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ACTIVE HARMONIC FILTRATION

The need to provide close economic control of industrial processes and HVAC equipment has seen a marked increase the use of variable speed drives. These variable speed drives provide many valuable benefits, namely complete control of motor speed and voltage, reducing the consumption of motors - especially during times of low loading. In addition to the reduced kWh consumption, inverter drives operate at a near unity power factor, further reducing the consumption of a motor whose normal operating power factor would be in the region of 0.80 – 0.85.

The main drawback of variable speed motor control is the production of harmonics as a result of the rectification / inversion process. The level of harmonic current produced by the variable speed drives depends upon the installation design specification. If no reference to harmonic performance is made in the design specification then it is possible that no harmonic mitigation will be provided with the inverter systems, the result of which is that the ac input current distortion of the inverter drive could be in excess of 40%. The basic level of mitigation required by many projects is the installation of ac input chokes. This typically results in a reduction of the harmonic current distortion to around 20-25%.

An installation that uses significant amounts of inverters (especially on larger motors such as chilling plant) will have potentially high levels of harmonic current distortion, which depending upon the strength of the supply may result in high voltage distortion. If this voltage distortion reaches levels exceeding the European compatibility limits (8.0 % VTHD) the operation of equipment can no longer be guaranteed, almost certainly resulting in equipment malfunction. Even well below this level extra stress is being placed upon equipment, potentially reducing its life span.

Traditionally, passive harmonic filters have been used to control the level of harmonic current produced by non-linear loads. A passive filter is, in simple terms, a tuned LC circuit which provides very low impedance to a specific harmonic. A number of these tuned arms are connected in parallel (each on tuned to a different harmonic), providing a low impedance path for them. The harmonic currents flow into these filters in preference to the supply, effectively isolating these harmonics from the supply.

The major drawback with passive filtration is that it is basically a parallel connected capacitor and consequently produces significant levels of leading reactive power (VArs). With older DC variable speed drives this was not an issue as such drives operate at a poor lagging power factor and the VArs produced by them normally more than compensate for the leading VArs produced by the passive filter. As has already been mentioned above, modern inverter based VSD systems operate at a near unity power factor and as a consequence there is no reactive power available to offset that produced by a passive filter.

The solution to this problem is an active harmonic filter. An active filter is basically an inverter based harmonic current source that measures the magnitude and phase of the load current harmonics. The active filter control synthesises the load harmonic currents but phase shifts them by 180°. This harmonic anti-phase current is injected into the system and combines with the load current to create a supply current that has a much-reduced level of harmonic distortion. The principal of operation is shown graphically in the illustration below.

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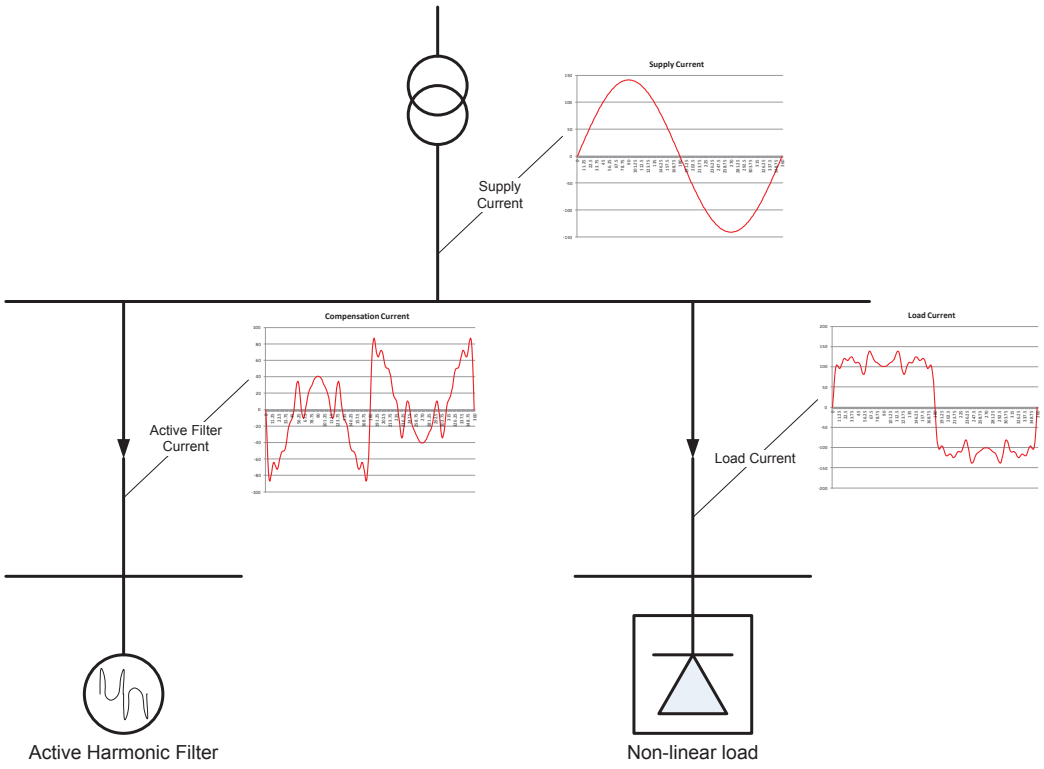
PFC Engineering offer a full harmonic analysis, design and installation service for active harmonic filtration systems, drawing on 25 years of power quality experience to provide an optimal harmonic filtering solution tailored to the sites specific needs.



The Energy Solution Specialists.

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