

### Filter Resistors



The ever-increasing use of power electronics and other solid state devices, which generate harmonic voltages, make the issue of power quality more and more important both for suppliers and users of electrical power.

Complex waveforms created by solid-state devices in power system converters, motor controls, etc. feed harmonics into power systems, causing trouble with equipment connected elsewhere in the system. The solution is higher order harmonic filters consisting of capacitors, inductors and resistors tuned to eliminate specific frequencies. The capacitors and inductors allow the fundamental frequency through and divert the harmonics into the filter resistor where the harmonic currents are dissipated as heat and thus lost from the system.

#### Design Considerations

##### Power Dissipation

This power is partially stored in the mass of the resistor elements before being transferred to the surrounding environment through convection cooling. Not only is the overall mass of the current carrying material important, but also:

- The surface area of the resistor elements
- The temperature difference between ambient air and the heating elements
- The cumulative effect of the resistors on each other

##### Resistance Value

The overall filter design dictates the required resistance. As such, it is imperative the Customer specify the nominal value of the resistor as well the desired tolerance.

Additionally, the inherent inductance of the resistor may affect the performance of the filter. Fortress engineers their resistor assemblies to not only minimize this inductance, but also limit the change in resistance as the elements heat up to guarantee a stable operating profile.

##### Voltage/Insulation class

The resistor must be designed in accordance with local standards (IEEE, IEC, etc.) and consider line to line voltage, arcing distances, creepage distances, BIL withstand level and any expected voltage transients.

##### Current Rating

The resistive elements, along with the internal and external connections have to be carefully considered and engineered to carry not only the rated current, but also periodic high current transients.

##### Miscellaneous

Other factors can contribute to the design of the resistor, including physical conditions of the site such as the level of atmospheric pollution, seismic zone, corrosive environment, wind and altitude.

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### Enclosure Materials and Design

The standard enclosure material is mill galvanised steel. Alternative materials include both GR304 & GR316 stainless steel.

As standard we offer IP23 enclosures. They keep out birds and vermin and are suitable for outdoor use whilst also allowing good ventilation. We also supply IP33 enclosures. IP54 and IP55 are rarely used for HV filter resistors due to the requirement to dissipate a large amount of heat energy. Termination is normally to exposed side bushings. When side mounted cable termination chambers are specified they are IP54 or IP55 as standard.

We routinely supply cyclone wind load rated enclosures to customers in harsh coastal environments and seismic rated enclosures for earthquake prone areas.

Whilst our standard range of enclosures are suitable for most applications we are also happy to provide custom designed equipment if your application requires it.



400kV Filter Resistors



Filter Resistors in Canada



West Ham (UK) MSCDN