

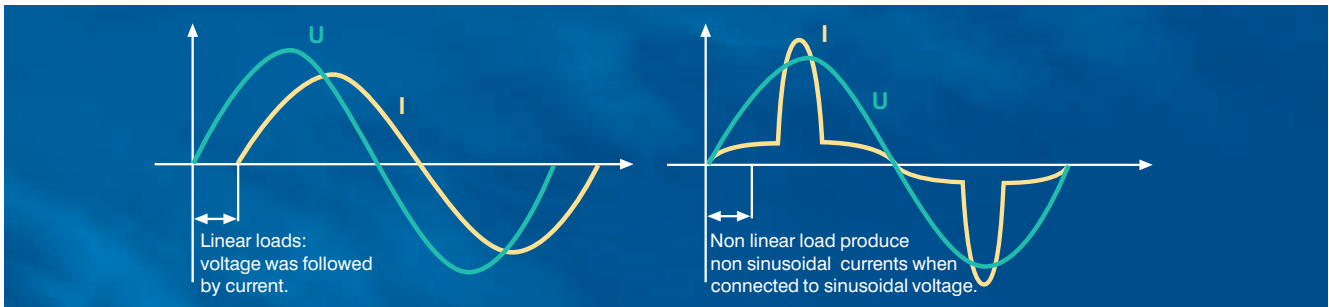
EPCOS Product Profile (India) 2013

Power Factor Correction

Power Quality Solutions



Preview



General

The increasing demand of electrical power and the awareness of the necessity of energy saving is very up to date these days. Also the awareness of power quality is increasing, and power factor correction (PFC) and harmonic filtering will be implemented on a growing scale. Enhancing power quality – improvement of power factor – saves costs and ensures a fast return on investment. In power distribution, in low- and medium-voltage networks, PFC focuses on the power flow ($\cos \varphi$) and the optimization of voltage stability by generating reactive power – to improve voltage quality and reliability at distribution level.

How reactive power is generated

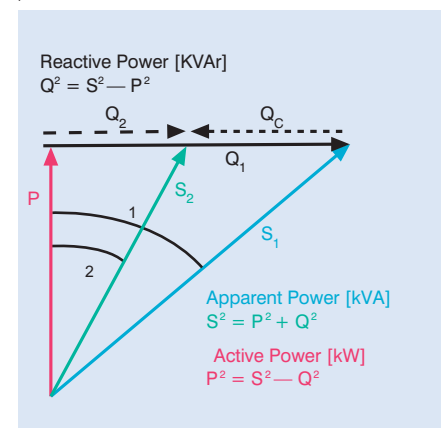
Every electric load that works with magnetic fields (motors, chokes, transformers, inductive heating, arc welding, generators) produces a varying degree of electrical lag, which is called inductance. This lag of inductive loads maintains the current sense (e.g. positive) for a time even though the negative-going voltage tries to reverse it. This phase shift between current and voltage is maintained, current and voltage having opposite signs. During this time, negative power or energy is produced and fed back into the network. When current and voltage have the same sign again, the same amount of energy is again needed to build up the magnetic fields in inductive loads. This magnetic reversal energy is called reactive power.

In AC networks (50/60 Hz) such a process is repeated 50 or 60 times a second. So an obvious solution is to briefly store the magnetic reversal energy in capacitors and relieve the network (supply line) of this reactive energy. For this reason, automatic

reactive power compensation systems (detuned /conventional) are installed for larger loads like industrial machinery. Such systems consist of a group of capacitor units that can be cut in and cut out and which are driven and switched by a power factor controller.

$$\begin{aligned} \text{Apparent power } S &= \sqrt{P^2 + Q^2} \\ \text{Active power } P &= S \cdot \cos \varphi \\ \text{Reactive power } Q &= S \cdot \sin \varphi \end{aligned}$$

With power factor correction the apparent power S can be decreased by reducing the reactive power Q.



Power factor

Low power factor ($\cos \varphi$)

Low $\cos \varphi$ results in

- Higher energy consumption and costs,
- Less power distributed via the network,
- Power loss in the network,
- Higher transformer losses,
- Increased voltage drop in power distribution networks.

Power factor improvement

Power factor improvement can be achieved by

- Compensation of reactive power with capacitors,
- Active compensation – using semiconductors,
- Overexcited synchronous machine (motor /generator).

Types of PFC

(detuned or conventional)

- individual or fixed compensation (each reactive power producer is individually compensated),
- group compensation (reactive power producers connected as a group and compensated as a whole),
- central or automatic compensation (by a PFC system at a central point),
- mixed compensation.

Preview



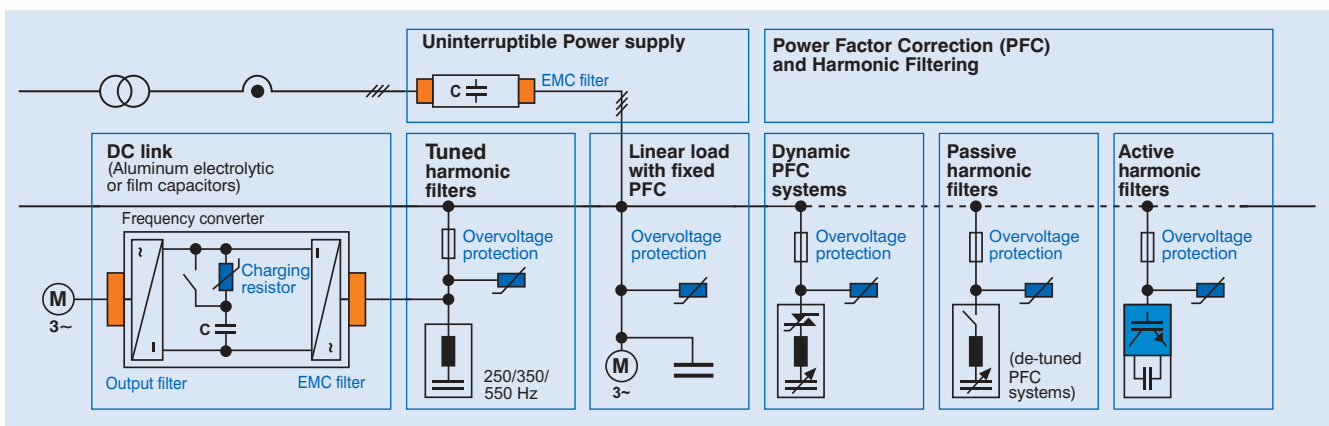
Power Quality Solution strategy

Along with the emerging demand for power quality and a growing awareness of the need for environmental protection, the complexity in the energy market is increasing: users and decision-makers are consequently finding it increasingly difficult to locate the best product on the market and to make objective decisions. It is in most cases not fruitful to compare catalogs and data sheets, as many of their parameters are identical in line with the relevant standards. Thus operating times are specified on the basis of

tests under laboratory conditions that may differ significantly from the reality in the field. In addition, load structures have changed from being mainly linear in the past to non-linear today. All this produces a clear trend: the market is calling increasingly for customized solutions rather than off-the-shelf products. This is where Power Quality Solutions come into the picture. It offers all key components for an effective PFC system from a single source, together with:

- Application know-how
- Technical skills
- Extensive experience in the field of power quality improvement
- A worldwide network of partners
- Continuous development
- Sharing of information

These are the cornerstones on which Power Quality Solutions are built. On the basis of this strategy, EPCOS is not only the leading manufacturer of power capacitors for PFC applications but also a PQS supplier with a century of field experience, reputation and reliability.



PFC Capacitor Series Overview



PFC Capacitor series for power factor correction capacitors			
PhaseCap Premium		B25667L . . .	
Power	KVAr	5...31	
Voltage range	V	415...800 V*	
Frequency	Hz	50Hz	
Impregnation		Gas-impregnated, dry type, Non-PCB	
Life expectancy	Hrs	Up to 130 000 h for -40/D Up to 180 000 h for -40/C	
Inrush current	A	$300 \bullet I_R$	
PhaseCap Super Heavy Duty		B25673L . . .	
Power	KVAr	5...33	
Voltage range	V	415...1000 V*	
Frequency	Hz	50 Hz	
Impregnation		Non-PCB, semi-dry biodegradable resin	
Life expectancy	Hrs	Up to 200 000 h for -40/C Up to 150 000 h for -40/60	
Inrush current	A	$400 \bullet I_R$	
PhiCap ND		B32343L . . . /B32344B . . .	
Power	KVAr	5...30	
Voltage range	V	230...525 V*	
Frequency	Hz	50 Hz	
Impregnation		Non-PCB, semi-dry biodegradable resin	
Life expectancy	Hrs	Up to 100 000 hours	
Inrush current	A	$200 \bullet I_R$	
PhiCap HD		B32447A . . . /B32448A . . .	
Power	KVAr	1...30	
Voltage range	V	415...480 V*	
Frequency	Hz	50 Hz	
Impregnation		Non-PCB, semi-dry biodegradable resin	
Life expectancy	Hrs	Up to 115 000 hours	
Inrush current	A	$250 \bullet I_R$	

*Other voltages on request.

Important Notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule, EPCOS is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether an EPCOS product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous). Useful information on this will be found in our Material Data Sheets on the Internet (www.epcos.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.
We also reserve the right to discontinue production and delivery of products. Consequently, we cannot guarantee that all products named in this publication will always be available.
The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
6. Unless otherwise agreed in individual contracts, **all orders are subject to the current version of the "General Terms of Delivery for Products and Services in the Electrical Industry" published by the German Electrical and Electronics Industry Association (ZVEI)**.
7. The trade names EPCOS, BAOKE, Alu-X, CeraDiode, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, FormFit, MiniBlue, MiniCell, MKD, MKK, SquareCap, AgriCap, PoleCap, MLSC, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.epcos.com/trademarks.

PhaseCap Premium PFC Capacitors

Gas-impregnated • Dry type • Concentric winding • Wavy cut • Triple safety system



General

PhaseCap capacitors in cylindrical aluminum cases have been designed for power factor correction in low-voltage applications.

Loads like motors and transformers consume active power as well as reactive power.

Generators, supply cables and other electrical distribution equipment, in turn, should be relieved of reactive power.

The MKK (metalized plastic compact) AC series is intended to increase packing density per bank and cut component costs.

Improved thermal response and simplified installation are advantages of the cylindrical aluminum case.

PoleCap Capacitors:
A modified version of PhaseCap capacitor with connection cable, suitable for long-term out door applications and for mounting on the pole.



Applications

- Automatic PFC equipment, capacitor banks
- Individual fixed PFC (e.g. motors, transformers, lighting)
- Group fixed PFC
- Detuned capacitor banks
- Filter applications
- Dynamic PFC

Features

- Compact design in cylindrical aluminum can with stud
- Concentric winding
- MKK-technology with wavy cut and heavy edge
- Voltage range 230 V ... 800 V
- Output range 5.0 ... 33 KVAR

Electrical

- Long life expectancy
- High pulse current withstand capability

Mechanical and maintenance

- Reduced mounting costs
- Mounting position upright/ horizontal
- Maintenance-free
- Highest packing density thanks to compact dimensions

Safety

- Self-healing
- Overpressure disconnecter
- Shock hazard protected terminals
- Longterm approved
- Ceramic discharge resistor pre-mounted

Environmental

- Dry design, inert gas
- No oil leakage

PhaseCap Premium PFC Capacitors

Gas-impregnated • Dry type • Concentric winding • Wavy cut • Triple safety system



Technical data : PhaseCap Premium PFC Capacitors	
Series Type	B25667L
Power-KVAr	5...31KVAr
Rated voltage-V (AC)	415...800 V*
Frequency	50 Hz
Transient peak current maximum permissible	300 • I _R
Maximum permissible temperature category	-40/D
Losses (without discharge resistors)	0.5W/KVAr
Maximum Permissible voltage	V _R + 10% (up to 8 h daily) / V _R + 15% (up to 30 min daily)** V _R + 20% (up to 5 min daily) / V _R + 30% (up to 1 min daily)**
Maximum Permissible current	Up to 1.6 • I _R ***
Safety	Self-healing, overpressure disconnecter
Impregnation	Gas-impregnated, dry type, Non-PCB
Life expectancy	Up to 130 000 h for -40/D Up to 180 000 h for -40/C
Cooling	Natural or forced
Case shape/finish	Extruded round aluminium can with stud
Terminal	Optimized capacitor safety terminals
Mounting and grounding	Threaded stud at bottom of can (max. torque for M12=10Nm)
Enclosure	IP 20, indoor mounting (optionally with terminal cap for IP54)
Discharge resistor	Provided with discharge resistor
Connection	Delta
Casing of capacitor cell	Extruded round aluminium can with stud
Dielectric	Polypropylene film (metallised)
No. of switching per annum	Max. 7500 switching
Reference standard	IEC60831-1/2, UL 810-5th edition

* Other voltages available on request

** V_R rated voltage

*** I_R : RMS line current that occurs at rated sinusoidal voltage and rated frequency, excluding transients.

Note: for capacitors with different features/parameters than above, please check with our nearest sales office

PhaseCap Premium PFC Capacitors

Gas-impregnated • Dry type • Concentric winding • Wavy cut • Triple safety system



PhaseCap Premium PFC Capacitors - 3 Phase								
Rating KVAR	Voltage V (AC)	Material code	I _R A	C _N F	d x h mm	Packing units	MOQ	Approx weight Kg
PhaseCap - 415 V(AC) 3PH, 50Hz (Series B25667)								
5	415	B25667L4926A375	7.0	3 x 30.8	116 x 164	1	4	1.1
6.3	415	B25667L4117A375	8.8	3 x 38.5	116 x 164	1	4	1.2
10	415	B25667L4197A375	13.9	3 x 64.1	116 x 164	1	4	1.2
12.5	415	B25667L4237A375	17.4	3 x 77	116 x 164	1	4	1.3
15	415	B25667L4277A375	20.9	3 x 92.5	116 x 164	1	4	1.4
16.7	415	B25667L4307A375	23.2	3 x 102.9	116 x 164	1	4	1.5
20	415	B25667L4387A375	27.8	3 x 128.2	116 x 200	1	4	1.7
25	415	B25667L4467A375	34.8	3 x 154.1	136 x 200	1	4	2.1
PhaseCap - 440 V(AC) 3PH, 50Hz (Series B25667)								
5	440	B25667L4826A375	6.6	3 x 27.4	116 x 164	1	4	1.2
7.5	440	B25667L4127A375	9.8	3 x 41.1	116 x 164	1	4	1.2
10.4	440	B25667L4177A375	13.7	3 x 57	116 x 164	1	4	1.3
12.5	440	B25667L4207A375	16.4	3 x 68.5	116 x 164	1	4	1.4
14.2	440	B25667L4237A365	18.6	3 x 77.9	116 x 164	1	4	1.4
15	440	B25667L4247A375	19.7	3 x 82.2	116 x 164	1	4	1.5
20	440	B25667L4347A375	26.2	3 x 114.1	136 x 200	1	4	2.0
25	440	B25667L4417A375	32.8	3 x 137.1	136 x 200	1	4	2.1
PhaseCap - 480 V(AC) 3PH, 50Hz (Series B25667)								
5	480	B25667L4696A375	6.0	3 x 23	116 x 164	1	4	1.2
6.25	480	B25667L4866A375	7.5	3 x 28.3	116 x 164	1	4	1.2
7.5	480	B25667L4107A375	9.0	3 x 34.6	116 x 164	1	4	1.3
8	480	B25667L4117A365	9.6	3 x 38.4	116 x 164	1	4	1.3
10	480	B25667L4147A375	12.0	3 x 47.9	116 x 164	1	4	1.4
12.5	480	B25667L4177A365	15.0	3 x 57.6	116 x 164	1	4	1.5
15	480	B25667L4207A365	18.0	3 x 69.1	116 x 200	1	4	1.5
16.7	480	B25667L4237A355	20.1	3 x 76.9	116 x 200	1	4	1.8
20	480	B25667L4287A375	24.1	3 x 95.8	136 x 200	1	4	2.2
25	480	B25667L4347A365	30.1	3 x 115.2	136 x 200	1	4	2.5
31	480	B25667L4427A375	37.3	3 x 143	136 x 200	1	4	3.0
PhaseCap - 525 V(AC) 3PH, 50Hz (Series B25667)								
6.25	525	B25667L5726A375	7.0	3 x 24.1	116 x 164	1	4	1.1
8	525	B25667L5966A375	8.8	3 x 32.1	116 x 164	1	4	1.1
10	525	B25667L5127A375	11.0	3 x 40.1	116 x 164	1	4	1.2
12.5	525	B25667L5147A375	13.8	3 x 48.1	116 x 164	1	4	1.3
15	525	B25667L5177A375	16.5	3 x 57.1	116 x 200	1	4	1.8
16.7	525	B25667L5197A375	18.4	3 x 64.3	116 x 200	1	4	1.8
20	525	B25667L5247A375	22.0	3 x 80.1	136 x 200	1	4	2.2
25	525	B25667L5287A375	27.5	3 x 96.3	136 x 200	1	4	2.5
30	525	B25667L5347A375	33.0	3 x 115.5	136 x 200	1	4	2.8

PhaseCap Premium PFC Capacitors

Gas-impregnated • Dry type • Concentric winding • Wavy cut • Triple safety system



PhaseCap Premium PFC Capacitors - 3 Phase								
Rating KVAR	Voltage V (AC)	Material code	I _r A	C _N F	d x h mm	Packing units	MOQ	Approx. weight Kg
PhaseCap - 690 V(AC) 3PH, 50Hz (Series B25667)								
5	690	B25667C6336A375	4.2	3 x 11	116 x 164	6	6	1.3
10	690	B25667C6676A375	8.4	3 x 23	116 x 164	6	6	1.4
12.5	690	B25667C6836A375	10.5	3 x 28	116 x 164	6	6	1.5
15	690	B25667C6107A375	12.6	3 x 34	116 x 164	6	6	1.5
20.8	690	B25667C6137A375	17.5	3 x 47	136 x 200	4	4	2.0
25	690	B25667C6167A375	21	3 x 56	136 x 200	4	4	2.2
PhaseCap - 800 V(AC) 3PH, 50Hz (Series B25667)								
5	800	B25667C7246A375	3.6	3 x 8	116 x 164	6	6	1.2
7.5	800	B25667C7376A375	5.4	3 x 12.4	116 x 164	6	6	1.2
10	800	B25667C7496A375	7.2	3 x 17	116 x 164	6	6	1.3
12.5	800	B25667C7626A375	9	3 x 21	116 x 164	6	6	1.4
15	800	B25667C7746A375	11	3 x 25	116 x 164	6	6	1.5
20	800	B25667C7996A375	14.5	3 x 33	136 x 200	4	4	2.0
25	800	B25667C7127A375	18	3 x 41	136 x 200	4	4	2.3
28	800	B25667C7137A375	20	3 x 46	136 x 200	4	4	2.4

Other voltages available on request.

Packing units for capacitors equal minimum order quantity .

Orders will be rounded up to packing unit or multiple thereof .

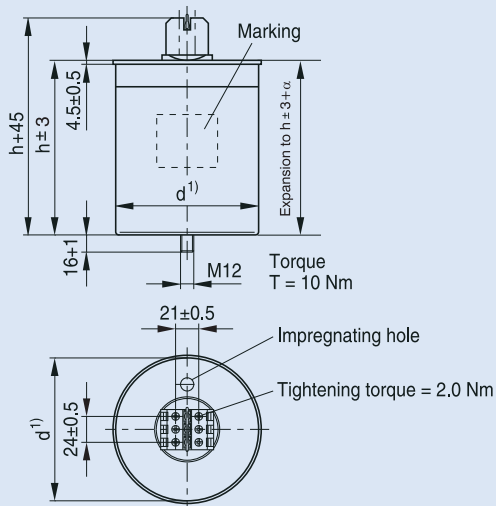
PhaseCap Premium PFC Capacitors

Gas-impregnated • Dry type • Concentric winding • Wavy cut • Triple safety system



Dimensional drawings

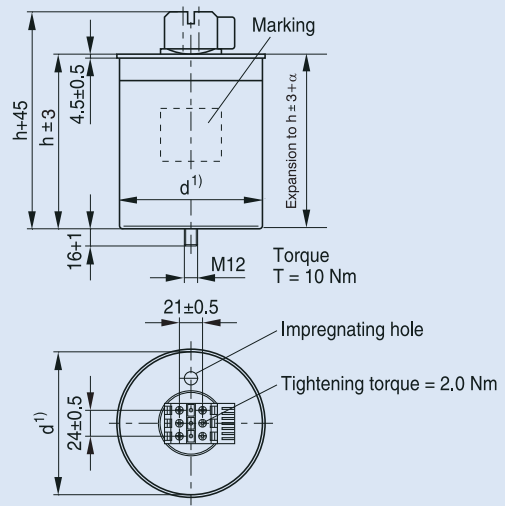
Capacitor up to 690 V AC



- 1) Seaming adds 5.5 mm in diameter
- 2) Expansion α max.15 mm

KLK1841-1-E

Capacitor > 690 V AC



- 1) Seaming adds 5.5 mm in diameter
- 2) Expansion α max.15 mm

KLK1834-I-E

Discharge resistor

Pre-mounted for series B25667, B25673
available as spare parts upon request



Discharge resistor module

Side mounted discharge
resistor module for B25673, B25667
and B25669 series

