse condition. If a fuse opens, a red indicator located on the exterior of the enclosure will light. An additional control relay provides N.O. and N.C. contacts for remote monitoring of the filter status, or allows for shutdown of the variable frequency drive.

Units are available in either a NEMA 1 or NEMA 3R enclosure. The Nema 3R outdoor model includes a baffling plate behind the louvers to prevent water from coming in contact with the resistor or inductor during extreme storm conditions. Finish options are power coated, mill galvanized, hot dipped galvanized, or stainless steel.

INDUCTOR & RESISTOR COMPARTMENT



CAPACITOR & CONTROLS COMPARTMENT



## DESIGN REQUIREMENTS

The following information is necessary to facilitate a proper Type SF Sinewave Output Filter design:

- Normal Line Voltage
- Carrier Frequency
- Current Rating
- Motor Horsepower
- Fundamental Frequency
- Enclosure Type

# Harmonic Filter Applications

## APPLICATION

Harmonic filters are commonly used in industrial applications where there are concerns about harmonic distortion caused by the increasing number of nonlinear power electronic devices. Harmonic distortion causes stress and resultant problems for a plant's distribution system, as well as all of the equipment that is serviced by that system. For example, the higher voltage peaks that are created by harmonic distortion put extra stress on motor and wire insulation, which ultimately results in insulation breakdown and failure. In addition, harmonics increase RMS current, causing increased operating temperatures for many pieces of equipment, resulting in greatly reduced equipment life. The primary objective of a harmonic filter is to reduce the amplitude of one or more fixed frequency currents or voltages.

Powerohm can design resistor configurations for harmonic filtering systems requiring power resistors, such as static var compensation systems and damping filters. The resistor is normally designed to meet certain criteria outlined in a detailed specification. Our experienced engineering staff, using our wide selection of resistor elements, will design a resistor assembly to meet your needs.

## BASIC CONSTRUCTION

The resistor type is determined largely by the requirements of the specification. Elements are selected to best meet the power rating, inductance limits and voltage requirements of the system. A typical assembly includes all stainless steel elements, interconnecting jumpers, and terminals. Most designs are natural convection cooled, but forced air cooling can be utilized for certain applications.

Powerohm filter resistors are available in open-style configurations for indoor or outdoor use. These resistors can be installed in NEMA 1 or NEMA 3R enclosures, complete with nearly any finish including mill galvanized, power coated, hot dipped galvanized after fabrication, aluminum or stainless steel. Our assemblies are also available with additional options such as special entrance bushings, elevating stands, and drip hoods for open-style units.



**Pictured above is a 3-phase Powerohm resistor configuration rated 150 kW continuous, for a 5th and 7th harmonic filter. The harmonic filter is rated 3000 KVAR for a 13.8 kV system. The unit is installed outdoors in Milne Point, Alaska, approximately one mile from the Arctic Ocean, where it is subjected to wind blown snow and ambient temperatures as low -130°F.**

## DESIGN REQUIREMENTS

The following information is necessary to facilitate a proper resistor design:

- Resistance with Tolerances
- Current Rating or Spectrum
- Inrush Peaks and Duty
- Voltage Class
- Inductance Limits
- Enclosure Requirements