Hilkar®

Air Core Harmonic Filter Reactors

Use of nonlinear loads such as power electronics based equipment and electric furnaces have been on the rise for the last decades. Such loads decrease the power quality of the network that they are connected to. One of the most important parameters for defining the power quality is harmonic distortion.

The harmonic distortion in a network causes:

- Equipment heating
- Insulation failure due to overheating and higher voltage peaks than rated fundamental voltage (50Hz or 60Hz) sinusoidal signal
- Equipment malfunction (false zero cross detection on power electronics devices)
- Communication interference
- Increased noise in electrical machines
- Fuse and breaker mis-operation

Passive harmonic filters are the most commonly used devices for reducing the harmonic distortion in a network. These filters are built up from passive RLC components, i.e. resistors, inductors and capacitors.

The inductors (reactors) in these filters serve to provide a resonance path together with the capacitors existing in the harmonic filter. By appropriately tuning the resonance frequency of a harmonic filter, the unwanted harmonic currents injected by the nonlinear loads can be prevented from going into the electrical grid. This is a very important measure that is taken for reducing the harmonic distortion in a network. Harmonic filter reactors may be used in single-tuned, second order, and C-type filters according to the type of load and purpose. Moreover, they may be used in series with Flexible AC Transmission Systems (FACTS) devices such as Static VAr Compensator (SVC), Static Synchronous Compensator (STATCOM) and High Voltage Direct Transmission (HVDC) in order to reduce the amount of harmonics that would be injected by these systems into the electrical grid.

At medium voltage level, usually air core dry type reactors are used as harmonic filter reactors. Having no magnetic core, air core reactors are free from saturation. They may be installed outdoor and indoor as long as magnetic flux path is considered during installation in order to stay away from ferromagnetic material while in operation.

In some industrial applications such as arc furnaces and ladle melt furnaces, it is vital to filter out some harmonics while not amplifying the existing interharmonics. Otherwise, excessive heating or overvoltages can occur which may damage or at least degrade the lifetime of equipment.

Moreover, industrial customers are forced to obey harmonic current and harmonic voltage limits defined with respect to voltage level and with respect to the ratio of short circuit power to load power, in standards such as IEEE 519.92. Therefore, careful design of the tuning frequency and rating of the reactors considering a wide frequency band including both the harmonics and interharmonics are important.

All Hilkar air core harmonic filter reactors are custom designed for different applications by considering the voltage, current, inductance, type of application (or filter type), harmonics, interharmonics, size, transient events such as switchings, and loss characteristics that are required to provide the most efficient design at the most economical prices. All the routine tests are performed in accordance with EN 60289 or other standards depending on customer request. Type test reports are available on request. All the test reports are submitted to customer. Basic testing program includes some or all of the following tests:

- Routine Tests (Inductance, Resistance, One Minute AC Insulation Voltage Withstand Test and Impulse Voltage Withstand Test)
- Short Circuit Withstand Test
- Temperature Rise Test
- Sound Level Test
- Seismic Test

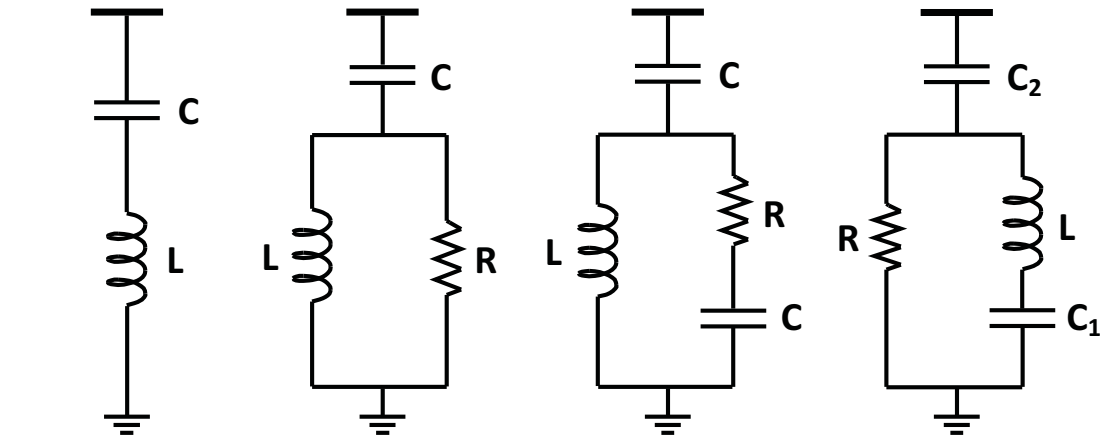
Features

- Designed and tested to applicable IEC and IEEE standards
- Excellent high voltage strength
- High quality factor (Q)
- High thermal capacity
- High mechanical strength to withstand high short-circuit forces
- Fiberglass spacers are used in order to provide ease of cooling
- Compact design, dimensions can be adjusted according to customer's specific needs
- Side by side, delta or vertical arrangement depending on space availability
- Pulsed power compatibility for filter energization and transformer inrush scenarios
- Corrosion and heat resistant paint for indoor and outdoor applications
- Insulators with high creepage distance on demand for highly polluted areas and high altitudes
- Special surface protection against UV and pollution Class IV areas
- Maintenance-free design
- Aluminium, hot dip galvanized steel or concrete support stands are available
- Elevation stands are available

Air Core Harmonic Filter Reactors

Technical Specifications	
Voltage	Up to 36 kV*
Fundamental Frequency	50 Hz / 60Hz
Harmonic Current	$I_h = 0.3I_1$
Maximum Current	$I_{max} = 2I_1$ for 60 seconds
Type	Dry, air core
Frequency (Harmonic Order)	Up to 2.5 kHz (50^{th} harmonic for 50 Hz systems)
Altitude	Up to 1000 m*
Installation	Indoor / Outdoor
Insulation Class	F (155°C)
Winding Material	Aluminum or Copper
Protection Degree	IP00 (indoor), IP23 (outdoor), others on demand
Temperature Range	-40°C to 55°C
Painting	RAL 7035, other colors on demand
Cooling	Air Natural (AN)
Options	Taps with DIN or NEMA terminal configuration

Filter Types



single-tuned (or detuned) filter | second-order damped filter | third-order damped filter | C-type damped filter