Power Factor Correction Assemblies

Power Factor Correction (PFC) is a widely adopted and well established practice in Industry but it has not been widely used in the Construction sector. However, because the adoption of PFC can significantly reduce the size of supply required by a site, with the dual benefits of reduced cost and reduced carbon emissions, use by Construction is increasing.

We have two approaches to providing PFC for construction installations. Firstly, through the supply of a “main” PFC assembly, which is installed at the main site intake. Secondly, through “local” PFC units to supply individual pieces of plant, such as tower cranes. The advantage of “local” correction is that savings are achieved within the site itself through the use of smaller supply cables, etc.

Both types of PFC assembly are fully automatic and incorporate capacitor banks, typically supplied in modules of 25 kVAr or 50 kVAr, which are controlled by a power factor control relay. The PF relay monitors the supply and alters the number of modules connected by switching banks of capacitors IN and OUT via a soft switching contactor arrangement.

PFC equipment to be incorporated at the “main” site intake can either be supplied as a stand alone assembly, positioned adjacent to the incoming Mains Distribution Assembly (see adjacent image of a stand alone 250 kVAr assembly) or they can be incorporated within the incoming Mains Distribution Assembly (MDA) itself.

When a stand alone, main PFC assembly is supplied, it requires two connections to the incoming MDA: (i) a mains connection from the MDA to the PFC Assembly (a 250 kVAr PFC assembly should be supplied from a 400A MCCB) and (ii) a current transformer (provided with the PFC assembly) needs to be incorporated within the incoming section of the MDA and an auxiliary connection made to the PFC monitoring relay.

No additional connections are required when the PFC equipment is incorporated within the incoming MDA: it is provided fully wired and fitted. Similarly, when PFC equipment is incorporated within local switchgear (i.e. crane isolators), only a normal mains connection is required to the isolator.

Please see over the page for further information on Power Factor Correction.

Free-standing 250 kVAr Assembly

Banks of capacitors located within the free-standing 250 kVAr assembly

100A Crane Isolator with integral PFC

What is Power Factor Correction?
Power Factor is the ratio of “useful” power to “total” power consumed by an item of electrical plant. All electrical equipment requiring the creation of a magnetic field to operate will draw a current which is said to ‘lag’ behind the voltage thus producing a “lagging” Power Factor. Capacitors contained within our Power Factor Correction assemblies draw current which is said to ’lead’ the voltage, thus producing a “leading” Power Factor. If Capacitors are connected to a circuit that operates at a nominally lagging power factor, the extent that the circuit lags is reduced proportionately.
Circuits having no resultant leading or lagging component are said to operate at “unity” (1) power factor, and the total energy consumed is equal to the useful energy.

Why improve Power Factor ?
Improving a system’s power factor will reduce the total power consumed by an electrical installation and will provide the following benefits:

Financial saving - By reducing the size of supply, electricity costs are less and cable sizes can be reduced.
Environmental benefit - Reduced power consumption means lower CO_2 emissions
Extended equipment life - Reduced electrical burden on cables and electrical components.
Increase load capacity - Provide additional capacity for other loads to be connected.

How Much Power Factor Correction Do I Need?
It is possible to calculate the amount of PFC that is required for specific pieces of plant, providing information is available from the providers of the plant on the electrical characteristics of their machinery. It is less easy to be accurate about the amount of PFC that is required for a whole site, without carrying out a power survey. If the power factor of an overall installation is known (or can be estimated) the Blakley kVAr calculator (available on our website) will calculate the size of main PFC assembly required.

Equipment Design
Our PFC assemblies are fully automatic and incorporate modules or banks of capacitors that are switched IN and OUT of circuit, to provide the optimum amount of correction. Assemblies incorporate special soft switching contactor arrangements to minimise system disturbance which is caused by capacitor switching. For example, a 50kVAr automatic step is controlled by two contactors switching in cascade. These contactors incorporate a pre-connection resistor system which reduces the effect of current inrush, thus reducing system disturbance and increasing product life. 100 Amp circuit fuses are installed to protect each 50kVAr capacitor step and its associated control gear.

Capacitors
The capacitor unit comprises the requisite number of individual capacitor elements. These elements are manufactured from impregnated metallized polypropylene or metallized paper and plastic film and have a self-healing capacity. Each one incorporates a fail-safe protection device.

Maintenance
All capacitors have a finite life. When failure occurs no apparent warning is given. In fact, contactors operate and indicator lights will still switch on and off, but the capacitors may not be operational. Most modern capacitors incorporate fail-safe protection mechanisms which quietly disconnect them, so again failure goes undetected. The loss of effective Power Factor Correction is very expensive because the savings it is designed to provide are irretrievably lost.

We are able to arrange for routine site maintenance of PFC assemblies to be carried out or, at the end of a major construction contract, PFC assemblies can be returned to us and we will provide a free of charge quotation for the cost to replace any capacitors or other components that require replacement. As a large percentage of the overall cost of a main PFC assembly is within the enclosure and the controlgear, the replacement of capacitors is likely to be an economic proposition and properly maintained assemblies should be able to be used on a succession of contracts.

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