# FILTER SELECTION CRITERIA

## 1-VOLTAGE AND CURRENT

The first and most obvious consideration is to determine the voltage (both line - to – line and line - to ground) of the system and the current that will pass through the filter. For a power line filter, the voltage will normally be 120/208 Vac or 277/480 Vac, but it may also be DC voltage. Current may be less than 1 amp to well over 1000 amperes.

## 2-FREQUENCY

Both the pass - band and the stop - band must be specified. The pass – band must be large enough to insure that the filter will allow the system in which it is installed to operate properly. Obviously, power – line filters, the power frequency must be given... The stop – band should also be specified so that the filter will adequately reject all undesired frequencies

## 3-INSERTION LOSS

Insertion loss, measured in db, is the ratio between the power received at a specified load before and after the insertion of the filter at a given frequency. This measurement is an indication of the degree of attenuation provided by the filter at that frequency.

In determining or specifying Insertion Loss, a number of key factors must be considered. For any filter design, Insertion Loss can be increased with a commensurate increase in size and weight as additional components (or stages) are added. Even seemingly small increases n (e.g. from 94 db to 100 db) can significantly increase the size and weight.

Because early test equipment had only a 50 Ohm Characteristic Impedance, it became the convention to specify Insertion Loss with a 50 Ohm source and Load Impedance. In actual operation the source and load Impedance's will normally be different and the Insertion Loss in a system will thus be different as well

## 4-PASS-BAND IMPEDANCE

For data and signal line filters, the Pass band Impedance of the load must be specified to insure that the filter is properly matched for data transmission.

## 5-CIRCUITS

Each phase of a power line should have its own filter. In addition, the neutral line, if included, should be filtered as well.

It should be noted that the latest revision of the National Electrical Code requires that the neutral line in many systems be the same size as the phase line.

Customer's instrumentation packages, because of size constraints, usually require that a number of custom filters be contained in a single enclosure with multi-pin input and output connectors. The circuit layout in these multiple circuit filters is a critical in achieving the desired filter performance.

## 6-REACTIVE CURRENT

The reactive current allowed is normally defined by a regulatory agency or military specification for safety purposes. Limiting reactive current may increase the size of the filter with a given attenuation requirements. Decreasing the line-to ground capacitance in order to decrease reactive current will tend to require the in-line inductance to increase. This may increase the DC Resistance, voltage drop, size and weight.

## 7-CAPACITIVE vs. INDUCTIVE INPUT AND OUTPUT

A filter may be designed with either capacitive or inductive input. An inductive input will normally cost more than one with a capacitive input. The advantage of an inductive input is the ability of the input inductor to limit the effect of transients or spikes on the line as well as some EMP pulses.

## 8-SIZE and WEIGHT

The size of a filter may be restricted by the space available in the application and may be further constrained by the dimensions of mounting surfaces that also serve as ground planes.

Weight constraints are equally imposed for portable or aircraft instrument applications. These constraints should not be imposed lightly as their imposition may restrict more important characteristics of a filter such as Insertion Loss and Leakage Current.

## 9-SPECIAL CONSIDERATIONS

There is an almost unlimited list of possible special considerations in selection of a filter. Regulatory Agencies such as UL,FCC,CSA, TUV, and VDE, as well as a long list of military specifications, such as MIL-PRF-15733, MIL-I-45208, MIL-STD-202, MIL-STD 220,and MIL-STD-461. In addition, special requirements such as EMP and TEMPEST must be given careful consideration.