



Power Factor Correction

Why Might I Need Power Factor Correction?

Power factor correction reduces the current drawn on a power supply by reducing the 'reactive' current. This is the current which creates reactive power, which is often seen denoted as kVAr instead of the usual kVA. This power is used to energise magnetic fields used in devices such as motors.

Some electricity consumers pay for reactive power, some do not. If you pay reactive charges, then you can reduce these with power factor correction, presenting a direct payback.

There are many reasons why electricity users may wish to expand their power supplies. These include catering for new machinery, increases in production levels and moving premises. Whatever the reason, many supplies upgrades are carried out unnecessarily when power factor correction could achieve the same end at a fraction of the cost.

Environmentally Acceptable

Clearly, reduced energy use presents an environmental benefit. But the construction of our equipment also has the environment in mind. Our capacitors have always been PCB-free. This material (polychlorinated biphenyl), which is toxic and highly persistent, was used extensively for the manufacture of capacitors. PCBs are now governed by the Poisonous Waste Act 1972.

Self Healing

Procuco capacitors are manufactured from metallised polypropylene or metallized paper and plastic film, which are self healing. This promotes the longevity and reliability which are a feature of Procuco power factor correction units.

Low Losses

Procuco capacitors have losses of approximately 0.5 Watts per KVAR. This low loss means that the capacitors run at low temperatures, thus reducing dielectric ageing again promoting longevity. This feature also means that the capacitors can be mounted in fully sealed enclosures especially valuable in dusty or damp atmospheres.

Safety Protection Systems

All Procuco PFC units incorporate a safety cut-out switch, which disconnects the capacitors should electrical or thermal overloading be detected. This system also disconnects capacitors subject to ageing at the end of their useful life.

Modular Construction

Procuco PFC capacitance units are modular in their construction, manufactured from the required number of individual capacitors. This method of construction has several distinct advantages:-

- In the unlikely event of failure of one unit, the others will be unaffected.
- Identification and replacement of failed capacitors is simple and inexpensive.
- Both manual and automatic units can be modified and extended as required.

Standards

All Procuco PFC equipment is manufactured to comply with VDE0560, EN60831-1 and EN60831-2.

Installations

Installation can be performed by our engineers at your convenience. The work will be planned to cause minimal disruption at the client's premises.

Comprehensive Range

Procuco offer a wide range of capacitors and control enclosures to meet varying requirements. Designs can be modified to suit individual needs without additional cost.

Competitively Priced

Procuco PFC capacitors, which are of course guaranteed, incorporate many technical benefits, but remain highly competitively priced.

The Self-Healing Process

The insulation material of modern capacitors is subjected to high dielectric stresses. It is feasible that after having been in use for a long time, a breakdown may occur in a capacitor element owing to ageing.

The elements of our capacitors are designed in such a manner that, should the elements be unusable in the event of a puncture, there is practically no reduction in their rating.

The capacitor elements can be directly connected in parallel inside their case, without fuses, thus eliminating troubles due to switching-current transients.

The conductors of the capacitors are about 100th of the thickness of conventional aluminium foil conductors and consist of a thin metallic layer which is deposited on the insulating dielectric by evaporation under vacuum.

In the event of a puncture, the thin metal coating in the vicinity of the defective region is vaporised by the resulting electric arc. Heat is extracted simultaneously from the arc, which is elongated rapidly over the surface of the dielectric. Hence, the discharge at the defective spot is stopped within 1/100,000 second. The area around the puncture, which has become free of metal, effectively insulates the defective point, thus enabling the capacitor to operate without any further restriction of its output. The

self-healing process consumes only a fraction of the energy previously stored in the element. The effect of the short duration of the arc is therefore unlike that of a short circuit, so that neither the supply nor the protection and regulating equipment are affected by the process.

The self healing process is, in addition, neither influenced nor impaired by the available short circuit power of the supply.

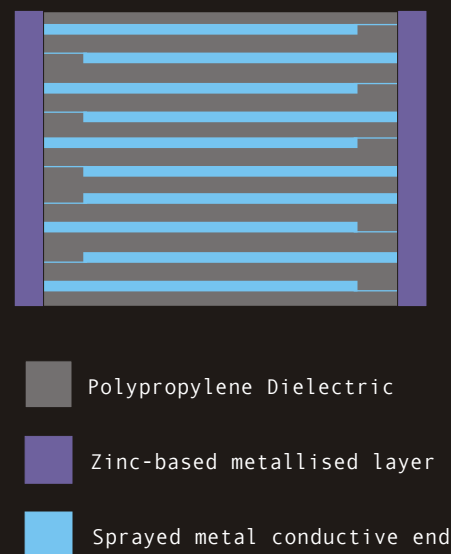
Construction

Procurow are able to offer various types of capacitor to meet specialist applications.

The most widely used types are constructed entirely from layers of metallized polypropylene. The dielectric materials are wound into rolls. Metal connectors are sprayed onto the ends of each roll by means of a metal spray gun, each contact film being connected to one of the capacitor conductors (See below).

The elements are consequently virtually non-inductive and have a high impulse strength, enabling them to withstand transient currents during switching operations of a hundred times the rated

Construction of Metallised Polypropylene Capacitor Element



A special mechanical thermal cut-out reliably prevents damage in the vicinity of a capacitor in the event of failure due to excessive thermal overload.

Vector FS Automatic Capacitor Series

(Up to 400kVAr)

- Highly reliable capacitors with self healing properties.
- Low losses: 0.5W / kVAr
- Safety protection systems incorporated within each capacitor element
- Internally extendable to 150, 200, 300 or 400 kVAr (See table below)
- Floor standing units for easy installation
- Ideally suited to areas with limited floor space
- Soft switching contactors for minimal disturbance
- Also available with harmonic blocking filter reactors
- Multi-stage switching with on/off/auto facility available on the control relay
- Panel mounted on/off/auto switches and indicator lamps available as low cost option
- Suitably rated fuse, circuit-breaker or loadbreak switch is available as an option upon request.



Equipment Size	Height	Width	Depth
Up to 108 kVAr	850	600	325
Up to 216 kVAr	1450	600	400
Up to 324 kVAr	1850	600	400

Construction: The enclosure is manufactured from robust steel and is designed for front access. Top or side cable entry is provided as standard. Bottom cable entry can also be available upon request.

Control Gear: The equipment incorporates a special soft switching contactor arrangement to minimise system disturbance which is caused by capacitor switching. Each 50kVAr automatic step is controlled by two contactors switching in cascade. These contactors incorporate a pre-connection resistor system which reduces to a minimum the effect of current inrush. Fuses rated at 100 Amps 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.

Permissible Overloads:

Voltage: The figures given are for our standard 415 volt capacitor products. Other voltages available on request.

- 440V permanently
- 480V 8 hours per day
- 506V 30 minutes per day
- 528V 5 minutes per day
- 572V 1 minute per day

Current: 1.5xIn continuously

Permissible Temperatures:

Ambient -10 to +60°C

Max. permissible mean ambient 1hour 45°C

Max. permissible mean ambient 24hour 40°C

Max. permissible mean ambient 1 year 35°C

Dielectric loss: 0.5 watts per kVAr

Discharge Devices fitted: Residual voltage reduced to 50 Volts in 1 minute

Paint Specification: RAL 7032 (Eurogrey) as standard. Alternative specifications supplied upon request.

Standards:

Equipment manufactured to VDE0560, EN60831-1:1998 and EN60831-2:1996

Type T Automatic Capacitor Series

(Up to 54kVAr)

- Highly reliable capacitors with self healing properties.
- Low losses: 0.5W / kVAr
- Safety protection systems incorporated within each capacitor element
- Wall or floor mounting
- Available with multi-stage switching with on/off/auto switch and indicator lamps.
- Incorporates fused interlocking isolator switch on door.
- Smart and compact unit
- Simple installation



Equipment Size	Height	Width	Depth
Up to 54 kVAr	615	600	300

Construction: The enclosure is manufactured from robust steel and is designed for front access. Top or side cable entry is provided as standard. Bottom cable entry can also be available upon request. The enclosure is designed for floor or wall mounting.

Control Gear:

Type T: Fitted with switch-fuse HBC fuses
Type TF: Fitted with withdrawable fuses
Soft switching contactors
Control circuit fuses
Control relay with specified number of stages.
Hand/off/auto switches (optional)

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

Permissible Overloads:

Voltage: The figures given are for our standard 415 volt capacitor products. Other voltages available on request.

- 440V permanently
- 480V 8 hours per day
- 506V 30 minutes per day
- 528V 5 minutes per day
- 572V 1 minute per day

Current: 2 x In continuously

Permissible Temperatures:

Ambient -10 to +60°C
Max. permissible mean ambient 1hour 45°C
Max. permissible mean ambient 24hour 40°C
Max. permissible mean ambient 1 year 35°C

Dielectric loss: 0.5 watts per kVAr

Discharge Devices fitted: Residual voltage reduced to 50 Volts in 1 minute

Paint Specification: RAL 7032 (Eurogrey) as standard. Alternative specifications supplied upon request.

Standards:

Equipment manufactured to VDE0560, EN60831-1:1998 and EN60831-2:1996

Type C Capacitor Series

(0.16 to 108kVAr)

- Highly reliable capacitors with self healing properties.
- Low losses: 0.5W / kVAr
- Internally expandable to 108kVAr
- Safety protection systems incorporated within each capacitor element
- Extendable and maintainable modular construction
- Low weight and volume
- Strong terminals
- Robust welded steel construction incorporating a large terminal chamber to simplify connection.
- Substantial brass connection terminals, rather than more fragile ceramic type
- Variety of fixing dimensions



Equipment Size	Height	Width	Depth
0.16-2.50 kVAr	220	145	110
2.75-2.95 kVAr	220	145	110
3.20-4.50 kVAr	220	145	110
8.50 kVAr	220	145	110
2.70 kVAr	380	145	110
3.06 kVAr	380	145	110
6.40-8.10 kVAr	380	145	110
9.10-16.2 kVAr	380	145	110

Construction: The enclosure is manufactured from robust steel and is designed for easy access. The enclosure is designed for floor or wall mounting.

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

Permissible Overloads:

Voltage: The figures given are for our standard 415 volt capacitor products. Other voltages available on request.

- 440V permanently
- 480V 8 hours per day
- 506V 30 minutes per day
- 528V 5 minutes per day
- 572V 1 minute per day

Current: 2 x In continuously

Permissible Temperatures:

Ambient -10 to +60°C

Max. permissible mean ambient 1hour 45°C

Max. permissible mean ambient 24hour 40°C

Max. permissible mean ambient 1 year 35°C

Dielectric loss: 0.5 watts per kVAr

Discharge Devices fitted: Residual voltage reduced to 50 Volts in 1 minute

Paint Specification: RAL 7032 (Eurogrey) as standard. Alternative specifications supplied upon request.

Standards:

Equipment manufactured to VDE0560, EN60831-1:1998 and EN60831-2:1996

Type C OEM Range

This special range is specifically designed for OEMs who wish to enclose their capacitor units within a switchgear or control enclosure.

These products incorporate exposed terminals for ease of connection. The low losses associated with these capacitors allows the capacitor elements to be safely mounted in a sealed enclosure, which is especially useful for applications in dusty or damp ambient environments.

Type CF Capacitor Series

(0.16 to 108kVAr)

- Highly reliable capacitors with self healing properties.
- Low losses: 0.5W / kVAr
- Internally expandable to 108kVAr
- Safety protection systems incorporated within each capacitor element
- **Incorporates fused interlocking isolator.**
- Extendable and maintainable modular construction
- Low weight and volume
- Strong terminals
- Robust welded steel construction incorporating a large terminal chamber to simplify connection.
- Substantial brass connection terminals, rather than more fragile



Construction: The enclosure is manufactured from robust steel and is designed for easy access. The enclosure is designed for floor or wall mounting.

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

Permissible Overloads:

Voltage: The figures given are for our standard 415 volt capacitor products. Other voltages available on request.

- 440V permanently
- 480V 8 hours per day
- 506V 30 minutes per day
- 528V 5 minutes per day
- 572V 1 minute per day

Current: 2 x In continuously

Permissible Temperatures:

Ambient -10 to +60°C

Max. permissible mean ambient 1hour 45°C

Max. permissible mean ambient 24hour 40°C

Max. permissible mean ambient 1 year 35°C

Dielectric loss: 0.5 watts per kVAr

Discharge Devices fitted: Residual voltage reduced to 50 Volts in 1 minute

Paint Specification: RAL 7032 (Eurogrey) as standard. Alternative specifications supplied upon request.

Standards:

Equipment manufactured to VDE0560, EN60831-1:1998 and EN60831-2:1996

Harmonic Filtration Systems

Modern technology has led to the ever increasing use of thyristors and other solid state devices in static power converters. These systems provide many benefits, but they also create harmonics which distort the AC wave form.

Many types of equipment cause harmonics. However, it is the increased use of Static Power Converters that is the major cause of the substantial rise in harmonics on electrical systems. These Power Converters are used in modern UPS (Uninterruptible Power Supplies) and Motor Speed Control Systems.

This type of equipment usually operates at a low power factor thus also introducing the need for additional power factor correction equipment.

Problems that harmonics can cause are as follows:-

- Increase in the losses on the network and transformers.
- Detrimental effect upon motor efficiency.
- Nuisance tripping of circuit breakers.
- Premature ageing of electrical insulation.
- Malfunction or failure of some electronic circuits.
- Some types of metering can be subject to erroneous operation.
- Fuses suffer de-rating because of the heat generated by harmonics during normal operation.
- Possible cause of system resonances when power factor correction equipment is present on the system. This phenomena can impose high voltages and currents on the system, which is most undesirable.
- Premature failure of unprotected capacitor installations.

Reactor connected capacitors can be installed which are designed to prevent resonance. They can also be designed to reduce the level of harmonics.

Procuero are able to offer the services of a fully qualified team of engineers, who can provide assistance and complete harmonic analyses.

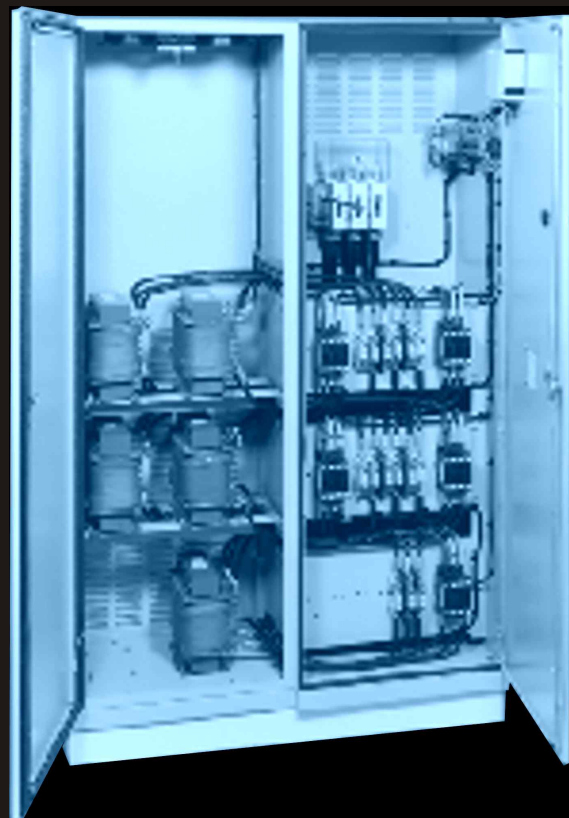
All equipment is designed and manufactured specifically to meet Customer's requirements, using the highest quality components.

Solutions

Blocking Reactor system. This reactor connected capacitor combination is designed to have a resonant frequency of 189 Hz. In this case system resonances are avoided and between 17% and 20% of the 5th harmonic is absorbed. Suitable for variable loads.

Partial Filter System. Here the reactor capacitor combination is designed to resonate at a frequency of 210 Hz. Again system resonances are avoided and between 40% and 50% of the 5th Harmonic is absorbed. Suitable for variable loads where harmonic reduction is also required.

Full Filter System. In this system the capacitor/reactor legs are tuned to a given harmonic frequency producing almost zero impedance to the harmonic current. Therefore most of the current is absorbed by the filter. This type of filter can realistically reduce the harmonic current flowing in the supply network by up to 90%. Ideally suited for constant loads.



Services

Maintenance Agreements

Existing power factor correction equipment is often found not to be operating correctly and in some cases has failed completely. This is obviously very expensive because savings are irretrievably lost.

All capacitors have a finite life. With the older capacitors this was often over 20 years but when failure occurs, no apparent warning is given. In fact, contactors operate and indicator lights will still switch on and off, but the capacitors are not in operation.

Most modern capacitors incorporate fail-safe protection mechanisms which quietly disconnect them, so once again failure goes undetected.

Many companies in today's competitive marketplace find themselves with a much slimmer maintenance department. Consequently, routine inspection and maintenance of Power Factor Correction equipment is often undertaken infrequently or not at all again resulting in loss of savings, supply under-capacity, or even total unit failure.

Modern networks are frequently subjected to adverse system transients and harmonics which makes regular maintenance of Power Factor Correction even more essential. This is particularly true of environments where variable speed drives are in use, such as printers.

The Solution

Procuco are able to offer a low cost nationwide inspection and maintenance service. This is usually offered as a maintenance contract, whereby our engineer will visit on an annual basis, but it can also be provided on an individual basis. Written quotations can be provided upon request.

FREE Power Surveys

Procuco offers a free consultation service to UK companies who may require new or additional Power Factor Correction and Harmonic filtration systems.

To apply for this service, please contact us using the details at the end of this brochure. You will be asked to supply some site details, then we will arrange for an engineer to visit site.

This survey is entirely without cost or commitment on your behalf.

Following the site survey, we will provide a diagnostic report, along with comprehensive details of any corrective actions required.

Related Services

Procuco can also provide supply upgrade services. Using reputable contractors, we are able to offer significant advantages compared to the traditional route using the regional electricity company's contracting company.

Using this service can offer savings in the order of 50%, compared to the traditional supply route - with no compromise in terms of quality.

We are able to undertake both low voltage (400 vac) and high voltage (11,000 vac) work.

All work is carried out to the same exacting standards as that performed by REC contracting companies.

The correct choice of corrective action can be supported by a full tariff arrangement service, which is included in our pricing. Even in cases where this is not required, proposals will be backed by current tariff data to illustrate payback.



Please beware of false claims by companies selling power factor correction equipment. Typically, for an investment not aimed at increasing supply capacity, payback will be reasonable, though not spectacular - around 2 years would be a good guide. Unless you are paying a separate charge for reactive units on your electricity bill, direct savings may be small. In some areas reactive unit charges are not made separately, so a claim of high direct savings would be wrong in such an area. We are happy to discuss applications and give impartial advice regarding costs, savings and payback, as well as ensuring your tariff maximises benefit.



Procurow
Felaw Maltings
Felaw Street
Ipswich
IP2 8SJ

Tel. 08707 606 356

Fax. 07092 356 093

sales@procurow.co.uk

www.procurow.co.uk