

March 2006
Aftermarket Solutions, Ref. No. [443]

Power Factor Correction Capacitors

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*Low Voltage Fixed and Automatic
Power Factor Correction Systems*

Power Factor Correction Systems

Power Factor Correction Capacitors



UNIPAK and AUTOVAR

Product Description

Power Factor Correction Systems

Power factor correction capacitors and harmonic filters are an essential part of modern electric power systems. Power factor correction capacitors are the simplest and most economical means of increasing the transmission capacity of a power system, minimizing energy losses and correcting load power factor. In addition, power factor penalties can be reduced and power quality can be greatly enhanced.

There are two main reasons to correct poor power factor. The first is to reduce or eliminate a power factor penalty charged by your local utility. Another reason is that your existing transformer is, or shortly will be, at full capacity and installing power factor correction capacitors can be a very cost-effective solution to installing a brand new service. Depending on the amount of power factor correction (amount of kvar required for the electrical system to improve the power factor) and the dynamic nature of the load, a fixed or switched capacitor bank may be the best solution. When capacity becomes a problem, the choice of a solution will be dependent upon the size of the increase needed. Like all power quality solutions, there are many factors that need to be considered when determining which solution will be best to solve your power factor problem.

Harmonic Filtering

As the world becomes more dependent on electric and electronic equipment, the likelihood that the negative impact of harmonic distortion increases dramatically. The efficiency and productivity gains from these increasingly sophisticated pieces of equipment have a negative side effect...increased harmonic distortion in the power lines. The difficult thing about harmonic distortion is determining the cause. Once this has been determined, the solution can be easy. Passive harmonic filtering equipment will mitigate specific harmonic issues, and correct poor power factor as well.

Product History

Eaton's Cutler-Hammer® power factor correction product line began as Sprague Electric in Massachusetts in 1942. They were the first manufacturers of dry capacitor cells in the United States. Throughout the next 40 years, they manufactured capacitors in both the dry and oil-filled designs.

In 1986 the company was purchased and renamed Commonwealth Sprague. Eaton's Cutler-Hammer Power Quality Division began a name brand relationship with Commonwealth Sprague in 2001, and purchased the Commonwealth Sprague capacitor systems business in 2003. At that time, manufacturing was moved to the Asheville, NC manufacturing plant.

Product History Time Line

Page	Product	1940	1950	1960	1970	1980	1990	2000	Present
	Sprague Electric								
	UNIPAK								
	Eccol UNIPAK								
	Eccopak								
	Eccovar								
	UNIVAR								
	Eccol UNIVAR								
	UNIVAR AUTOVAR								
	Commonwealth Sprague								
	UNIPAK								
	AUTOVAR								
	UNIVAR								
22-4	Eaton/Cutler-Hammer UNIPAK								
22-4	AUTOVAR								
22-5	UNIVAR								

Figure 22-1. Product History Time Line

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Replacement Parts

Replacement Capabilities

Capacitor Cells — Dry-Type

- **Terminals:** Threaded for secure connection, all sizes. 10 kVAC stand-off terminal bushings. Rated for 30 kV BIL.
- **Dielectric fill:** Thermosetting polymer resin.
 - Flash point: +415°F (+212°C)
 - Fire point: +500°F (+260°C)
- **Dielectric film:** Self-healing metallized polypropylene. Losses less than 1/2 watt per kvar.
- **Pressure-sensitive interrupter:** Built-in, 3-phase interrupter design. UL recognized. Removes capacitor from line before internal pressures can cause case rupture.
- **Discharge resistors:** Reduce residual voltage to less than 50 volts within one minute of deenergization. Mounted on terminal stud assemblies. Selected for 20-year nominal life. Exceeds NEC® requirements.
- **Capacitor operating temperature:** -40°F (-40°C) to +115°F (+46°C).

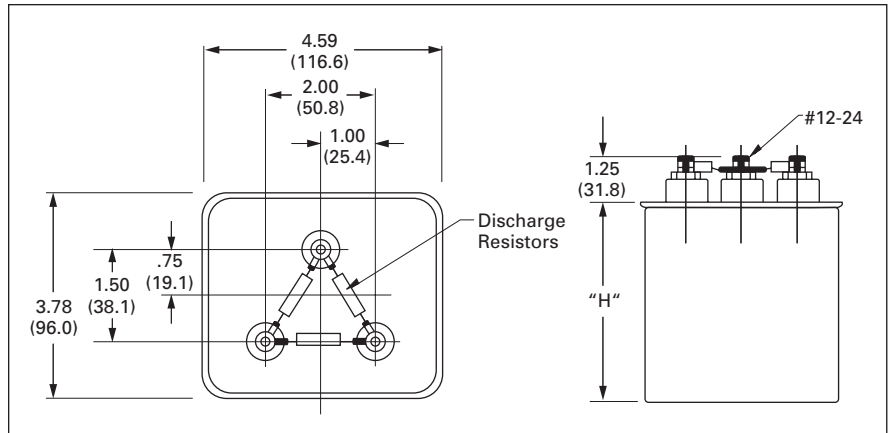


Figure 22-2. PCDM Cell Showing Threaded Nut and Stud Terminal Connection

Table 22-1. Dry Cell Chart

Voltage Rating	kvar ①	Height — Inches (mm)	Approximate Weight — Lbs. (kg)	Catalog Number ②
240	0.50	4.00 (101.6)	2.1 (1.0)	243PCDMF
240	1.00	4.00 (101.6)	2.1 (1.0)	443PCDMF
240	1.50	4.00 (101.6)	2.1 (1.0)	643PCDMF
240	2.00	4.00 (101.6)	2.1 (1.0)	843PCDMF
240	2.50	4.50 (114.3)	2.6 (1.2)	1043PCDMF
240	3.00	5.50 (139.7)	3.2 (1.5)	12X43PCDMF
240	4.00	6.00 (152.4)	3.5 (1.6)	16S43PCDMF
240	5.00	5.00 (127.0)	2.6 (1.2)	523PCDMF
240	6.25	6.00 (152.4)	3.2 (1.5)	6A23PCDMF
240	7.50	6.00 (152.4)	3.5 (1.6)	7X23PCDMF
240	8.33	7.00 (177.8)	3.5 (1.6)	8B23PCDMF
480	1.00	4.00 (101.6)	2.1 (1.0)	143PCDMF
480	2.00	4.00 (101.6)	2.1 (1.0)	243PCDMF
480	2.50	4.00 (101.6)	2.1 (1.0)	2X43PCDMF
480	3.00	4.00 (101.6)	2.1 (1.0)	343PCDMF
480	4.00	4.00 (101.6)	2.1 (1.0)	443PCDMF
480	5.00	4.00 (101.6)	2.1 (1.0)	543PCDMF
480	6.00	4.00 (101.6)	2.1 (1.0)	643PCDMF
480	7.50	4.00 (101.6)	2.1 (1.0)	7X43PCDMF
480	8.00	4.00 (101.6)	2.1 (1.0)	843PCDMF
480	10.00	5.00 (127.0)	2.6 (1.2)	1043PCDMF
480	12.50	5.50 (139.7)	3.2 (1.5)	12X43PCDMF
480	15.00	6.00 (152.4)	3.2 (1.5)	1543PCDMF
480	16.67	6.00 (152.4)	3.5 (1.6)	16S43PCDMF
480	17.50	7.00 (177.8)	3.5 (1.6)	17X43PCDMF
480	20.00	7.00 (177.8)	4.2 (1.9)	2043PCDMF
600	2.00	4.00 (101.6)	2.1 (1.0)	263PCDMF
600	2.50	4.00 (101.6)	2.1 (1.0)	2X63PCDMF
600	5.00	4.00 (101.6)	2.1 (1.0)	563PCDMF
600	7.50	4.00 (101.6)	2.1 (1.0)	7X63PCDMF
600	10.00	5.00 (127.0)	2.6 (1.2)	1063PCDMF
600	12.50	6.00 (152.4)	3.2 (1.5)	12X63PCDMF
600	15.00	6.00 (152.4)	3.5 (1.6)	1563PCDMF
600	16.67	7.00 (177.8)	3.5 (1.6)	16S63PCDMF
600	17.50	7.00 (177.8)	3.5 (1.6)	17X63PCDMF
600	20.00	8.75 (222.3)	5.0 (2.3)	2063PCDMF

① kvar rating standard. NEMA® kvar tolerance is +15% – 0%.

② Catalog Number as shown is for 3-phase units.

Note: Dry-type. Thermoplastic encapsulation medium.

Note: On all units, customer must provide overcurrent protection as tabulated or equivalent (fuse interruption rating shall be 100,000 amperes or greater).

Note: All units supplied unpainted.

Note: Case material terne plate steel approximately 0.017 thick.

Technology Upgrades

UNIPAK



UNIPAK

Fixed power factor correction for retrofit and upgrades. Units are available in 240 – 600 volts and 1 – 400 kvar ratings for retail, commercial and industrial applications for single point correction. Units can also be configured to include harmonic filters in order to reduce harmonics in applications with large amounts of nonlinear loads, such as variable speed drives. They are most commonly applied to LV motors, motor control centers, and incoming switchboards.

UNIPUMP



UNIPUMP

Fixed power factor correction for retrofit or upgrade of indoor or outdoor pump motor applications. Units are available in 240 – 600 volts and 2 – 20 kvar ratings. Units include mounting brackets and a 4-foot flexible power cable attached for simple mounting and connection.

AUTOVAR



AUTOVAR 300



AUTOVAR 600

Switched power factor correction for retrofit or upgrade at the substation or facility level. An intelligent controller senses the customer's current power factor, and automatically steps on and off stages of capacitance in order to achieve the customer's programmed target power factor. Units are available in 240 – 600 volts and 25 – 840 kvar ratings in wall and floor-mount designs. Higher ratings are available — contact the factory for assistance. Units can also be configured to include harmonic filters in order to reduce harmonics in applications with large amounts of non-linear loads, such as variable speed drives.

Harmonic Correction Unit



Harmonic Correction Units

Active Harmonic Filters provide active harmonic control. The Active Harmonic Filter will monitor the distorted electrical signal, determine the frequency and magnitude of the harmonic content, and then cancel those harmonics with the dynamic injection of opposing current. Active harmonic control provides the benefit of traditional passive filters with simpler engineering requirements, easier and less expensive installation, comprehensive control, and assured compliance with the IEEE 519-1992 standard.

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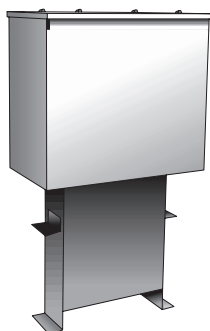
Technology Upgrades

**Technology Upgrades
(Continued)**

**Medium Voltage UNIVAR
and AUTOVAR**



**Metal-Enclosed Medium Voltage Power
Factor Correction System**



UNIVAR Fixed Medium Voltage PFC Unit

Eaton’s Cutler-Hammer metal-enclosed medium voltage capacitors, systems, and harmonic filters are designed for indoor or outdoor commercial, industrial, and utility power systems requiring motor start support, power factor correction, harmonic filtering, IEEE 519 compliance, and increased system capacity. Fixed motor start capacitors are available to assist in motor starting applications. Engineered designs are available with a host of options and accessories to fit the requirements and desired configurations of virtually any installation. Single-stage and multi-stage, tuned or de-tuned filter banks can be supplied. Metal-enclosed medium voltage capacitor banks are designed for industrial, commercial and utility power systems involving motors, feeder circuits, and transmission and distribution lines where power factor improvement is required.

Further Information

Publication Number	Description
TD02607001E TD02607011E	Low Voltage Power Factor Correction Capacitor Banks and Harmonic Filters. Metal-Enclosed Medium Voltage Power Factor Correction and Harmonic Filter Systems.

Pricing Information

Price and Availability Digest (PAD)
Vista/VISTALINE™ Discount Symbol C10-S27 for Systems
Vista/VISTALINE Discount Symbol C10-ST for Replacement Capacitor Cells
Price List — PL02607002E

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