Product Overview 2023

Power Factor Correction (PFC) Capacitors and Key Components

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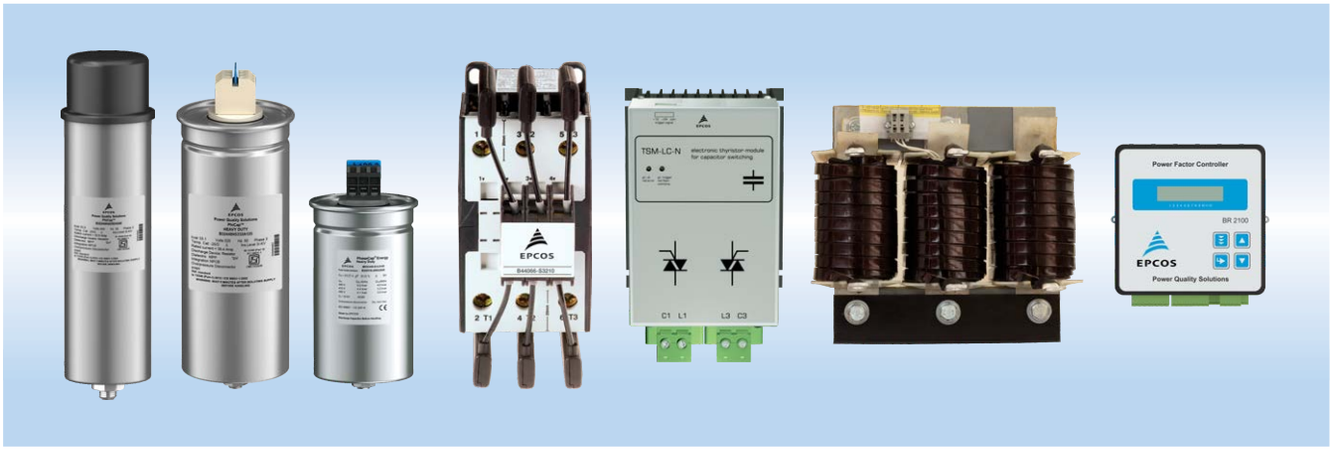
Contents

PFC Capacitors and Key Components



Preview		04
Important Notes		06
Fundamentals of Power Factor Correction		07
Ordering Code System		09
PhiCap Normal Duty Capacitor	B32340, B32341 and B32344	12
PhiCap Heavy Duty Capacitor	B32447 and B32448	16
PhaseCap Super Heavy Duty Capacitor	B25675L	21
PhaseCap Energy Heavy Duty Capacitors	B25674L	26
SquareCap Capacitors - ENDC	B32457	30
SquareCap Capacitors - EHDLL	B32459	32
SquareCap Capacitors - ESHDC	B32455	36
LT - APP Capacitors	B25160	40
DuraCube™ Heavy Duty Capacitors	B25160*	44
AgriCap Capacitors	B32454	47
PFC Capacitors for Air Conditioners	B3244T	49
Power Factor Controllers	BR6000, BR5000, BR4000, BR2100	53
Switching Devices – Capacitor Contactors	J110/J230/C24*	59
Switching Devices – Thyristor Modules	TSM-LC-N	63
Detuned Filter Reactors	B44066	65
Capacitor (kvar) Selection Chart		67
Detuned PFC: Important Facts and Instructions		72
Cautions		75

Preview

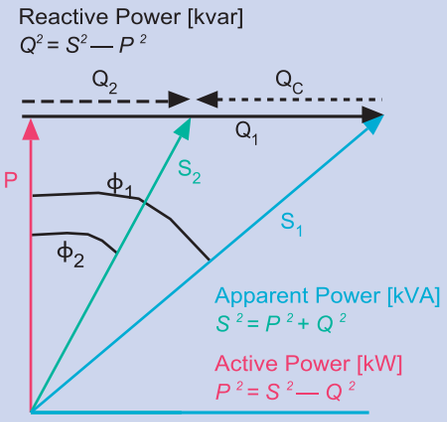
General
The increasing demand of electrical power and the awareness of the necessity of energy saving is very up to date these days. Also the awareness of power quality is increasing, and power factor correction (PFC) and harmonic filtering will be implemented on a growing scale. Enhancing power quality 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 j) 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.

Apparent power S = ÖP² + Q² Active power P = S * cos j Reactive power Q = S * sin j

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

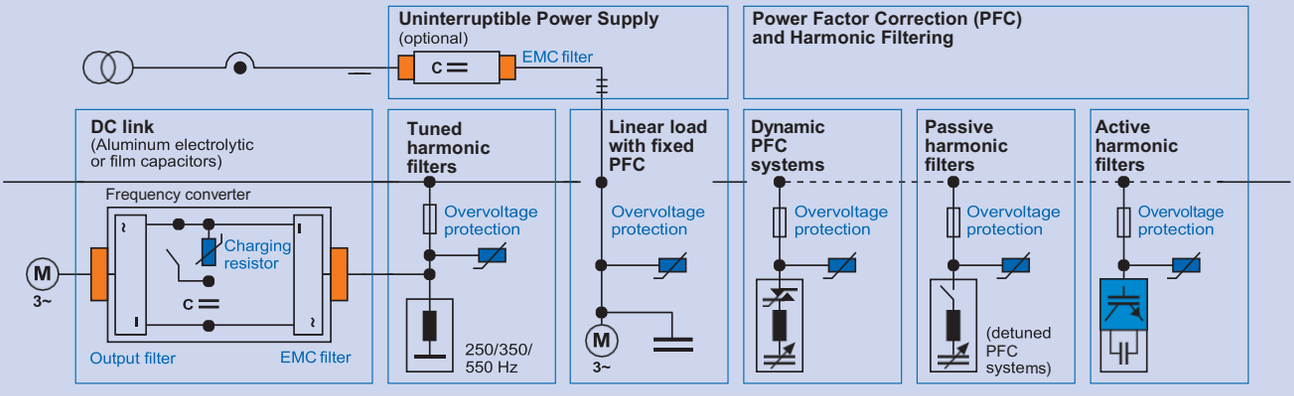


Preview

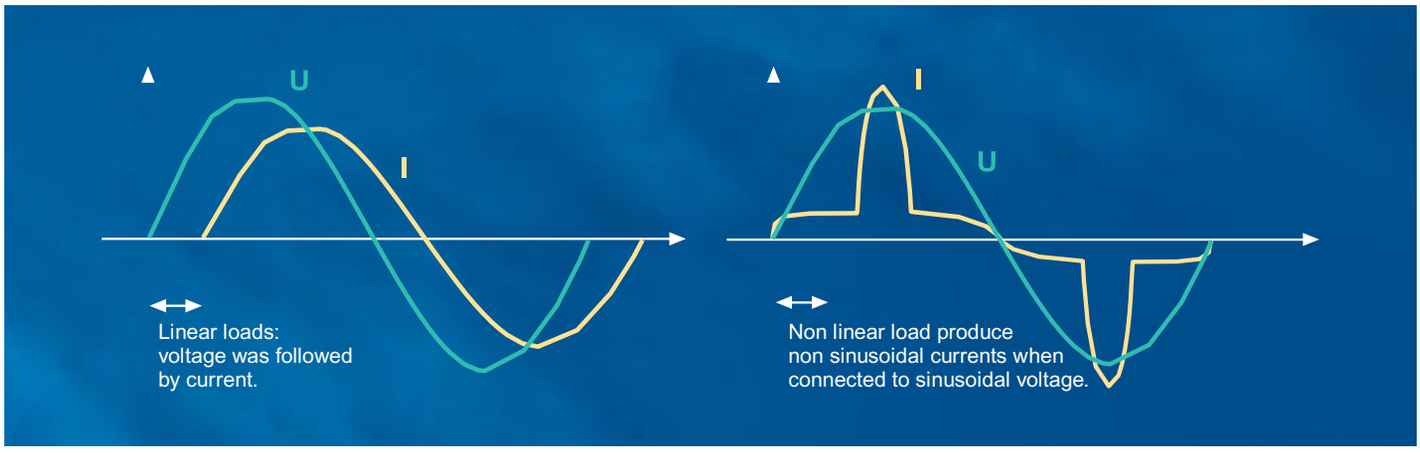
Power factor
Low power factor (cos j)
Low cos j results in
- Higher energy consumption and costs
- Less power distributed via the network
- Power loss in the network
- Higher transformer losses
- Increased voltage drop in power distribution networks

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



PQS 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, TDK 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.

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 we are 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 a 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.tdk-electronics.tdk.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 our General Terms and Conditions of Supply.

7. Our manufacturing sites serving the automotive business apply the IATF 16949 standard. The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements (“CSR”) TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that only requirements mutually agreed upon can and will be implemented in our Quality Management System. For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.

8. The trade names EPCOS, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap are trademarks registered or pending in Europe and in other countries.

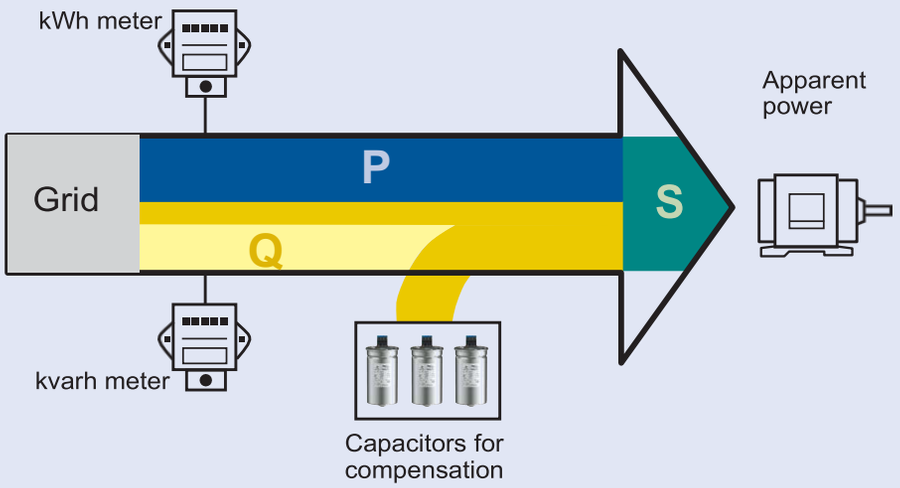
   Further information will be found on the Internet at

   www.tdk-electronics.tdk.com/trademarks.

Power Factor Correction

Fundamentals

Conventional power factor correction



1. Capacitor

Power factor correction (PFC) capacitors produce the necessary leading reactive power to compensate the lagging reactive power. They should be capable of withstanding high inrush currents caused by switching operations (>100 · I_R). If they are connected in parallel, i.e. as banks, the inrush current will increase (≈ 150 I_R) because the charging current comes from the power line as well as from other capacitors connected in parallel.

Design of capacitors

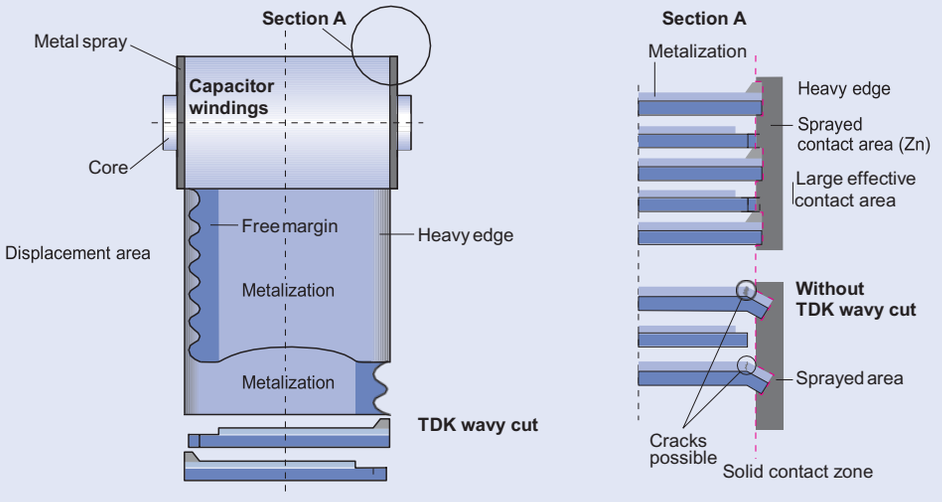
MKK/MKP/MKD technology

Metalized plastic compact capacitors with self-healing properties and a polypropylene dielectric. Film metallization with zinc/aluminum alloy results in high performance and a low film thickness allowing significantly more compact dimensions and a lower weight.

A heavy edge and special film-cutting technique (optimized combination of wavy and smooth cuts) produces a maximum effective surface for the metal spraying or contacting process.

- Series PhaseCap Energy with gas impregnation (dry technology) or with semi-dry biodegradable soft resin.
- Series PhaseCap and PhaseCap HD dry technology impregnation with an inert gas (nitrogen N2).
- Series PhaseCap Compact-semi dry biodegradable resin.
- Series DeltaCap impregnation with semi-dry biodegradable soft resin.
- Series PhiCap impregnation with semi dry biodegradable soft resin.

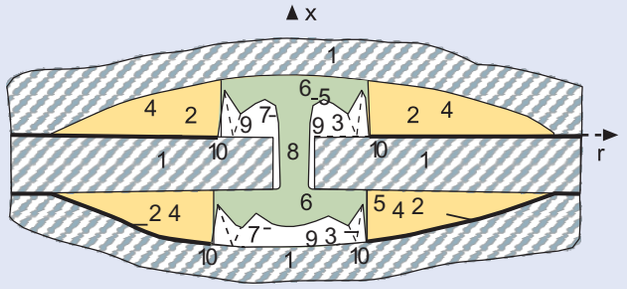
Wavy cut design



Power Factor Correction

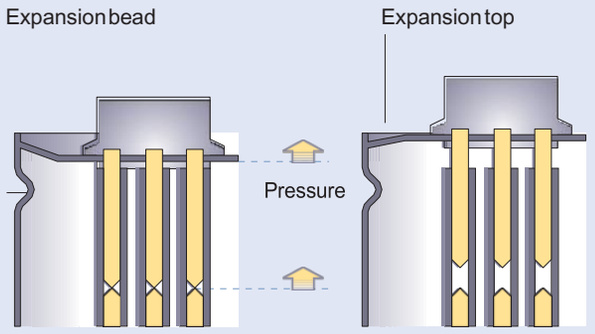
Fundamentals

Self-healing



1. Dielectric
2. Metalized electrodes
3. Material displacing shock wave
4. Airgap with metal vapor
5. Plasma zone
6. Boundary layer between gas phase dielectric and plasma
7. Breakdown channel
8. Gas phase dielectric
9. Zone of displaced metalization and dielectric (isolating region)

Overpressure disconnector



Safety

Self-healing properties

In the event of thermal or electrical overload, an electric breakdown occurs. The dielectric in the breakdown channel is broken down into highly compressed plasma that explodes out of the breakdown channel and pushes the dielectric layers apart. The discharge continues within the spreading plasma via the metal layers so that the metal surrounding the faulty area is completely burnt out. This produces perfect isolation of the faulty area within microseconds. The self-healing process results in negligible capacitance loss less than 100 pF per event. The capacitor remains fully functional during the entire process.

Overpressure disconnector

At the end of the capacitor's service life or when a high pressure forms in side the can, the overpressure disconnector is activated.

The specially designed cover with an expansion bead moves upwards. Expansion beyond a certain degree will separate the wires and disconnect the capacitor safely from the line. The disconnector is separated at its break point (small notch) and the flow of current to the capacitor windings is interrupted.

Caution:
To ensure full functionality of an overpressure disconnector, the following is required:

1. The elastic elements must not be hindered, i.e.
   - connecting lines must be flexible leads (cables),
   - there must be sufficient space (at least 20 mm) for expansion above the connections (specified for the different models),
   - folding beads must not be retained by clamps.
2. The maximum permissible fault current of 10000 A to the UL 810 standard must not be exceeded.
3. Stress parameters of the capacitor must be within the IEC 60831 specification.

Dry Technology/ Vacuum Impregnation

The active winding elements are heated and then dried for a defined period. Impregnation is performed under vacuum. In this way, air and moisture are extracted from the inner capacitor, and oxidation of the electrodes as well as partial discharges are avoided. Afterwards, the capacitor elements are hermetically sealed in cases (e.g. aluminum). This elaborate process ensures excellent capacitance stability and long useful life.

2. Power factor controller

Modern PF controllers are microprocessor based. The microprocessor analyzes the signal from a current transformer and produces switching commands to control the contractors that add or remove capacitor stages.
Intelligent control by microprocessor based PF controllers ensures even utilization of capacitor stages, a minimized number of switching operations and an optimized life cycle of the capacitor bank.

After the required capacitor output has been determined, the number of steps should be defined. The broad product range of controllers from TDK allows customized solutions: the BR604 is suited to small PFC systems with four steps. The BR6000 and BR2100 series is available for conventional, dynamic and mixed compensation with six and twelve steps for medium and large systems respectively; BR6000-T6 for dynamic compensation with 6 steps.

The PF controller BR7000 with its 15 outputs and BR5000 with 16 steps offers a broad range of applications, e.g. 15 and 16 conventional steps (each for one three phase capacitor), 15 steps for single phase capacitors or mixed operation.

Ordering Code System

PhiCap Normal Duty

7.5 kvar out put power

PhiCap Capacitor					Type	Revision								
B	3	2	3	4	4	N	4	0	7	1	A	5	4	0

0-1Ø Plastic Top ND
1-1Ø Metal Top ND
3-3Ø Plastic Top ND
4-3Ø Metal Top ND

1 - 60 Hz
2 - 50 Hz

B32340-C-Standard Export
S-Customer Name
B,L-Local Series

B32343-C-Standard Export
R....L-Customer Name
R....E-Customer Name
C-P-Electricity Board
L,B,F-Local series Discontinued
U-Customer Name

B32344-B,F-Standard Screw Local series Discontinued
N-Fast on/Srew New Local series
E-New Sigut Export
S-Customer Name
U-Customer Name
P-Electricity Board (PoleCap)
H-Hisar (MT)
W-Windmil
R...L-Customer Name
R....E-Customer Name
T-Air Conditioner application
X -Customer Name

Rated Voltage AC

2 - 200 + a
3 - 300 + a
4 - 400 + a
5 - 500 + a

10/15=15
00=00
20/25=25
30=30
40=40
50=50
70=70
70=75
80=80

A-5%/+10%
Z-Customer Name
(Tol-A)

Other below- (Tol-A)
R....L-Customer Name
R....E-Customer Name
C-P-Electricity Board
W....W-New windmil
B....S-Special

PhiCap Heavy Duty

1.5 kvar out put power

PhiCap Capacitor					Type	Revision								
B	3	2	4	6	0	A	4	0	1	2	B	5	4	0

6-1Ø Plastic Top ND
6-1Ø Metal Top ND
4-3Ø Plastic Top ND
4-3Ø Metal Top ND

1 - 60 Hz
2 - 50 Hz

0-1Ø Plastic Top ND
1-1Ø Metal Top ND
7-3Ø Plastic Top ND
8-3Ø Metal Top ND

For A, H - Standard Local Series
R...H - Customer Name
S...A - Customer Name

Rated Voltage AC

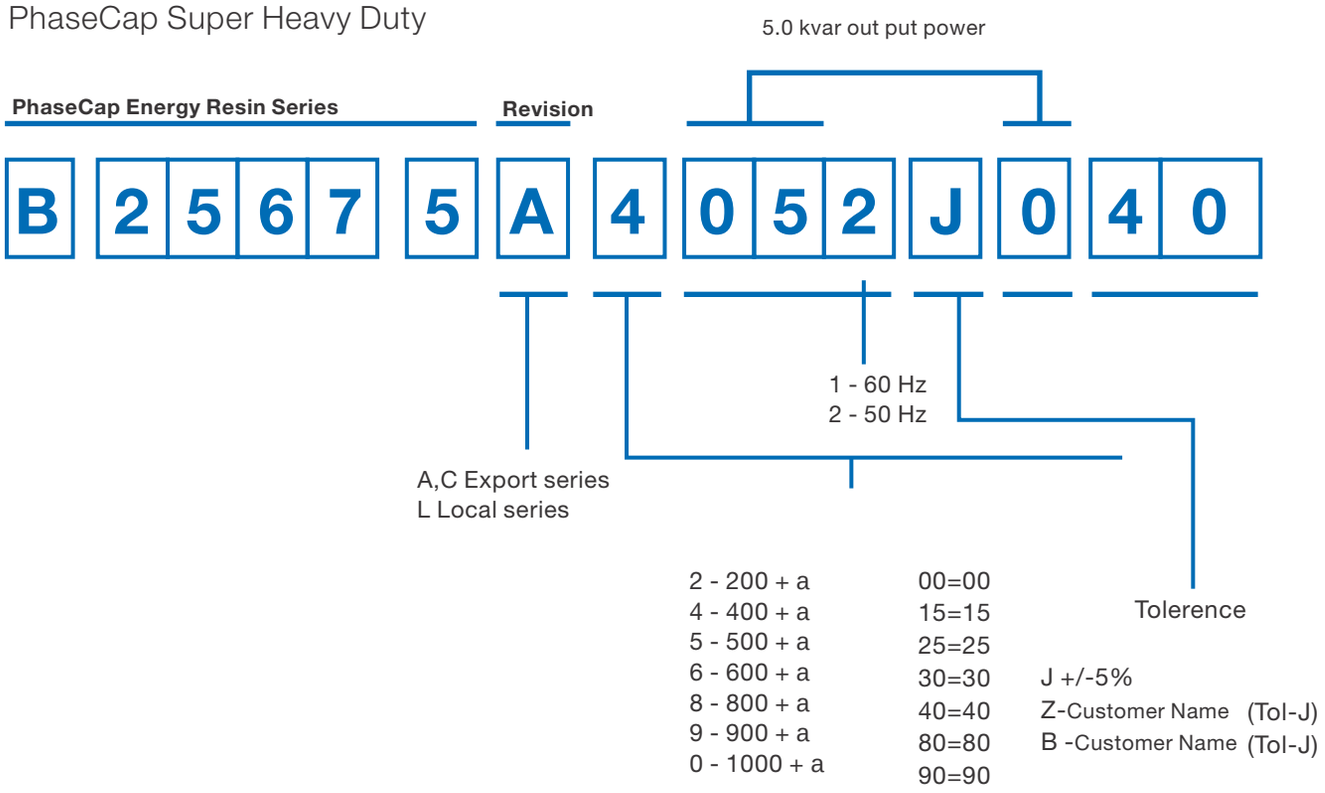
2 - 200 + a
3 - 300 + a
4 - 400 + a
5 - 500 + a

00=00
10=15
20=20/25
30=30
40=40
80=80

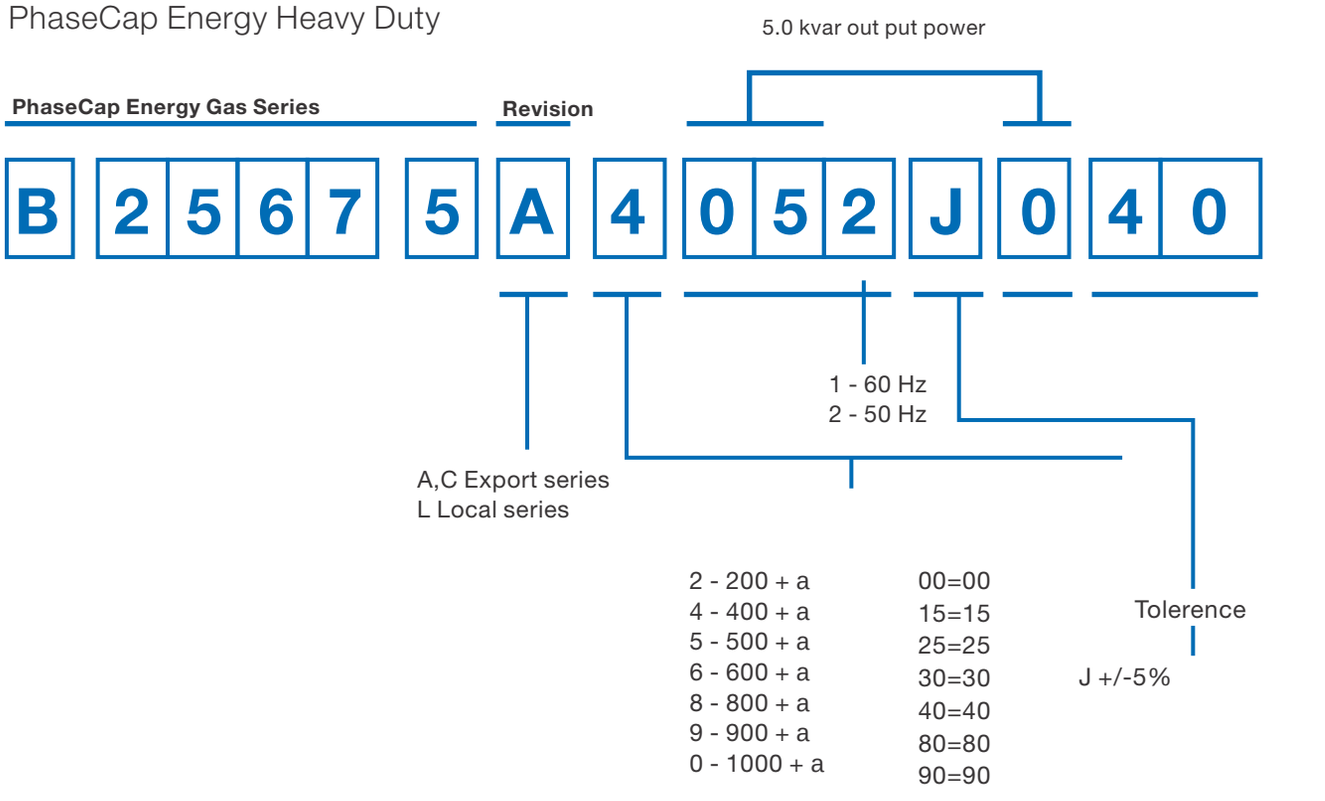
A, B - 5% + 10%
R...H - Customer Name
(Tol -A,B)

Ordering Code System

PhaseCap Super Heavy Duty

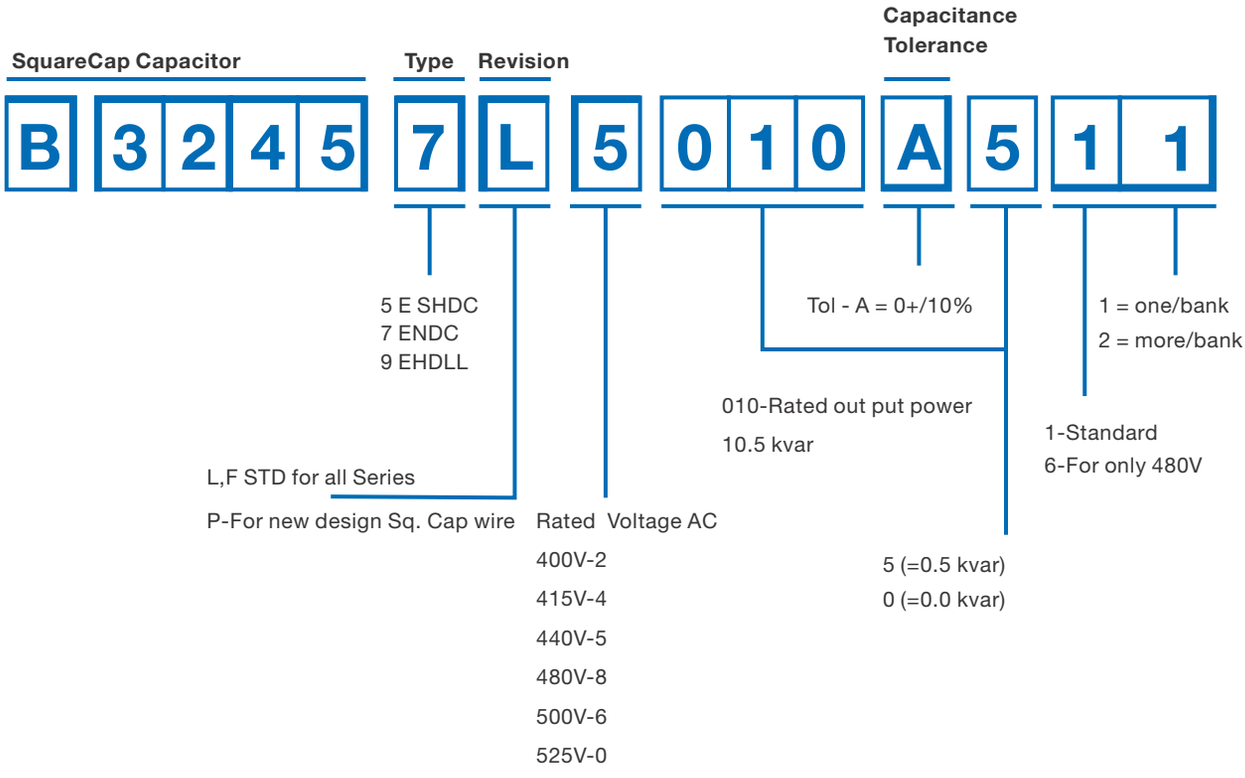


PhaseCap Energy Heavy Duty

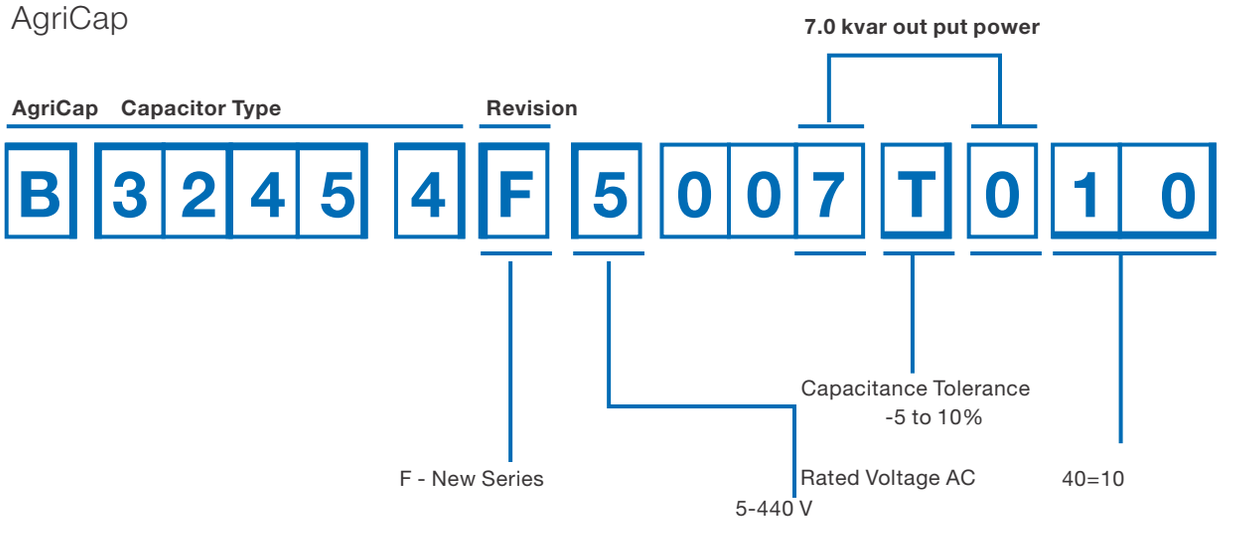


Ordering Code System

SquareCap



AgriCap



Film Capacitors

PFC Capacitors and Key Components

PhiCap Normal Duty Capacitor

Series	PhiCap Normal Duty B32340, B32341 and B32344
Technical data	Single unit up to 30 kvar Rated Voltage: 230 V to 525 V
Features	• Manufactured using state-of-art metalisation process for MPP film with heavy edge • Self healing property • Low energy consumption • Soft biodegradable resin as impregnant • Safety device in the form of pressure sensitive (over pressure) mechanical interrupter • Temp class : -25/D
Specification	Conformance to Standards IEC 60831-1 & 2 IS 13340
Applications	• Power Factor Correction (PFC) automatic capacitor banks • Fixed PFC applications, e.g. motor compensation • Detuned PFC systems • Dynamic PFC systems

PhiCap Normal Duty Capacitor

Technical data : PhiCap Normal Duty Capacitors

Series type	B32340, B32341and B32344
Power-kvar	1 to 30 kvar
Rated voltage-V (AC)	415, 440, 480, 525
Frequency	50 Hz
Connection	Delta
Transient peak current (Maximum permissible)	200 • IR***
Maximum permissible temperature category	-25/D
Dielectric losses	0.2 W / kvar
Total Losses (without discharge resistor)	≤ 0.5 W / 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	1.3 to 1.5 • I_R***
Safety	Self-healing, overpressure disconnector
Impregnation	Non PCB, soft biodegradable resin
Life expectancy	Up to 100 000 hours
Cooling	Natural or forced
Case/Shape	Extruded round aluminum can with stud
Terminal	6.3 mm fast-on terminals for 1 to 7 kvar Screw terminal for 7.5 to 30 kvar
Mounting and grounding	Threaded stud at bottom of can (max. torque 4 Nm for M8 and 10 Nm for M12)
Enclosure	IP 20, indoor mounting (optionally with terminal cap for IP54)
Discharge resistor	Provided with discharge resistor
Dielectric	Polypropylene film (metallised)
No. of switching per annum	Max. 5000 switching
Reference standard	IEC 60831-1/2, IS 13340

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

Film Capacitors

PFC Capacitors and Key Components

PhiCap Normal Duty

Ordering code	Rated capacitance C_N	Rated voltage V_N	Output & Rated current at 50 Hz		Dimensions (D x H)	Terminal type
	µF	V	kvar	I_N A	mm	
Rated Voltage 415VAC, delta connection						
B32344N4012A015	3 x 6.2	415	1.0	1.4	50 x 75	A
B32344N4012A515	3 x 9.2	415	1.5	2.1	50 x 88	A
B32344N4022A015	3 x 12.3	415	2.0	2.8	50 x 112	A
B32344N4022A515	3 x 15.4	415	2.5	3.5	55 x 112	A
B32344N4032A015	3 x 18.5	415	3.0	4.2	55 x 137	A
B32344N4042A015	3 x 24.7	415	4.0	5.6	55 x 147	A
B32344N4052A015	3 x 30.8	415	5.0	7.0	63.5 x 137	A
B32344N4062A315	3 x 38.8	415	6.3	8.8	75 x 157	B
B32344N4072A515	3 x 46.2	415	7.5	10.4	75 x 167	B
B32344N4082A315	3 x 51.2	415	8.3	11.5	75 x 167	B
B32344N4102A015	3 x 61.6	415	10.0	13.9	75 x 197	B
B32344N4122A515	3 x 77.0	415	12.5	17.4	75 x 197	B
B32344N4152A015	3 x 92.5	415	15.0	20.9	75 x 270	B
B32344N4202A015	3 x 123.3	415	20.0	27.8	75 x 270	B
B32344N4252A015	3 x 154.1	415	25.0	34.8	85 x 270	B
Rated Voltage 440 V AC, delta connection						
B32344N4012A040	3 x 5.5	440	1.0	1.3	50 x 75	A
B32344N4012A240	3 x 6.6	440	1.2	1.6	50 x 75	A
B32344N4012A540	3 x 8.2	440	1.5	1.8	50 x 88	A
B32344N4022A040	3 x 11.0	440	2.0	2.6	50 x 112	A
B32344N4022A540	3 x 13.7	440	2.5	3.3	50 x 112	A
B32344N4032A040	3 x 16.4	440	3.0	3.9	55 x 112	A
B32344N4042A040	3 x 21.9	440	4.0	5.2	55 x 137	A
B32344N4052A040	3 x 27.4	440	5.0	6.6	55 x 147	A
B32344N4052A640	3 x 30.7	440	5.6	7.3	63.5 x 136	A
B32344N4062A040	3 x 32.9	440	6.0	7.9	63.5 x 137	A
B32344N4072A040	3 x 38.4	440	7.0	9.2	63.5 x 147	A
B32344N4072A540	3 x 41.1	440	7.5	9.8	75 x 157	B
B32344N4082A340	3 x 45.5	440	8.3	10.9	75 x 157	B
B32344N4092A040	3 x 49.3	440	9.0	11.8	75 x 167	B
B32344N4102A040	3 x 54.8	440	10.0	13.1	75 x 167	B
B32344N4122A540	3 x 68.5	440	12.5	16.4	75 x 197	B
B32344N4152A040	3 x 82.2	440	15.0	19.7	75 x 270	B
B32344N4162A740	3 x 91.5	440	16.7	21.9	85 x 270	B
B32344N4202A040	3 x 109.7	440	20.0	26.2	85 x 270	B
B32344N4252A040	3 x 137.1	440	25.0	32.8	90 x 270	B
B32344N4282A040	3 x 153.5	440	28.0	36.7	85 x 348	B
B32344N4302A040	3 x 164.5	440	30.0	39.4	90 x 348	B

Film Capacitors

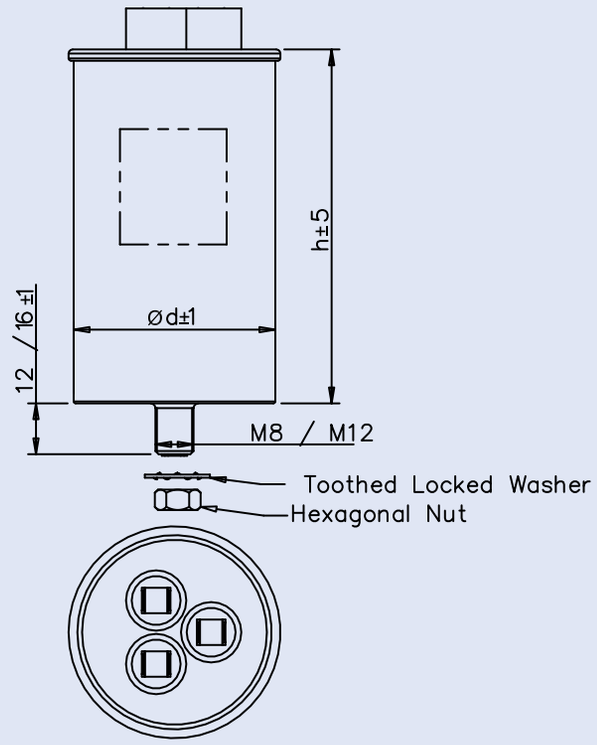
PFC Capacitors and Key Components

PhiCap Normal Duty

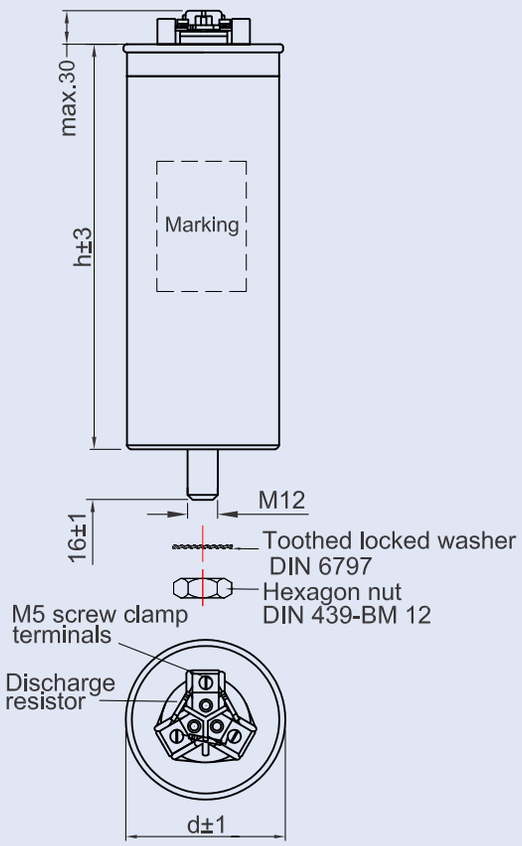
Ordering code	Rated capacitance C_N	Rated voltage V_N	Output & Rated current at 50 Hz		Dimensions (D x H)	Terminal type
	µF	V	kvar	I_N A	mm	
Rated Voltage 480 V AC, delta connection						
B32344N4052A080	3 x 23.0	480	5.0	6.0	63.5 x 136	A
B32344N4052A580	3 x 25.3	480	5.5	6.6	63.5 x 136	A
B32344N4082A380	3 x 38.2	480	8.3	10.0	75 x 167	B
B32344N4102A480	3 x 47.9	480	10.4	12.5	75 x 197	B
B32344N4112A180	3 x 51.1	480	11.1	13.4	75 x 197	B
B32344N4122A580	3 x 57.6	480	12.5	15.0	75 x 197	B
B32344N4132A880	3 x 63.6	480	13.8	16.6	75 x 270	B
B32344N4152A080	3 x 69.1	480	15.0	18.0	75 x 270	B
B32344N4162A780	3 x 76.9	480	16.7	20.0	75 x 270	B
B32344N4202A880	3 x 95.8	480	20.8	25.0	85 x 270	B
B32344N4222A180	3 x 101.8	480	22.1	26.6	85 x 348	B
B32344N4252A080	3 x 115.2	480	25.0	30.1	85 x 348	B
B32344N4272A780	3 x 127.6	480	27.7	33.3	90 x 348	B
B32344N4302A080	3 x 138.2	480	30.0	36.1	90 x 348	B
Rated Voltage 525 V AC, delta connection						
B32344N5052A025	3 x 19.3	525	5.0	5.5	63.5 x 146	A
B32344N5062A625	3 x 25.4	525	6.6	7.3	75 x 157	B
B32344N5072A525	3 x 28.9	525	7.5	8.3	75 x 167	B
B32344N5082A325	3 x 32	525	8.3	9.1	75 x 160	B
B32344N5102A425	3 x 40.1	525	10.4	11.4	75 x 197	B
B32344N5122A525	3 x 48.1	525	12.5	13.7	85 x 197	B
B32344N5132A225	3 x 50.8	525	13.2	14.5	85 x 270	B
B32344N5162A725	3 x 64.3	525	16.7	18.4	85 x 270	B
B32344N5202A825	3 x 80.1	525	20.8	22.9	90 x 270	B
B32344N5252A025	3 x 96.3	525	25.0	27.5	90 x 348	B
B32344N5262A525	3 x 102.1	525	26.5	29.1	90 x 348	B

Dimensional drawing: PhiCap Normal Duty

Terminal type A



Terminal type B



Film Capacitors

PFC Capacitors and Key Components

PhiCap Heavy Duty Capacitor

Series	PhiCap Heavy Duty B32447 and B32448
Technical data	5 to 33.1 kvar Rated Voltage: 415 V to 525 V
Features	• Manufactured using state-of-art metalisation process for MPP film with heavy edge • Self-healing property • Low energy consumption • Capable of withstanding high inrush current for non-linear loads • Soft biodegradable resin as impregnant • Three phase safety device in the form of pressure sensitive (over pressure) mechanical interrupter • Temp class: -25/D
Specification	Conformance to Standards IEC 60831-1 & 2 IS 13340
Applications	• Power Factor Correction (PFC) automatic capacitor banks • Fixed PFC applications, e.g. motor compensation • Detuned PFC systems • Dynamic PFC systems

PhiCap Heavy Duty Capacitor

Technical data : PhiCap Heavy Duty Capacitors

Series type	B32447H series (1 to 6.3 kvar) / B32448H series (6.3 to 33.1 kvar)
Power-kvar	1 to 33.1 kvar
Rated voltage-V (AC)	415, 440, 480, 525
Frequency	50 Hz
Connection	Delta
Transient peak current (Maximum permissible)	250 • IR***
Maximum permissible temperature category	-25/D
Dielectric losses	0.2 W / kvar
Total Losses (without discharge resistor)	≤ 0.5 W / 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	1.5 to 1.8 • I_R***
Safety	Self-healing, overpressure disconnector
Impregnation	Non PCB, soft biodegradable resin
Life expectancy	Up to 130 000 hours
Cooling	Natural or forced
Case/Shape	Extruded round aluminum can with stud
Terminal	6.3 mm fast-on terminals for plastic top Sigut terminals for metal top
Mounting and grounding	Threaded stud at bottom of can (max. torque 4 Nm for M8 and 10 Nm for M12)
Enclosure	IP 20, indoor mounting (optionally with terminal cap for IP54)
Discharge resistor	Provided with discharge resistor
Dielectric	Polypropylene film (metallised)
No. of switching per annum	Max. 7500 switching
Reference standard	IEC 60831-1/2, IS 13340

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

Film Capacitors

PFC Capacitors and Key Components

PhiCap Heavy Duty

Ordering code	Rated capacitance C_N	Rated voltage V_N	Output & Rated current at 50 Hz		Dimensions (D x H)	Terminal type
	µF	V	kvar	I_N A	mm	
Rated Voltage 415 V AC, delta connection						
B32447H4012A015	3 x 6.2	415	1.0	1.4	53 x 117	A
B32447H4022A015	3 x 12.3	415	2.0	2.8	53 x 117	A
B32447H4032A015	3 x 18.5	415	3.0	4.2	53 x 152	A
B32447H4042A015	3 x 24.6	415	4.0	5.6	53 x 152	A
B32447H4052A015	3 x 30.8	415	5.0	7.0	63.5 x 129	A
B32448H4072A515	3 x 46.2	415	7.5	10.4	75 x 160	B
B32448H4082A015	3 x 49.3	415	8.0	11.1	75 x 160	B
B32447H4092A015	3 x 55.4	415	9.0	12.5	75 x 160	B
B32447H4102A015	3 x 61.6	415	10.0	13.9	75 x 197	B
B32448H4122A515	3 x 77.0	415	12.5	17.4	75 x 197	B
B32448H4152A015	3 x 92.4	415	15.0	20.9	75 x 270	B
B32448H4202A015	3 x 123.2	415	20.0	27.8	75 x 270	B
B32448H4252A015	3 x 154.0	415	25.0	34.8	85 x 270	B
Rated Voltage 440 V AC, delta connection						
B32447H4012A040	3 x 5.5	440	1.0	1.3	53 x 117	A
B32447H4022A040	3 x 11.0	440	2.0	2.6	53 x 117	A
B32447H4032A040	3 x 16.4	440	3.0	3.9	53 x 117	A
B32447H4042A040	3 x 21.9	440	4.0	5.2	53 x 152	A
B32447H4052A040	3 x 27.4	440	5.0	6.6	53 x 152	A
B32447H4062A040	3 x 32.9	440	6.0	7.9	63.5 x 152	A
B32448H4072A540	3 x 41.1	440	7.5	9.8	75 x 160	B
B32448H4082A340	3 x 45.5	440	8.3	10.9	75 x 160	B
B32448H4092A040	3 x 49.3	440	9.0	11.8	75 x 160	B
B32448H4102A040	3 x 54.8	440	10.0	13.1	75 x 197	B
B32448H4122A540	3 x 68.5	440	12.5	16.4	75 x 197	B
B32448H4152A040	3 x 82.2	440	15.0	19.7	75 x 270	B
B32448H4202A040	3 x 109.6	440	20.0	26.2	85 x 270	B
B32448H4252A040	3 x 137.0	440	25.0	32.8	90 x 270	B
B32448H4282A140	3 x 154.0	440	28.1	36.9	85 x 348	B
B32448H4302A040	3 x 164.4	440	30.0	39.4	90 x 348	B
Rated Voltage 480 V AC, delta connection						
B32447H4052A080	3 x 23.0	480	5.0	6.0	63.5 x 152	A
B32447H4052A580	3 x 25.3	480	5.5	6.6	63.5 x 152	A
B32447H4062A380	3 x 29.0	480	6.3	7.6	63.5 x 152	A
B32448H4082A380	3 x 38.2	480	8.3	10.0	75 x 160	B
B32448H4102A480	3 x 47.9	480	10.4	12.5	75 x 197	B
B32448H4112A180	3 x 51.1	480	11.1	13.4	75 x 197	B
B32448H4122A580	3 x 57.6	480	12.5	15.0	75 x 197	B
B32448H4132A880	3 x 63.5	480	13.8	16.6	75 x 270	B

Film Capacitors

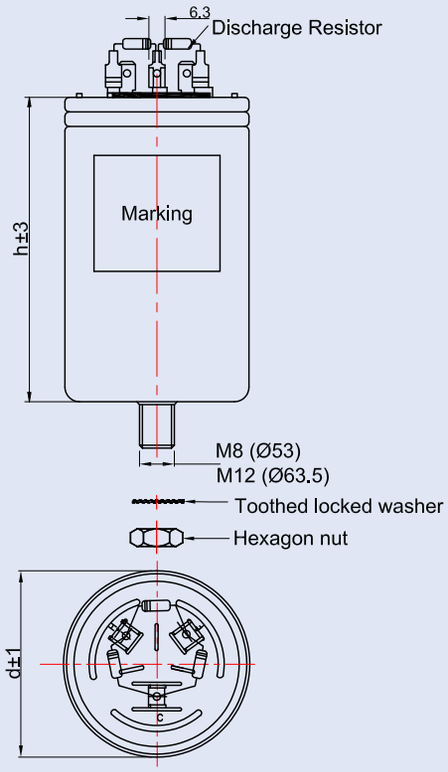
PFC Capacitors and Key Components

PhiCap Heavy Duty

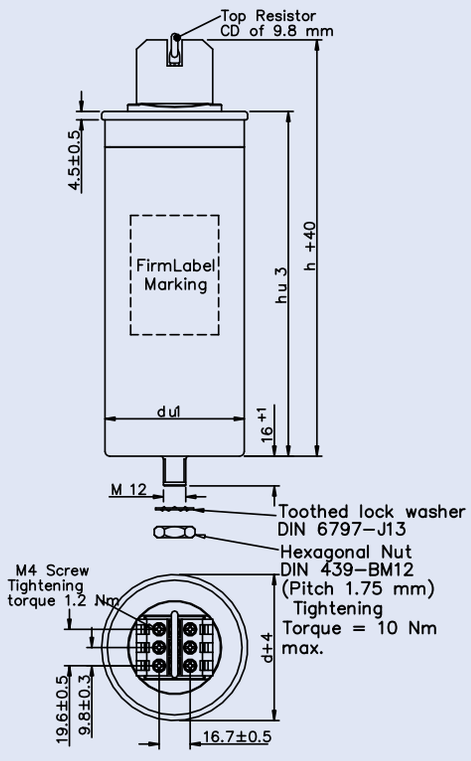
Ordering code	Rated capacitance C_N	Rated voltage V_N	Output & Rated current at 50 Hz		Dimensions (D x H)	Terminal type
	µF	V	kvar	I_N A	mm	
B32448H4152A080	3 x 69.1	480	15.0	18.0	75 x 270	B
B32448H4162A780	3 x 76.9	480	16.7	20.1	85 x 270	B
B32448H4182A780	3 x 86.1	480	18.7	22.5	85 x 270	B
B32448H4202A080	3 x 92.1	480	20.0	24.1	85 x 270	B
B32448H4222A080	3 x 101.3	480	22.0	26.5	85 x 348	B
B32448H4252A080	3 x 115.1	480	25.0	30.1	85 x 348	B
B32448H4272A780	3 x 127.5	480	27.7	33.3	90 x 348	B
B32448H4282A180	3 x 129.4	480	28.1	33.8	90 x 348	B
B32448H4302A080	3 x 138.1	480	30.0	36.1	90 x 348	B
Rated Voltage 525 V AC, delta connection						
B32447H5052A025	3 x 19.2	525	5.0	5.5	63.5 x 152	A
B32448H5062A325	3 x 24.2	525	6.3	6.9	75 x 160	B
B32448H5062A625	3 x 25.4	525	6.6	7.3	75 x 160	B
B32448H5072A525	3 x 28.9	525	7.5	8.2	75 x 160	B
B32448H5082A325	3 x 31.9	525	8.3	9.1	75 x 160	B
B32448H5102A425	3 x 40.0	525	10.4	11.4	75 x 197	B
B32448H5122A525	3 x 48.1	525	12.5	13.7	85 x 197	B
B32448H5132A225	3 x 50.8	525	13.2	14.5	75 x 270	B
B32448H5152A025	3 x 57.7	525	15.0	16.5	85 x 270	B
B32448H5162A725	3 x 64.3	525	16.7	18.4	85 x 270	B
B32448H5202A025	3 x 77.0	525	20.0	22.0	90 x 270	B
B32448H5252A025	3 x 96.2	525	25.0	27.5	90 x 348	B
B32448H5262A525	3 x 102.0	525	26.5	29.1	90 x 348	B
B32448H5302A025	3 x 115.5	525	30.0	33.0	116 x 280	B
B32448H5332A125	3 x 127.4	525	33.1	36.4	116 x 280	B

Dimensional drawings: PhiCap Heavy Duty

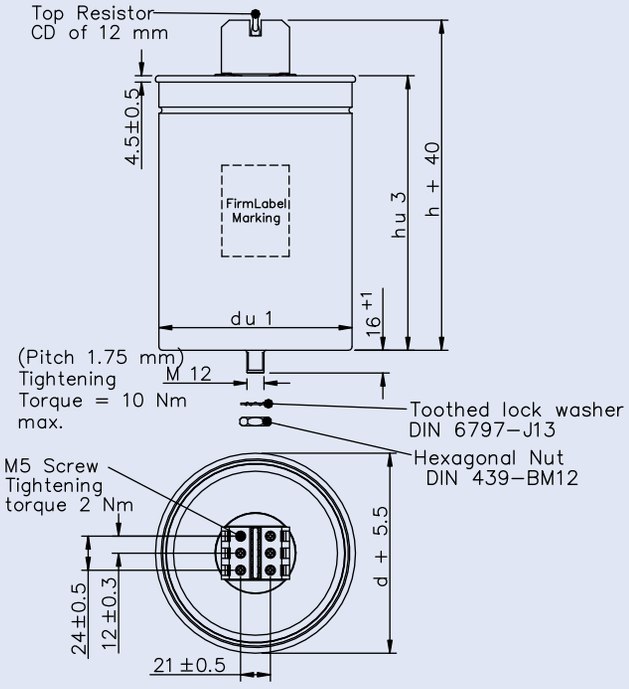
Capacitors with plastic top (B32447H)
Terminal type A



Capacitors with metal top (B32448H)
Terminal type B



Terminal type C



PFC Capacitors & Key Components

Superior Solutions for Power Factor Correction

World-class EPCOS brand PFC capacitors and key components with ,IEC and VDE certifications*, manufactured in State-of-the-art automated production facilities

TDK PFC Capacitors

- **PhiCap®**
  TDK quality and cost effectiveness: Capacitors to meet both the aspects
- **PhaseCap®**
  New generation of PFC capacitors based on successful PhaseCap® MKK® design; gas or resin filled
- **SquareCap®**
  Rectangular box type, self standing units. Modular construction with sheet metal enclosure
- **PoleCap®**
  Based on the PhaseCap and PhiCap technology, designed for outdoor, pole-mounted and fixed PFC applications

EPCOS key components

- **Three-Phase Reactor**
  Anti-resonance three phase filter reactor used to prevent harmonic resonance and also harmonic overloading of capacitor banks
- **Power factor controllers**
  For real 1 or 3-phase measuring & monitoring and phase-specific power factor correction
- **Thyristor modules**
  Used for high frequency switching to ensure real time power factor correction.10 to100 kvar at 440 to 690 V AC; the EPCOS brand TSM range covers it all
- **Capacitor Duty Contractors**
  Used for enhancing life of the capacitors and improving power quality. Upto 100 kvar at 220 V to 690 V with highest reliability and minimal space requirements
- **LT – APP Capacitors**
  Low voltage robust capacitors, suitable for use in arduous applications including applications related to Tuned and Detuned Harmonic Filters

* Certifications depending on type

Film Capacitors

PFC Capacitors and Key Components

PhaseCap Super Heavy Duty Capacitors

Series	PhaseCap SHD B25675L
Technical data	5 to 33.1 kvar Voltage : 415 V to 690 V (800/1000 V on request)
Features	• Manufactured using state-of-art wavecut technology for MPP film with heavy edge • Self healing property • Low energy consumption • Capable of withstanding high inrush current (Upto 500 IR) • Very High life expectancy up to 2,00,000 operating hours (-40/D) • Capable for 15000 switching per year to handle dynamic loads • Three phase safety device in the form of pressure sensitive (over pressure) mechanical interrupter • Compact size and light weight • Soft biodegradable resin as impregnant. • Temp class: -40 °C to 60 °C
Specification	Conformance to standards IEC 60831-1 & 2, EN60831-1 & 2, IS:13340
Applications	• Automatic PFC equipment, capacitor banks • Individual Fixed PFC (e.g. motors, transformers, lighting) • Group fixed PFC • Tuned and detuned capacitor banks • Dynamic PFC

PhaseCap Super Heavy Duty Capacitors

Technical data : PhaseCap Super Heavy Duty	
Series type	B25675L
Power-kvar	1 to 37.1 kvar
Rated voltage-V (AC)	415, 440, 480, 525, 690
Frequency	50 Hz
Connection	Delta
Transient peak current (Maximum permissible)	≤ 500 • IR***
Maximum permissible temperature category	-40/60
Dielectric losses	0.2 W / kvar
Total Losses (without discharge resistor)	≤ 0.45 W / kvar
Maximum permissible voltage	VR + 10% (up to 8 h daily) / VR + 15% (up to 30 min. daily) / VR + 20% (up to 5 min. daily) / VR + 30% (up to 1 min. daily)**
Maximum permissible current	1.6 to 2.0 • IR***
Safety	Self-healing, overpressure disconnector
Impregnation	Non PCB, soft biodegradable resin
Life expectancy	Up to 180 000 hours for -40/60
Cooling	Natural or forced
Case/Shape	Extruded round aluminum can with stud
Terminal	6.3 mm fast-on terminals for plastic top Sigut terminals for metal top
Mounting and grounding	Threaded stud at bottom of can (max. torque 4 Nm for M8 and 10 Nm for M12)
Enclosure	IP 20, indoor mounting (optionally with terminal cap for IP54)
Discharge resistor	Provided with discharge resistor
Dielectric	Polypropylene film (metallised)
No. of switching per annum	Max. 15000 switching
Reference standard	IEC 60831-1/2, IS 13340

*** VR Rated voltage, *** IR RMS line current that occurs at rated sinusoidal voltage and rated frequency, excluding transients*

Film Capacitors

PFC Capacitors and Key Components

PhaseCap Super Heavy Duty

Ordering code	Series/type	Rated capacitance C_N µF	Rated capacitance V_N V	Output & Rated current at 50 Hz		Output & Rated current at 60 Hz		Dimensions (D x H)	Weight approx.	Terminal type
				kvar	I_R A	kvar	I_R A	mm	kg	
Rated Voltage 415 V AC, delta connection										
B25675L4052J015	MKK415-D-5.0-04	3 x 30.8	415	5.0	7.0	6.0	8.3	75 x 164	0.9	A
B25675L4062J315	MKK415-D-6.3-04	3 x 38.8	415	6.3	8.8	7.6	10.6	75 x 164	0.9	A
B25675L4072J515	MKK415-D-7.5-04	3 x 46.2	415	7.5	10.4	9.0	12.5	75 x 200	1.1	A
B25675L4102J015	MKK415-D-10.0-04	3 x 61.6	415	10.0	13.9	12.0	16.7	75 x 200	1.1	A
B25675L4102J415	MKK415-D-10.4-04	3 x 64.1	415	10.4	14.5	12.5	17.4	75 x 200	1.1	A
B25675L4122J515	MKK415-D-12.5-04	3 x 77.0	415	12.5	17.4	15.0	20.9	85 x 200	1.3	A
B25675L4152J015	MKK415-D-15.0-04	3 x 92.4	415	15.0	20.9	18.0	25.0	85 x 200	1.3	A
B25675L4202J015	MKK415-D-20.0-04	3 x 123.2	415	20.0	27.8	24.0	33.4	100 x 207	1.9	B
B25675L4252J015	MKK415-D-25.0-04	3 x 154.0	415	25.0	34.8	30.0	41.7	116 x 192	2.4	B
B25675L4282J115	MKK415-D-28.1-04	3 x 173.1	415	28.1	39.1	-	-	116 x 207	2.6	B
B25675L4302J015	MKK415-D-30.0-04	3 x 184.8	415	30.0	41.7	-	-	116 x 207	2.6	B
B25675L4332J015	MKK415-D-33.0-04	3 x 203.3	415	33.0	45.9	-	-	116 x 224	2.8	B
Rated Voltage 440 V AC, delta connection										
B25675L4012J040	MKK440-D-1.0-04	3 x 5.5	440	1.0	1.3	1.2	1.6	53 x 117	0.3	E
B25675L4022J040	MKK440-D-2.0-04	3 x 11.0	440	2.0	2.6	2.4	3.1	53 x 129	0.4	E
B25675L4032J040	MKK440-D-3.0-04	3 x 16.4	440	3.0	3.9	3.6	4.7	53 x 129	0.4	E
B25675L4042J040	MKK440-D-4.0-04	3 x 21.9	440	4.0	5.2	4.8	6.3	63.5 x 152	0.5	E
B25675L4061J040	MKK440-D-5.0-04	3 x 27.4	440	5.0	6.6	6.0	7.9	63.5 x 152	0.5	E
B25675L4072J540	MKK440-D-7.5-04	3 x 41.1	440	7.5	9.8	9.0	11.8	75 x 200	1.1	A
B25675L4102J040	MKK440-D-10.0-04	3 x 54.8	440	10.0	13.1	12.0	15.7	75 x 200	1.1	A
B25675L4102J440	MKK440-D-10.4-04	3 x 54.8	440	10.4	13.6	12.5	16.4	85 x 200	1.3	A
B25675L4122J540	MKK440-D-12.5-04	3 x 68.5	440	12.5	16.4	15.0	19.7	85 x 200	1.3	A
B25675L4152J040	MKK440-D-15.0-04	3 x 82.2	440	15.0	19.7	18.0	23.6	85 x 218	1.5	A
B25675L4202J040	MKK440-D-20.0-04	3 x 109.6	440	20.0	26.2	24.0	31.5	100 x 207	1.9	B
B25675L4252J040	MKK440-D-25.0-04	3 x 137.0	440	25.0	32.8	30.0	39.4	116 x 192	2.4	B
B25675L4282J140	MKK440-D-28.1-04	3 x 154.0	440	28.1	36.9	-	-	116 x 207	2.6	B
B25675L4302J040	MKK440-D-30.0-04	3 x 164.4	440	30.0	39.4	-	-	125 x 192	2.8	B
B25675L4332J140	MKK440-D-33.1-04	3 x 181.4	440	33.1	43.4	-	-	116 x 224	2.8	B
Rated Voltage 480 V AC, delta connection										
B25675L4052J080	MKK480-D-5.0-04	3 x 23.0	480	5.0	6.0	6.0	7.2	75 x 164	0.9	A
B25675L4052J580	MKK480-D-5.5-04	3 x 25.3	480	5.5	6.6	6.6	7.9	75 x 164	0.9	A
B25675L4062J380	MKK480-D-6.3-04	3 x 29.0	480	6.3	7.6	7.6	9.1	75 x 164	0.9	A
B25675L4082J380	MKK480-D-8.3-04	3 x 38.2	480	8.3	10.0	10.0	12.0	75 x 200	1.1	A
B25675L4102J480	MKK480-D-10.4-04	3 x 47.9	480	10.4	12.5	12.5	15.0	75 x 200	1.1	A
B25675L4112J080	MKK480-D-11.0-04	3 x 50.7	480	11.0	13.2	13.2	15.9	85 x 200	1.3	A
B25675L4122J580	MKK480-D-12.5-04	3 x 57.6	480	12.5	15.0	15.0	18.0	85 x 200	1.3	A
B25675L4132J880	MKK480-D-13.8-04	3 x 63.5	480	13.8	16.6	16.6	20.0	85 x 200	1.3	A
B25675L4152J080	MKK480-D-15.0-04	3 x 69.1	480	15.0	18.0	18.0	21.7	100 x 207	1.9	B
B25675L4162J780	MKK480-D-16.7-04	3 x 76.9	480	16.7	20.1	20.0	24.1	100 x 207	1.9	B

Film Capacitors

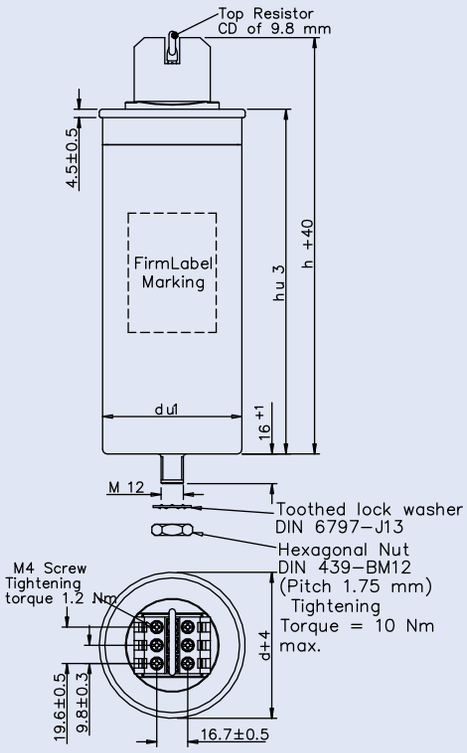
PFC Capacitors and Key Components

PhaseCap Super Heavy Duty

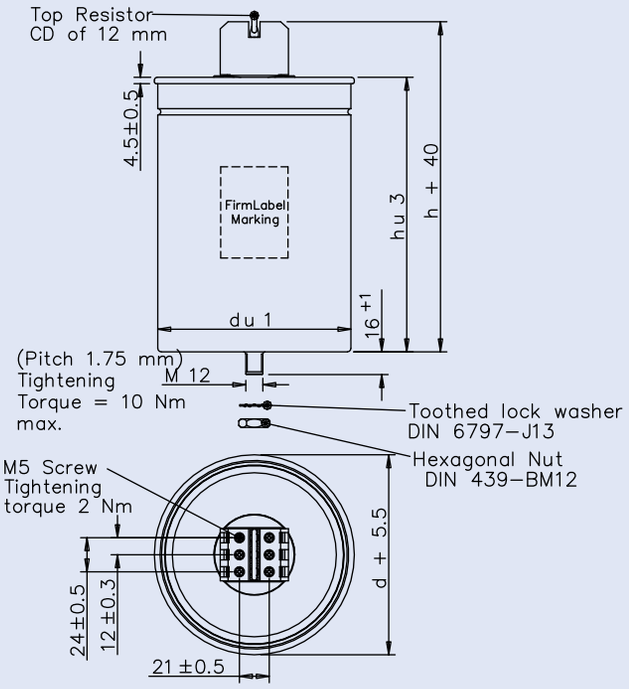
Ordering code	Series/type	Rated capacitance C_N µF	Rated capacitance V_N V	Output & Rated current at 50 Hz		Output & Rated current at 60 Hz		Dimensions (D x H)	Weight approx.	Terminal type
				kvar	I_R A	kvar	I_R A	mm	kg	
B25675L4182J780	MKK480-D-18.7-04	3 x 86.1	480	18.7	22.5	22.4	26.9	100 x 207	1.9	B
B25675L4202J080	MKK480-D-20.0-04	3 x 92.1	480	20.0	24.1	24.0	28.9	100 x 207	1.9	B
B25675L4202J880	MKK480-D-20.8-04	3 x 95.8	480	20.8	25.0	25.0	30.1	116 x 207	2.6	B
B25675L4222J080	MKK480-D-22.0-04	3 x 101.3	480	22.0	26.5	26.4	31.8	116 x 207	2.6	B
B25675L4252J080	MKK480-D-25.0-04	3 x 115.1	480	25.0	30.1	30.0	36.1	116 x 192	2.4	B
B25675L4282J180	MKK480-D-28.1-04	3 x 129.4	480	28.1	33.8	-	-	116 x 207	2.6	B
B25675L4312J080	MKK480-D-31-04	3 x 142.7	480	31	37.3	-	-	116 x 224	2.8	B
B25675L4332J080	MKK480-D-33.0-04	3 x 152.0	480	33.0	39.7	-	-	116 x 224	2.8	B
Rated Voltage 525 V AC, delta connection										
B25675L5052J025	MKK525-D-5.0-04	3 x 19.2	525	5.0	5.5	6.0	6.6	75 x 164	0.9	A
B25675L5062J325	MKK525-D-6.3-04	3 x 24.2	525	6.3	6.9	7.6	8.4	75 x 164	0.9	A
B25675L5082J325	MKK525-D-8.3-04	3 x 31.9	525	8.3	9.1	10.0	11.0	75 x 200	1.1	A
B25675L5102J425	MKK525-D-10.4-04	3 x 40.0	525	10.4	11.4	12.5	13.7	85 x 185	1.2	A
B25675L5122J525	MKK525-D-12.5-04	3 x 48.1	525	12.5	13.7	15.0	16.5	85 x 200	1.3	A
B25675L5132J225	MKK525-D-13.2-04	3 x 50.8	525	13.2	14.6	15.8	17.4	85 x 200	1.3	A
B25675L5152J025	MKK525-D-15.0-04	3 x 57.7	525	15.0	16.5	18.0	19.8	85 x 218	1.5	A
B25675L5162J725	MKK525-D-16.7-04	3 x 64.3	525	16.7	18.4	20.0	22.0	100 x 207	1.9	B
B25675L5202J025	MKK525-D-20.0-04	3 x 77.0	525	20.0	22.0	24.0	26.4	100 x 224	2.1	B
B25675L5252J025	MKK525-D-25.0-04	3 x 96.2	525	25.0	27.5	30.0	33.0	116 x 207	2.6	B
B25675L5262J525	MKK525-D-26.5-04	3 x 102.0	525	26.5	29.1	31.8	35.0	116 x 207	2.6	B
B25675L5302J025	MKK525-D-30.0-04	3 x 115.5	525	30.0	33.0	-	-	125 x 207	3.0	B
B25675L5332J125	MKK525-D-33.1-04	3 x 127.4	525	33.1	36.4	-	-	136 x 192	3.3	B
B25675L5372J125	MKK525-D-37.1-04	3 x 142.8	525	37.1	40.8	-	-	136 x 224	3.6	B
Rated voltage 690 V AC, delta connection										
B25675L6052J390	MKK690-D-5.3-04	3 x 11.8	690	5.3	4.4	6.4	5.4	75 x 185	1.0	C
B25675L6062J990	MKK690-D-6.9-04	3 x 15.4	690	6.9	5.8	8.3	6.9	75 x 200	1.1	C
B25675L6102J490	MKK690-D-10.4-04	3 x 23.2	690	10.4	8.7	12.5	10.5	75 x 200	1.1	C
B25675L6122J590	MKK690-D-12.5-04	3 x 27.9	690	12.5	10.5	15.0	12.6	85 x 200	1.3	C
B25675L6142J690	MKK690-D-14.6-04	3 x 32.5	690	14.6	12.2	17.5	14.6	100 x 207	1.9	D
B25675L6202J090	MKK690-D-20.0-04	3 x 44.6	690	20.0	16.7	24.0	20.1	100 x 207	1.9	D
B25675L6252J090	MKK690-D-25.0-04	3 x 55.7	690	25.0	20.9	30.0	25.1	116 x 192	2.4	D
B25675L6282J090	MKK690-D-28.0-03	3 x 62.4	690	28.0	23.4	-	-	116 x 207	2.6	D

Dimensional drawings: PhaseCap Super Heavy Duty

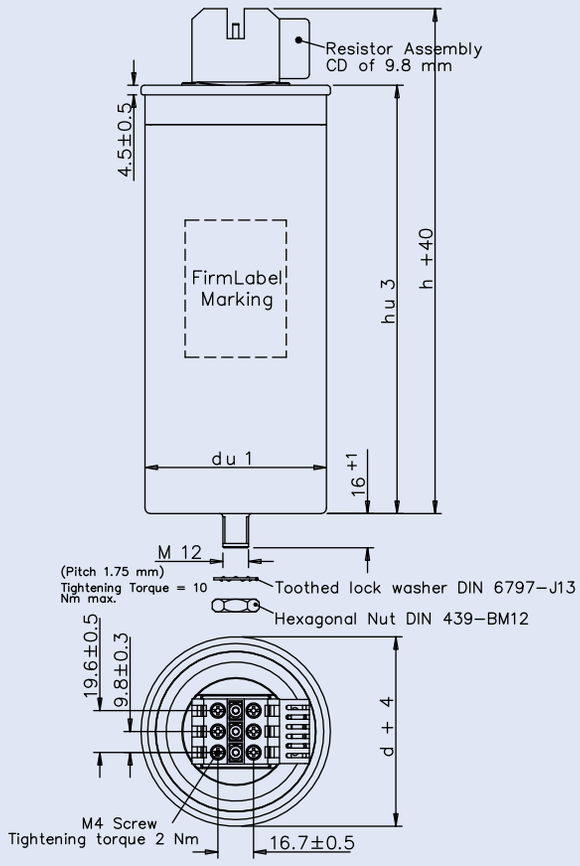
Terminal type A



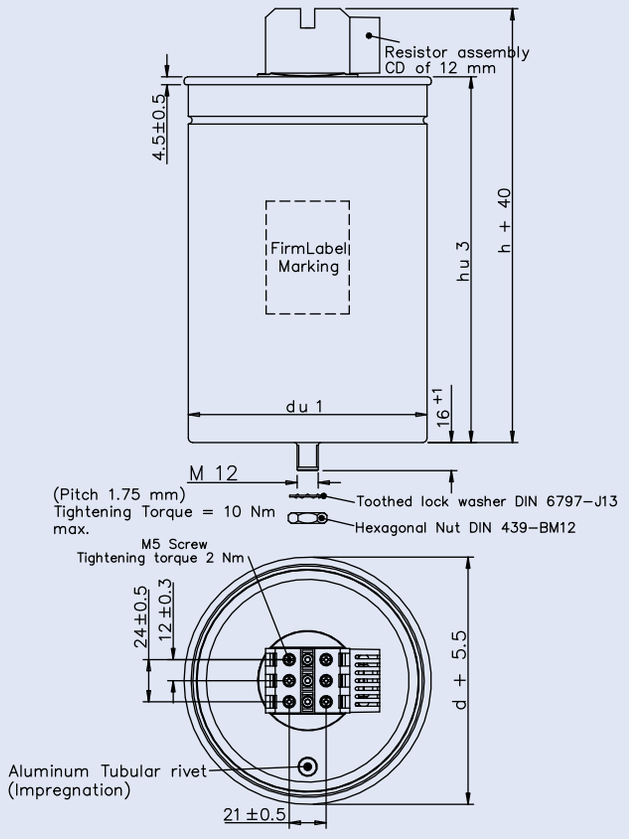
Terminal type B



Terminal type C

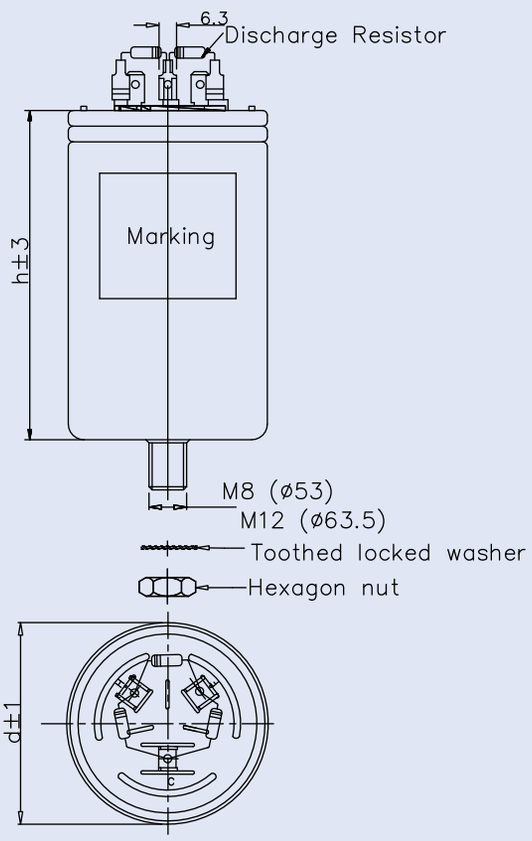


Terminal type D



Dimensional drawings: PhaseCap Super Heavy Duty

Terminal type E



Film Capacitors

PFC Capacitors and Key Components

PhaseCap Energy Heavy Duty Capacitors

Series	PhaseCap Energy HD B25674L
Technical data	Single Units from 5 to 33.1 kvar Voltage : 415 V to 690 V (800/1000V on request)
Features	• Manufactured using state-of-art wavecut technology for MPP film with heavy edge • Self healing property • Low energy consumption • Capable of withstanding high inrush current (Upto 400 IR) • Dry-type, freedom from oil leakage • Three phase safety device in the form of pressure sensitive (over pressure) mechanical interrupter • Compact size and light weight • Temp class: -40/D
Specification	Conformance to standards IEC 60831-1 & 2, IS:13340
Applications	• Automatic PFC equipment, capacitor banks • Individual Fixed PFC (e.g. motors, transformers, lighting) • Group fixed PFC • Tuned and detuned capacitor banks • Dynamic PFC

PhaseCap Energy Heavy Duty Capacitors

Technical data : PhaseCap Energy Heavy Duty Capacitors

Series type	B25674L
Power-kvar	5 to 33.1 kvar
Rated voltage-V (AC)	415, 440, 480, 525, 690
Frequency	50 Hz
Connection	Delta
Transient peak current (Maximum permissible)	≤ 400 • IR***
Maximum permissible temperature category	-40/D
Dielectric losses	0.2 W / kvar
Total Losses (without discharge resistor)	≤ 0.45 W / 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	1.6 to 1.8 • I_R***
Safety	Self-healing, overpressure disconnector
Impregnation	Dry, Inert Gas
Life expectancy	Up to 150 000 hours for -40/D
Cooling	Natural or forced
Case/Shape	Extruded round aluminum can with stud
Terminal	Sigut terminals
Mounting and grounding	Threaded stud at bottom of can (max. torque 10Nm for M12)
Enclosure	IP 20, indoor mounting (optionally with terminal cap for IP54)
Discharge resistor	Provided with discharge resistor
Dielectric	Polypropylene film (metallised)
No. of switching per annum	Max. 12500 switching
Reference standard	IEC 60831-1/2, IS 13340

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

Film Capacitors

PFC Capacitors and Key Components

PhaseCap Energy Heavy Duty

Ordering code	Series/type	Rated capacitance C_N µF	Rated capacitance V_N V	Output & Rated current at 50 Hz		Output & Rated current at 60 Hz		Dimensions (D x H)	Weight approx.	Terminal type
				kvar	I_R A	kvar	I_R A	mm	kg	
Rated Voltage 415 V AC, delta connection										
B25674L4052J015	MKK415-D-5.0-03	3 x 30.8	415	5.0	7.0	6.0	8.3	75 x 164	0.7	A
B25674L4062J315	MKK415-D-6.3-03	3 x 38.8	415	6.3	8.8	7.6	10.6	75 x 164	0.7	A
B25674L4072J515	MKK415-D-7.5-03	3 x 46.2	415	7.5	10.4	9.0	12.5	75 x 200	0.8	A
B25674L4082J315	MKK415-D-8.3-03	3 x 51.1	415	8.3	11.5	10.0	13.9	75 x 200	0.8	A
B25674L4102J415	MKK415-D-10.4-03	3 x 64.1	415	10.4	14.5	12.5	17.4	75 x 200	0.8	A
B25674L4122J515	MKK415-D-12.5-03	3 x 77.0	415	12.5	17.4	15.0	20.9	85 x 200	1.1	A
B25674L4152J015	MKK415-D-15.0-03	3 x 92.4	415	15.0	20.9	18.0	25.0	85 x 200	1.1	A
B25674L4162J715	MKK415-D-16.7-03	3 x 102.9	415	16.7	23.2	20.0	27.8	100 x 207	1.6	B
B25674L4202J015	MKK415-D-20.0-03	3 x 123.2	415	20.0	27.8	24.0	33.4	100 x 207	1.6	B
B25674L4252J015	MKK415-D-25.0-03	3 x 154.0	415	25.0	34.8	30.0	41.7	116 x 192	1.9	B
B25674L4282J115	MKK415-D-28.1-03	3 x 173.1	415	28.1	39.1	-	-	116 x 207	2.1	B
B25674L4302J015	MKK415-D-30.0-03	3 x 184.8	415	30.0	41.7	-	-	116 x 207	2.1	B
B25674L4332J015	MKK415-D-33.0-03	3 x 203.3	415	33.0	45.9	-	-	116 x 224	2.3	B
Rated Voltage 440 V AC, delta connection										
B25674L4052J040	MKK440-D-5.0-03	3 x 27.4	440	5.0	6.6	6.0	7.9	75 x 164	0.7	A
B25674L4062J040	MKK440-D-6.0-03	3 x 32.9	440	6.0	7.9	7.2	9.4	75 x 164	0.7	A
B25674L4062J340	MKK440-D-6.3-03	3 x 34.5	440	6.3	8.3	7.6	10.0	75 x 164	0.7	A
B25674L4072J040	MKK440-D-7.0-03	3 x 38.4	440	7.0	9.2	8.4	11.0	75 x 200	0.8	A
B25674L4072J540	MKK440-D-7.5-03	3 x 41.1	440	7.5	9.8	9.0	11.8	75 x 200	0.8	A
B25674L4082J040	MKK440-D-8.0-03	3 x 43.8	440	8.0	10.5	9.6	12.6	75 x 200	0.8	A
B25674L4102J040	MKK440-D-10.0-03	3 x 54.8	440	10.0	13.1	12.0	15.7	75 x 200	0.8	A
B25674L4102J440	MKK440-D-10.4-03	3 x 57.0	440	10.4	13.6	12.5	16.4	85 x 200	1.1	A
B25674L4122J540	MKK440-D-12.5-03	3 x 68.5	440	12.5	16.4	15.0	19.7	85 x 200	1.1	A
B25674L4142J240	MKK440-D-14.2-03	3 x 77.8	440	14.2	18.6	17.0	22.3	85 x 200	1.1	A
B25674L4152J040	MKK440-D-15.0-03	3 x 82.2	440	15.0	19.7	18.0	23.6	85 x 218	1.2	A
B25674L4182J840	MKK440-D-18.8-03	3 x 103.0	440	18.8	24.7	22.6	29.7	100 x 207	1.6	B
B25674L4202J040	MKK440-D-20.0-03	3 x 109.6	440	20.0	26.2	24.0	31.5	100 x 207	1.6	B
B25674L4252J040	MKK440-D-25.0-03	3 x 137.0	440	25.0	32.8	30.0	39.4	116 x 192	1.9	B
B25674L4282J140	MKK440-D-28.1-03	3 x 154.0	440	28.1	36.9	-	-	116 x 207	2.1	B
B25674L4302J040	MKK440-D-30.0-03	3 x 164.4	440	30.0	39.4	-	-	125 x 192	2.3	B
B25674L4332J140	MKK440-D-33.1-03	3 x 181.4	440	33.1	43.4	-	-	116 x 224	2.3	B
Rated Voltage 480 V AC, delta connection										
B25674L4052J080	MKK480-D-5.0-03	3 x 23.0	480	5.0	6.0	6.0	7.2	75 x 164	0.7	A
B25674L4062J380	MKK480-D-6.3-03	3 x 29.0	480	6.3	7.6	7.6	9.1	75 x 164	0.7	A
B25674L4072J580	MKK480-D-7.5-03	3 x 34.5	480	7.5	9.0	9.0	10.8	75 x 200	0.8	A
B25674L4082J380	MKK480-D-8.3-03	3 x 38.2	480	8.3	10.0	10.0	12.0	75 x 200	0.8	A
B25674L4102J480	MKK480-D-10.4-03	3 x 47.9	480	10.4	12.5	12.5	15.0	75 x 200	0.8	A
B25674L4112J080	MKK480-D-11.0-03	3 x 50.7	480	11.0	13.2	13.2	15.9	85 x 200	1.1	A
B25674L4122J580	MKK480-D-12.5-03	3 x 57.6	480	12.5	15.0	15.0	18.0	85 x 200	1.1	A

Film Capacitors

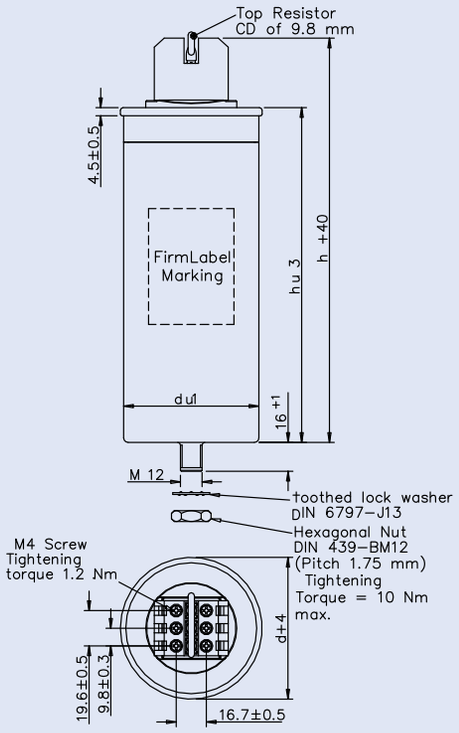
PFC Capacitors and Key Components

PhaseCap Energy Heavy Duty

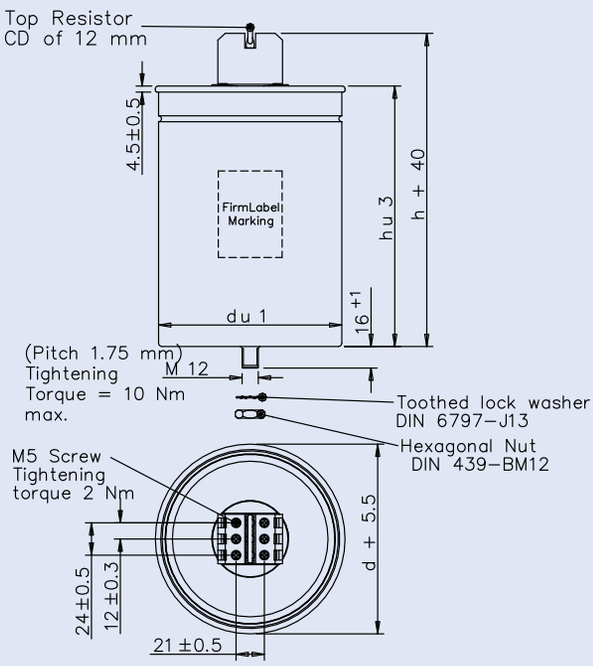
Ordering code	Series/type	Rated capacitance C_N µF	Rated capacitance V_N V	Output & Rated current at 50 Hz		Output & Rated current at 60 Hz		Dimensions (D x H)	Weight approx.	Terminal type
				kvar	I_R A	kvar	I_R A	mm	kg	
B25674L4132J880	MKK480-D-13.8-03	3 x 63.5	480	13.8	16.6	16.6	20.0	85 x 200	1.1	A
B25674L4152J080	MKK480-D-15.0-03	3 x 69.1	480	15.0	18.0	18.0	21.7	100 x 207	1.6	B
B25674L4162J780	MKK480-D-16.7-03	3 x 76.9	480	16.7	20.1	20.0	24.1	100 x 207	1.6	B
B25674L4202J080	MKK480-D-20.0-03	3 x 92.1	480	20.0	24.1	24.0	28.9	100 x 207	1.6	B
B25674L4202J880	MKK480-D-20.8-03	3 x 95.8	480	20.8	25.0	25.0	30.1	116 x 207	2.1	B
B25674L4222J080	MKK480-D-22.0-03	3 x 101.3	480	22.0	26.5	26.4	31.8	116 x 207	2.1	B
B25674L4252J080	MKK480-D-25.0-03	3 x 115.1	480	25.0	30.1	30.0	36.1	116 x 192	1.9	B
B25674L4282J180	MKK480-D-28.1-03	3 x 129.4	480	28.1	33.8	-	-	116 x 207	2.1	B
B25674L4312J080	MKK480-D-31.0-03	3 x 142.7	480	31.0	37.3	-	-	125 x 192	2.3	B
B25674L4332J080	MKK480-D-33.0-03	3 x 152.0	480	33.0	39.7	-	-	116 x 224	2.3	B
Rated Voltage 525 V AC, delta connection										
B25674L5052J025	MKK525-D-5.0-03	3 x 19.2	525	5.0	5.5	6.0	6.6	75 x 164	0.7	A
B25674L5062J325	MKK525-D-6.3-03	3 x 24.2	525	6.3	6.9	7.6	8.4	75 x 164	0.7	A
B25674L5072J525	MKK525-D-7.5-03	3 x 28.9	525	7.5	8.2	9.0	9.9	75 x 185	0.8	A
B25674L5082J325	MKK525-D-8.3-03	3 x 31.9	525	8.3	9.1	10.0	11.0	75 x 200	0.8	A
B25674L5102J425	MKK525-D-10.4-03	3 x 40.0	525	10.4	11.4	12.5	13.7	85 x 185	1.0	A
B25674L5122J525	MKK525-D-12.5-03	3 x 48.1	525	12.5	13.7	15.0	16.5	85 x 200	1.1	A
B25674L5132J225	MKK525-D-13.2-03	3 x 50.8	525	13.2	14.6	15.8	17.4	85 x 200	1.1	A
B25674L5152J025	MKK525-D-15.0-03	3 x 57.7	525	15.0	16.5	18.0	19.8	85 x 218	1.2	A
B25674L5162J725	MKK525-D-16.7-03	3 x 64.3	525	16.7	18.4	20.0	22.0	100 x 207	1.6	B
B25674L5202J025	MKK525-D-20.0-03	3 x 77.0	525	20.0	22.0	24.0	26.4	100 x 224	1.7	B
B25674L5202J825	MKK525-D-20.8-03	3 x 80.1	525	20.8	22.9	25.0	27.5	100 x 224	1.7	B
B25674L5252J025	MKK525-D-25.0-03	3 x 96.2	525	25.0	27.5	30.0	33.0	116 x 207	2.1	B
B25674L5262J525	MKK525-D-26.5-03	3 x 102.0	525	26.5	29.1	31.8	35.0	116 x 207	2.1	B
B25674L5332J125	MKK525-D-33.1-03	3 x 127.4	525	33.1	36.4	-	-	136 x 192	2.7	B
Rated Voltage 690 V AC, delta connection										
B25674L6052J390	MKK690-D-5.3-03	3 x 11.8	690	5.3	4.4	6.4	5.4	75 x 185	0.8	C
B25674L6102J490	MKK690-D-10.4-03	3 x 23.2	690	10.4	8.7	12.5	10.5	75 x 200	0.8	C
B25674L6122J590	MKK690-D-12.5-03	3 x 27.9	690	12.5	10.5	15.0	12.6	85 x 200	1.1	C
B25674L6142J690	MKK690-D-14.6-03	3 x 32.5	690	14.6	12.2	17.5	14.6	100 x 207	1.6	D
B25674L6202J090	MKK690-D-20.0-03	3 x 44.6	690	20.0	16.7	24.0	20.1	100 x 207	1.6	D
B25674L6252J090	MKK690-D-25.0-03	3 x 55.7	690	25.0	20.9	30.0	25.1	116 x 192	1.9	D
B25674L6282J090	MKK690-D-28.0-03	3 x 62.4	690	28.0	23.4	-	-	116 x 207	2.1	D

Dimensional drawings: PhaseCap Energy Heavy Duty

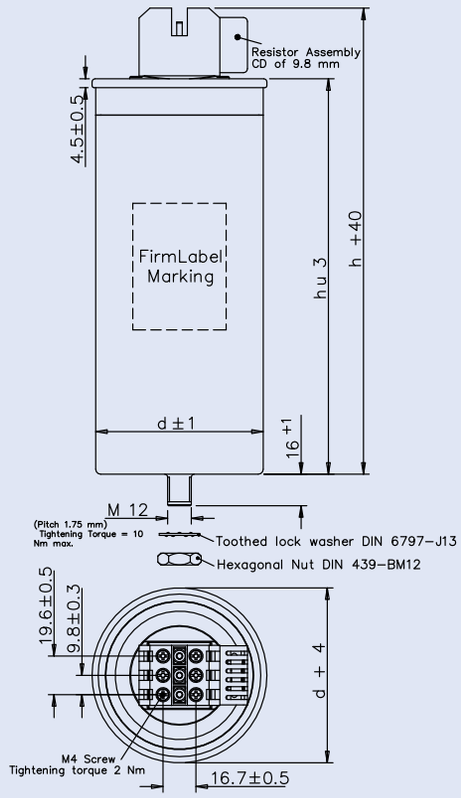
Terminal type A



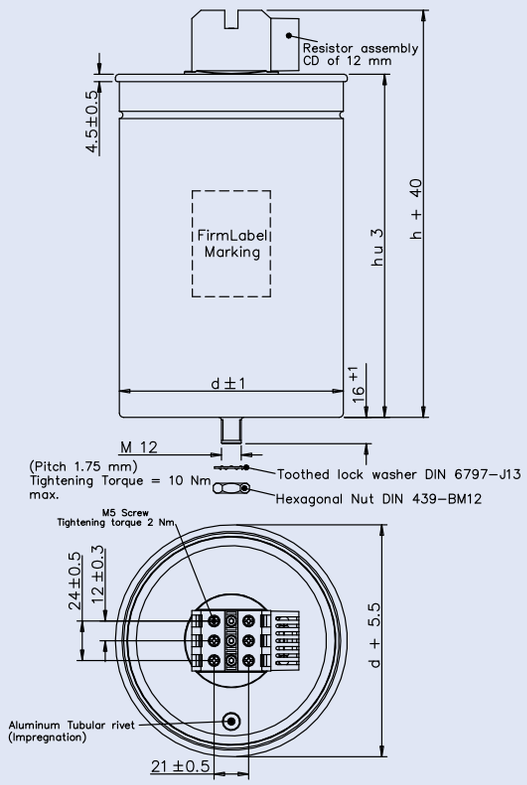
Terminal type B



Terminal type C



Terminal type D



Film Capacitors

PFC Capacitors and Key Components

SquareCap Capacitors - ENDC

Series	SquareCap ENDC B32457
Technical data	Single units up to 50 kvar Voltage: 440 V
Features	• Manufactured using state-of-art metallization process for MPP film with heavy edge • Self healing property • Low energy consumption • Easy & quick repairability at site. • Three phase safety device in the form of pressure sensitive (over pressure) mechanical interrupter. • Compact size and light weight • Soft biodegradable resin as impregnant. • Temp class: -10/D
Specification	Conformance to standards IEC 60831-1 & 2, EN60831-1 & 2, IS:13340
Applications	• Stand alone capacitors (Fixed compensation) • Capacitor banks • Detuned capacitor banks • Dynamic PFC

SquareCap Capacitors - ENDC

Technical data : SquareCap Capacitors

Series type	B32457
Power-kvar	1 to 50 kvar
Rated voltage-V (AC)	440
Frequency	50 Hz
Connection	Delta
Transient peak current (Maximum permissible)	100 • IR***
Maximum permissible temperature category	-10/D
Dielectric losses	0.2 W / kvar
Total Losses (without discharge resistor)	≤ 0.5 W / 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	1.3 • I_R***
Safety	Self-healing, overpressure disconnector
Impregnation	Non PCB, soft biodegradable resin
Life expectancy	Up to 100 000 hours for -10/D
Cooling	Natural or forced
Case/Shape	Rectangular MS container
Terminal	Stud terminals with ceramic bushings
Mounting and grounding	Mounting plates at bottom
Enclosure	IP 54
Discharge resistor	Provided with discharge resistor
Dielectric	Polypropylene film (metallised)
No. of switching per annum	Max. 5000 switching
Reference standard	IEC 60831-1/2, IS 13340

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

Film Capacitors

PFC Capacitors and Key Components

SquareCap ENDC

Ordering code	Rated capacitance C_N	Rated voltage V_N	Output & Rated current at 50 Hz		Dimensions		
					Height (H)	Width (W)	Depth (D)
	µF	V	kvar	I_N A	mm		
Rated Voltage 440VAC, delta connection							
B32457P5001A 11	3 x 5.5	440	1	1.3	95	125	45
B32457P5002A 11	3 x 11	440	2	2.6	120	125	45
B32457P5003A 11	3 x 16.4	440	3	3.9	120	145	55
B32457P5004A 11	3 x 21.9	440	4	5.2	140	145	55
B32457F4052A 40	3 x 27.4	440	5	6.6	240	185	60
B32457F4062A 40	3 x 32.9	440	6	7.9	282	185	60
B32457F4072A 40	3 x 38.4	440	7	9.2	282	185	60
B32457F4072A540	3 x 41.1	440	7.5	9.8	282	185	60
B32457F4082A 40	3 x 43.9	440	8	10.5	282	185	60
B32457F4092A 40	3 x 49.3	440	9	11.8	282	185	60
B32457F4102A 40	3 x 54.8	440	10	13.1	282	185	60
B32457F4122A540	3 x 68.5	440	12.5	16.4	300	240	80
B32457F4152A 40	3 x 82.2	440	15	19.7	300	240	80
B32457F4202A 40	3 x 109.7	440	20	26.2	300	240	80
B32457F4252A 40	3 x 137.1	440	25	32.8	300	240	80
B32457F4352A 40	6 x 96	440	35	45.9	300	240	160
B32457F4402A 40	6 x 109.7	440	40	52.5	300	240	160
B32457F4502A 40	6 x 137.1	440	50	65.6	300	240	160

Film Capacitors

PFC Capacitors and Key Components

SquareCap Capacitors - EHDLL

Series	SquareCap EHDLL B32459
Technical data	Single units up to 50 kvar Voltage: 440 V to 525 V
Features	Manufactured using state-of-art metalisation process for MPP film with heavy edge. • Heavy Duty long life capacitors. • Self healing property. • Low energy consumption. • PU resin as impregnant. • Safety device in the form of pressure sensitive (over pressure) mechanical interrupter. • Simplified modular construction using hermetically sealed single phase basic capacitor cells. • Easy and quick reparability at site. • Temp class: -10/D.
Specification	Conformance to standards IEC 60831-1 & 2, EN60831-1 & 2, IS:13340
Applications	• Stand alone capacitors (Fixed compensation) • Capacitor banks • Detuned capacitor banks • Dynamic PFC

SquareCap Capacitors - EHDLL

Technical data : SquareCap Capacitors

Series type	B32459
Power-kvar	1 to 50 kvar
Rated voltage-V (AC)	440, 480, 525
Frequency	50 Hz
Connection	Delta
Transient peak current (Maximum permissible)	250 • IR***
Maximum permissible temperature category	-10/D
Dielectric losses	0.2 W/ kvar
Total Losses (without discharge resistor)	≤ 0.5 W/ 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	1.5 • I_R***
Safety	Self-healing, overpressure disconnector
Impregnation	Non PCB, soft biodegradable resin
Life expectancy	Up to 125 000 hours for -10/D
Cooling	Natural or forced
Case/Shape	Rectangular MS container
Terminal	Stud terminals with ceramic bushings
Mounting and grounding	Mounting plates at bottom
Enclosure	IP 54
Discharge resistor	Provided with discharge resistor
Dielectric	Polypropylene film (metallised)
No. of switching per annum	Max. 5000 switching
Reference standard	IEC 60831-1/2, IS 13340

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

Film Capacitors

PFC Capacitors and Key Components

SquareCap EHDLL

Ordering code	Rated capacitance C_N	Rated voltage V_N	Output & Rated current at 50 Hz		Dimensions		
					Height (H)	Width (W)	Depth (D)
	µF	V	kvar	I_N A	mm		
Rated Voltage 440 V AC, delta connection							
B32459F4012A 40	3 x 5.5	440	1	1.3	170	125	45
B32459F4022A 40	3 x 11	440	2	2.6	170	125	45
B32459F4032A 40	3 x 16.4	440	3	3.9	240	185	60
B32459F4042A 40	3 x 21.9	440	4	5.2	240	185	60
B32459F4052A 40	3 x 27.4	440	5	6.6	240	185	60
B32459F4062A 40	3 x 32.9	440	6	7.9	300	240	80
B32459F4072A540	3 x 41.1	440	7.5	9.8	300	240	80
B32459F4082A 40	3 x 43.9	440	8	10.5	300	240	80
B32459F4102A 40	3 x 54.8	440	10	13.1	300	240	80
B32459F4122A540	3 x 68.5	440	12.5	16.4	300	240	80
B32459F4152A 40	3 x 82.2	440	15	19.7	300	240	80
B32459F4202A 40	6 x 54.8	440	20	26.2	300	240	160
B32459F4252A 40	6 x 68.5	440	25	32.8	300	240	160
B32459F4302A 40	6 x 82.2	440	30	39.4	300	240	160
B32459F4402A 40	12 x 54.8	440	40	52.5	350	240	320
B32459F4502A 40	12 x 68.5	440	50	65.6	350	240	320
Rated Voltage 480 V AC, delta connection							
B32459F4012A 80	3 x 4.6	480	1	1.2	170	125	45
B32459F4022A 80	3 x 9.2	480	2	2.4	170	125	45
B32459F4032A 80	3 x 13.8	480	3	3.6	240	185	60
B32459F4042A 80	3 x 18.4	480	4	4.8	240	185	60
B32459F4052A 80	3 x 23	480	5	6	240	185	60
B32459F4052A580	3 x 25.3	480	5.5	6.6	240	185	60
B32459F4062A 80	3 x 27.6	480	6	7.2	300	240	80
B32459F4072A580	3 x 34.6	480	7.5	9	300	240	80
B32459F4082A 80	3 x 36.9	480	8	9.6	300	240	80
B32459F4082A380	3 x 38.2	480	8.3	10	300	240	80
B32459F4092A 80	3 x 41.5	480	9	10.8	300	240	80
B32459F4102A 80	3 x 46.1	480	10	12	300	240	80
B32459F4112A180	3 x 51.1	480	11.1	13.4	300	240	80
B32459F4122A580	3 x 57.6	480	12.5	15	300	240	80
B32459F4132A880	3 x 63.6	480	13.8	16.6	300	240	80
B32459F4142A580	3 x 66.8	480	14.5	17.4	300	240	80
B32459F4152A 80	3 x 69.1	480	15	18	300	240	80
B32459F4162A680	6 x 38.2	480	16.6	20	300	240	80
B32459F4182A 80	6 x 41.5	480	18	21.7	300	240	80
B32459F4202A 80	6 x 46.1	480	20	24.1	300	240	160
B32459F4222A180	6 x 51.1	480	22.1	26.6	300	240	160
B32459F4252A 80	6 x 57.6	480	25	30.1	300	240	160

Film Capacitors

PFC Capacitors and Key Components

SquareCap EHDLL

Ordering code	Rated capacitance C_N	Rated voltage V_N	Output & Rated current at 50 Hz		Dimensions		
					Height (H)	Width (W)	Depth (D)
	µF	V	kvar	I_N A	mm		
B32459F4272A780	6 x 63.6	480	27.7	33.3	300	240	160
B32459F4292A 80	6 x 66.8	480	29	34.9	300	240	160
B32459F4502A 80	12 x 57.6	480	50	60.1	350	240	320
Rated Voltage 525 V AC, delta connection							
B32459F5062A625	3 x 25.4	525	6.6	7.3	300	240	80
B32459F5102A 25	3 x 38.5	525	10	11.0	300	240	80
B32459F5122A525	3 x 48.1	525	12.5	13.7	300	240	80
B32459F5132A225	3 x 51.1	525	13.2	14.5	300	240	80
B32459F5152A 25	3 x 57.8	525	15	16.5	300	240	80
B32459F5162A625	3 x 63.9	525	16.6	18.3	300	240	80
B32459F5202A 25	6 x 38.5	525	20	22.0	300	240	160
B32459F5252A 25	6 x 48.1	525	25	27.5	300	240	160
B32459F5262A525	6 x 51.1	525	26.5	29.1	300	240	160
B32459F5302A 25	6 x 57.8	525	30	33.0	300	240	160
B32459F5332A125	6 x 63.9	525	33.1	36.4	300	240	160
B32459F5502A 25	12 x 48.1	525	50	55.0	350	240	320

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  - Air conditioners
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  - Submersible pumps
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- PhiCap®
- PhaseCap®
- SquareCap®
- PoleCap®
- Three - Phase Reactors
- Power Factor Controllers
- Thyristor Modules
- Capacitor Duty Contractors
- LT - APP Capacitors

* Certifications depending on type

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Film Capacitors

PFC Capacitors and Key Components

SquareCap Capacitors - ESHDC

Series	SquareCap ESHDC B32455
Technical data	Single units up to 50 kvar Voltage: 440 V to 525 V
Features	• Super Heavy Duty capacitor for non-linear arduous and fluctuating loads. • Manufactured using state-of-art metalisation process for MPP film with heavy edge. • Self healing property. • Low energy consumption. • PU resin as impregnant. • Safety device in the form of pressure sensitive (over pressure) mechanical interrupter. • Simplified modular construction using hermetically sealed single phase basic capacitor cells. • Easy and quick reparability • Temp class: -10/D.
Specification	Conformance to standards IEC 60831-1 & 2, EN60831-1 & 2, IS:13340
Applications	• Stand alone capacitors (Fixed compensation) • Capacitor banks • Detuned capacitor banks • Dynamic PFC

SquareCap Capacitors - ESHDC

Technical data : SquareCap Capacitors

Series type	B32455
Power-kvar	1 to 50 kvar
Rated voltage-V (AC)	440, 480, 525
Frequency	50 Hz
Connection	Delta
Transient peak current (Maximum permissible)	350 • IR***
Maximum permissible temperature category	-10/D
Dielectric losses	0.2 W / kvar
Total Losses (without discharge resistor)	≤ 0.5 W / 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	1.6 • I_R***
Safety	Self-healing, overpressure disconnector
Impregnation	Non PCB, soft biodegradable resin
Life expectancy	Up to 150 000 hours for -10/D
Cooling	Natural or forced
Case/Shape	Rectangular MS container
Terminal	Stud terminals with ceramic bushings
Mounting and grounding	Mounting plates at bottom
Enclosure	IP 54
Discharge resistor	Provided with discharge resistor
Dielectric	Polypropylene film (metallised)
No. of switching per annum	Max. 7500 switching
Reference standard	IEC 60831-1/2, IS 13340

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

Film Capacitors

PFC Capacitors and Key Components

SquareCap ESHDC

Ordering code	Rated capacitance C_N	Rated voltage V_N	Output & Rated current at 50 Hz		Dimensions		
					Height (H)	Width (W)	Depth (D)
	µF	V	kvar	I_N A	mm		
Rated Voltage 440 V AC, delta connection							
B32455F4012A 40	3 x 5.5	440	1	1.3	270	185	60
B32455F4022A 40	3 x 11	440	2	2.6	270	185	60
B32455F4032A 40	3 x 16.4	440	3	3.9	300	240	80
B32455F4042A 40	3 x 21.9	440	4	5.2	300	240	80
B32455F4052A 40	3 x 27.4	440	5	6.6	300	240	80
B32455F4062A 40	3 x 32.9	440	6	7.9	400	240	80
B32455F4072A 40	3 x 41.1	440	7.5	9.8	400	240	80
B32455F4072A540	3 x 38.4	440	7	9.2	400	240	80
B32455F4082A 40	3 x 43.9	440	8	10.5	400	240	80
B32455F4092A 40	3 x 49.3	440	9	11.8	400	240	80
B32455F4102A 40	3 x 54.8	440	10	13.1	400	240	80
B32455F4122A540	3 x 68.6	440	12.5	16.4	400	240	80
B32455F4152A 40	6 x 41.1	440	15	19.7	400	240	160
B32455F4202A 40	6 x 54.8	440	20	26.2	400	240	160
B32455F4252A 40	6 x 68.6	440	25	32.8	400	240	160
B32455F4302A 40	12 x 48	440	35	45.9	450	240	320
B32455F4402A 40	12 x 54.8	440	40	52.5	450	240	320
B32455F4502A 40	12 x 68.6	440	50	65.6	450	240	320
Rated Voltage 480 V AC, delta connection							
B32455F4012A 80	3 x 4.6	480	1	1.2	270	185	60
B32455F4022A 80	3 x 9.2	480	2	2.4	270	185	60
B32455F4032A 80	3 x 18.4	480	4	4.8	300	240	80
B32455F4042A 80	3 x 23	480	5	6	400	240	80
B32455F4052A 80	3 x 25.4	480	5.5	6.6	400	240	80
B32455F4062A 80	3 x 27.6	480	6	7.2	400	240	80
B32455F4072A580	3 x 34.6	480	7.5	9	400	240	80
B32455F4082A380	3 x 36.9	480	8	9.6	400	240	80
B32455F4102A 80	3 x 46.1	480	10	12	400	240	80
B32455F4112A180	3 x 51.1	480	11.1	13.4	400	240	80
B32455F4122A580	3 x 57.6	480	12.5	15	400	240	80
B32455F4132A880	3 x 63.8	480	13.8	16.6	400	240	80
B32455F4142A580	6 x 33.4	480	14.5	17.4	400	240	160
B32455F4152A 80	6 x 34.6	480	15	18	400	240	160
B32455F4162A680	6 x 38.3	480	16.6	20	400	240	160
B32455F4202A 80	6 x 46.1	480	20	24.1	400	240	160
B32455F4222A180	6 x 50.9	480	22.1	26.6	400	240	160
B32455F4252A 80	6 x 57.6	480	25	30.1	400	240	160
B32455F4272A780	6 x 63.8	480	27.7	33.3	400	240	160
B32455F4292A 80	12 x 33.4	480	29	34.9	240	240	320

Film Capacitors

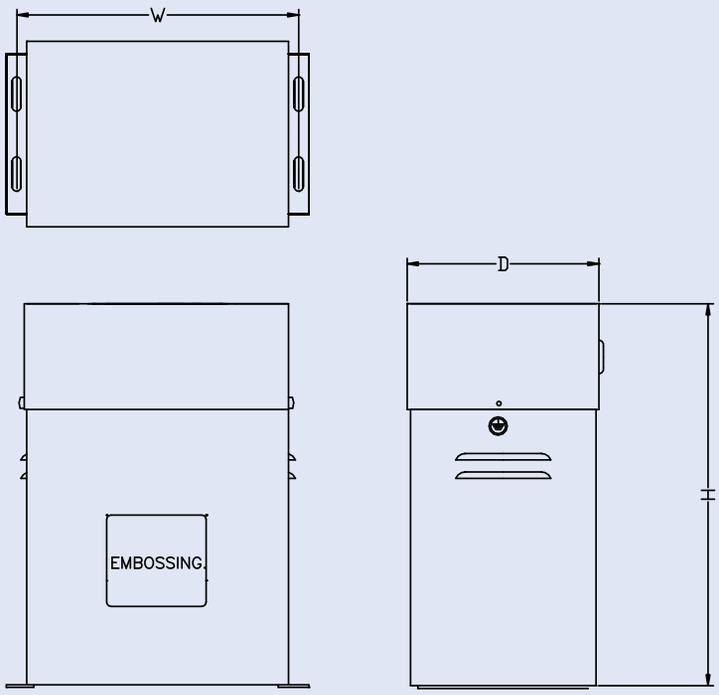
PFC Capacitors and Key Components

SquareCap ESHDC

Ordering code	Rated capacitance C_N	Rated voltage V_N	Output & Rated current at 50 Hz		Dimensions		
					Height (H)	Width (W)	Depth (D)
	µF	V	kvar	I_N A	mm		
B32455F4502A 80	12 x 57.6	480	50	60.1	240	240	320
Rated Voltage 525 V AC, delta connection							
B32455F5062A625	3 x 25.4	525	6.6	7.3	400	240	80
B32455F5102A 25	3 x 38.5	525	10	11	400	240	80
B32455F5122A525	3 x 48.2	525	12.5	13.7	400	240	80
B32455F5132A225	6 x 50.8	525	13.2	14.5	400	240	160
B32455F5152A 25	6 x 28.9	525	15	16.5	400	240	160
B32455F5162A625	6 x 32	525	16.6	18.3	400	240	160
B32455F5202A 25	6 x 38.5	525	20	22	400	240	160
B32455F5252A 25	6 x 48.2	525	25	27.5	400	240	160
B32455F5262A525	6 x 50.8	525	26.5	29.1	400	240	160
B32455F5332A225	12 x 32	525	33.1	36.4	450	240	320
B32455F5352A 25	12 x 33.7	525	35	38.5	450	240	320
B32455F5502A 25	12 x 48.2	525	50	55	450	240	320

Dimensional drawings: SquareCap

Dimensional Drawings: SquareCap



Film Capacitors

PFC Capacitors and Key Components

LT - APP Capacitors

Series	LT - APP Capacitors B25160
Technical data	• Up to 66.2 kvar, in single unit. • Higher ratings in form of banks. • Available in Ratings of 440, 480 and 525 V. Voltages up to 1000 V on request.
Features	• Extended foil design. • Low energy consumption. Leakproof CRCA sheet steel Container. • Provided with internal element fuse. • Extremely robust construction, suitable for use in arduous applications including applications related to Tuned and Detuned Harmonic Filters. • Suitable for indoor application. • Temp class: -5/D.
Specification	Conformance to Standards IS 13340.

LT - APP Capacitors

Technical data : LT - APP Capacitors

Series type	B25160C
Power-kvar	5 to 66.2 kvar
Rated voltage-V (AC)	440, 480, 525 V*
Frequency	50 Hz/60 Hz
Transient peak current (Maximum permissible)	300 • I_R
Maximum permissible temperature category	-5/D
Losses (without discharge resistor)	0.5 W / 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	(2.0 to 3.0) • I_n
Safety	Internal fuse provided
Impregnation	Non PCB, biodegradable oil
Life expectancy	150000 hours
Cooling	ONAN (Oil Natural Air Natural)
Case/Shape/Finish	Rectangular box spray painted
Terminal	M- 6, M-10 thread brass terminal
Mounting and grounding	Self standing with rigid mounting bracket and a bracket for grounding
Enclosure	IP 30 with terminal cover
Discharge resistor	Provided with external discharge resistor
Connection	Delta 3 Phase
Casing of capacitor cell	CRCA or SS container
Dielectric	Polypropylene film
No. of switching per annum	Max. 10000 switching per year
Reference standard	IS13585 (Part-1): 2012

** other voltages available on request*
*** V rated voltage R*
**** I : RMS line current that occurs at rated sinusoidal voltage and rated frequency, excluding transients. R*
Note : for capacitors with different features/parameters than above, please check with our nearest sales office

Film Capacitors

PFC Capacitors and Key Components

Rating kvar	Description	Material Code	I_R	C_N	W x D x H mm
LT - APP - 440 V (AC) 3PH, 50Hz (Series B25160)					
5.0	CAP UNIT 5 kvar, 440 V, 50Hz, 3-f ,#D, IF Comp	B25160C4005T 40	6.56	41.1	135 x 75 x 330
7.5	CAP UNIT 7.5 kvar, 440 V, 50Hz, 3-f ,#D, IF Comp	B25160C4007T540	9.84	61.65	135 x 85 x 330
10	CAP UNIT 10 kvar, 440 V, 50Hz, 3-f ,#D, IF Comp	B25160C4010T 40	13.12	82.2	135 x 115 x 330
12.5	CAP UNIT 12.5 kvar, 440 V, 3f ? IF Compact	B25160C4012T540	16.4	102.8	155 x 155 x 330
15	CAP UNIT 15 kvar, 440 V, 50Hz, 3-f ,#D, IF Comp	B25160C4015T 40	19.68	123.3	175 x 115 x 330
20	CAP UNIT 20 kvar, 440 V, 50Hz, 3-f ,#D, IF Comp	B25160C4020T 40	26.24	164.39	225 x 115 x 355
25	CAP UNIT 25 kvar, 440 V, 50Hz, 3-f ,#D, IF Comp	B25160C4025T 40	32.8	205.49	195 x 115 x 455
30	CAP UNIT 30 kvar, 440 V, 50Hz, 3-f ,#D, IF Comp	B25160C4030T 40	39.37	246.59	225 x 115 x 455
40	CAP UNIT 40 kvar, 440 V, 50Hz, 3-f ,#D, IF Comp	B25160C4040T 40	52.49	329	275 x 115 x 455
50	CAP UNIT 50 kvar, 440 V, 50Hz, 3-f ,#D, IF Comp	B25160C4050T 40	65.61	410.99	335 x 115 x 455
LT - APP - 480 V (AC) 3PH, 50Hz (Series B25160)					
5.0	CAP UNIT 5 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4005T 80	6.01	34.53	135 x 75 x 330
5.5	CAP UNIT 5.5 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4005T580	6.62	37.99	135 x 75 x 330
7.5	CAP UNIT 7.5 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4007T580	9.02	51.8	135 x 75 x 330
8.3	CAP UNIT 8.3 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4008T380	9.98	57.33	135 x 85 x 330
10	CAP UNIT 10 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4010T 80	12.03	69.07	135 x 100 x 330
11.1	CAP UNIT 11.1 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4011T180	13.35	76.67	135 x 115 x 330
12.5	CAP UNIT 12.5 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4012T580	15.04	86.34	135 x 115 x 330
13.8	CAP UNIT 13.8 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4013T880	16.6	95.31	155 x 115 x 330
15	CAP UNIT 15 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4015T 80	18.04	103.6	155 x 115 x 330
16.6	CAP UNIT 16.6 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4016T680	19.97	114.65	175 x 115 x 330
20	CAP UNIT 20 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4020T 80	24.06	138.14	195 x 115 x 355
22.1	CAP UNIT 22.1 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4022T180	26.58	152.64	210 x 115 x 355
25	CAP UNIT 25 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4025T 80	30.07	172.67	225 x 115 x 355
27.7	CAP UNIT 27.7 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4027T780	33.28	191.11	185 x 115 x 455
30	CAP UNIT 30 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4030T 80	36.09	207.21	195 x 115 x 455
33.2	CAP UNIT 33.2 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4033T280	39.93	229.31	210 x 115 x 455
40	CAP UNIT 40 kvar, 480 V, 50Hz, 33-f ,#D, IF Comp	B25160C4040T 80	48.11	276.27	245 x 115 x 455
44.3	CAP UNIT 44.3 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4044T380	53.29	305.97	275 x 115 x 455
50	CAP UNIT 50 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4050T 80	60.14	345.34	295 x 115 x 455
55.3	CAP UNIT 55.3 kvar, 480 V, 50Hz, 3-f ,#D, IF Comp	B25160C4055T380	66.52	381.95	315 x 115 x 455

Film Capacitors

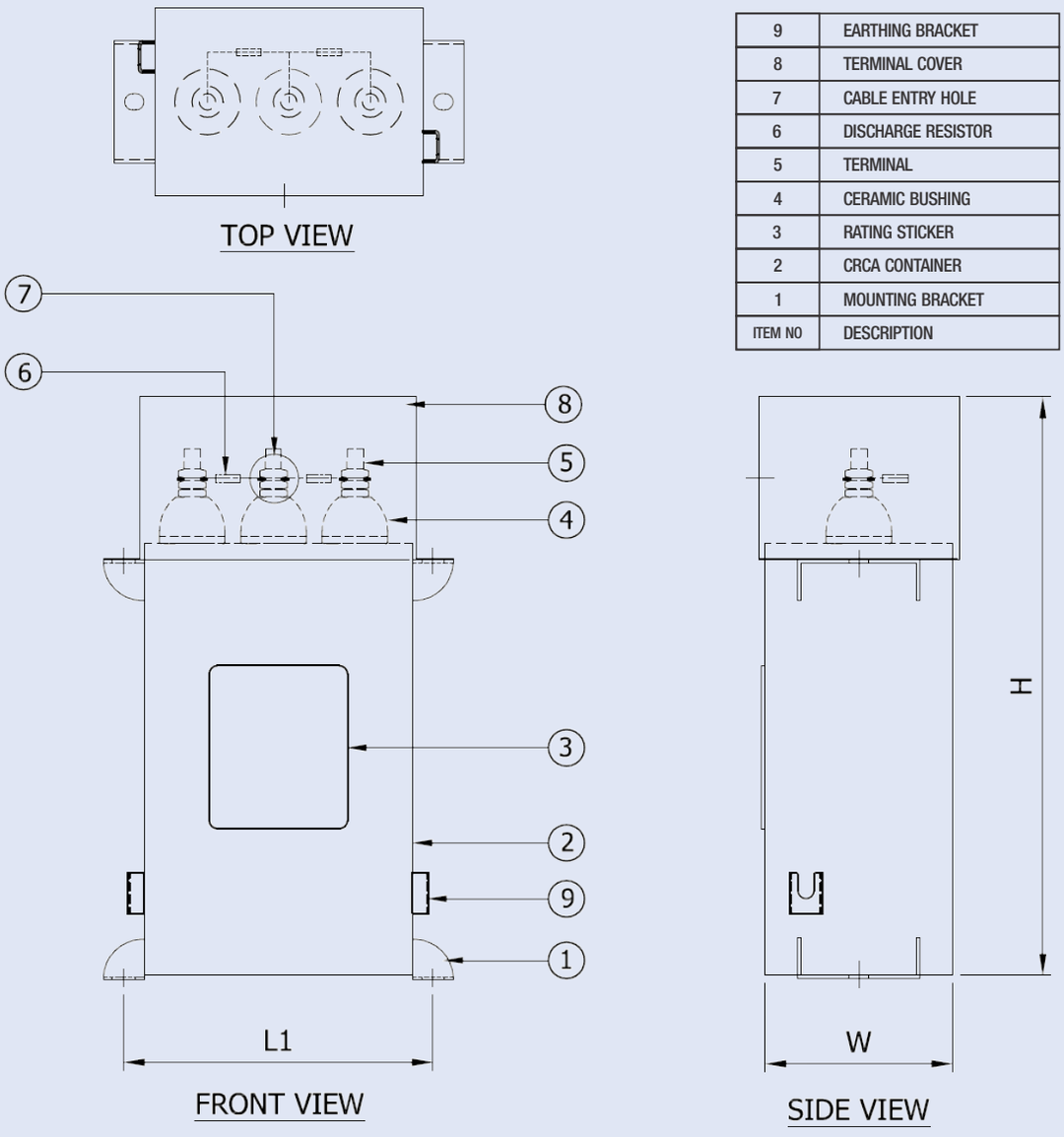
PFC Capacitors and Key Components

Rating kvar	Description	Material Code	I_R	C_N	W x D x H mm
LT - APP - 525 V (AC) 3PH, 50Hz (Series B25160)					
5.0	CAP UNIT 5 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5005T 25	5.5	28.87	135 x 115 x 230
6.6	CAP UNIT 6.6 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5006T625	7.26	38.11	155 x 115 x 230
7.5	CAP UNIT 7.5 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5007T525	8.25	43.3	185 x 115 x 230
8.3	CAP UNIT 8.3 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5008T325	9.13	47.92	185 x 115 x 230
10	CAP UNIT 10 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5010T 25	11	57.74	210 x 115 x 230
12.5	CAP UNIT 12.5 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5012T525	13.75	72.17	135 x 115 x 330
13.2	CAP UNIT 13.2 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5013T225	14.52	76.21	135 x 115 x 330
15	CAP UNIT 15 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5015T 25	16.5	86.6	155 x 115 x 330
16.6	CAP UNIT 16.6 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5016T625	18.26	95.84	175 x 115 x 330
20	CAP UNIT 20 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5020T 25	21.99	115.47	195 x 115 x 355
25	CAP UNIT 25 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5025T 25	27.49	144.34	225 x 115 x 355
26.5	CAP UNIT 26.5 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5026T525	29.14	153	245 x 115 x 355
30	CAP UNIT 30 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5030T 25	32.99	173.21	195 x 115 x 455
33.1	CAP UNIT 33.1 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5033T125	36.4	191.11	210 x 115 x 455
35	CAP UNIT 35 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5035T 25	38.5	202.09	210 x 115 x 455
40	CAP UNIT 40 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5040T 25	43.99	230.94	245 x 115 x 455
50	CAP UNIT 50 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5050T 25	54.99	288.68	295 x 115 x 455
53	CAP UNIT 53 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5053T 25	58.29	306	295 x 115 x 455
66.2	CAP UNIT 66.2 kvar, 525V, 50Hz, 3-f ,#Ð, IF Comp	B25160C5066T225	72.9	382.21	360 x 115 x 455

Film Capacitors

PFC Capacitors and Key Components

Dimensional Drawing



ITEM NO	DESCRIPTION
9	EARTHING BRACKET
8	TERMINAL COVER
7	CABLE ENTRY HOLE
6	DISCHARGE RESISTOR
5	TERMINAL
4	CERAMIC BUSHING
3	RATING STICKER
2	CRCA CONTAINER
1	MOUNTING BRACKET

Note: Dimensional drawing for 440 V is shown above. Other drawings are available on request.

Film Capacitors

PFC Capacitors and Key Components

DuraCube™ Heavy Duty Capacitors

Series	DuraCube™ Heavy Duty Capacitors B25160*
Technical data	• Power: 10 - 50 kvar • Rated Voltage: 440, 480, 525 • Frequency: 50 Hz • Transient peak current (Max permissible): 400 • IR • Max permissible temp. category: -10/D • Impregnation: Non-PCB, biodegradable oil • Life expectancy:300,000 Hrs(based on type and rating) • Case/Shape: CRCA Box type • Bushings: Polymeric Bushing • Mounting: Vertical • No. of switching per annum: Max. 15000 switching • Reference standard: IS 13585 (Part 1) : 2012 / IEC 60931-1 : 1996
Features	• Heavy Duty Robust Capacitor • Homogeneous double layer technology • Long Life Expectancy of up to 300 000 hours • High pulse current withstand capability • Polymeric Bushing • Stainless steel earthing brackets
Application	• Power Factor Correction for heavy loads

DuraCube™ Heavy Duty

Technical data : DuraCube™ Heavy Duty

Series type	B25160*
Power-kvar	10 kVAR - 50 kVAR
Rated voltage-V (AC)	440, 480, 525
Frequency	50 Hz
Connection	Delta
Transient peak current (Maximum permissible)	400 • IR
Maximum permissible temperature category	-10/D
Dielectric losses	0.2 W / kvar
Maximum permissible voltage	1.00 x UN – Continuous 1.10 x UN – 8 hours in every 24 hours 1.15 x UN – 30 minutes in every 24 hours 1.20 x UN – 5 minutes 1.30 x UN – 1 minute 1.5 to 1.8 • IR***
Maximum permissible current	2 x In (including combined effects of harmonics, over voltages and capacitance tolerance)
Impregnation	Non PCB, soft biodegradable resin
Life expectancy	300000 Hrs. (at rated voltage, rated frequency & -5/D Temperature category) based on type and rating
Cooling	Natural
Case/Shape	CRCA (Cold Rolled Cold Annealed) Box type
Bushings	Polymeric Bushing
Mounting	Vertical, should not be mounted upside down (bushing at bottom) or in cantilever position
Discharge Device (external)	Carbon film or Metal oxide film or Thick film resistor
Dielectric	Double-layer Biaxially Oriented Hazy Polypropylene (BOPP)
No. of switching per annum	Max. 15000 switching
Reference Standard	IS 13585 (Part 1):2012 / IEC 60931-1:1996

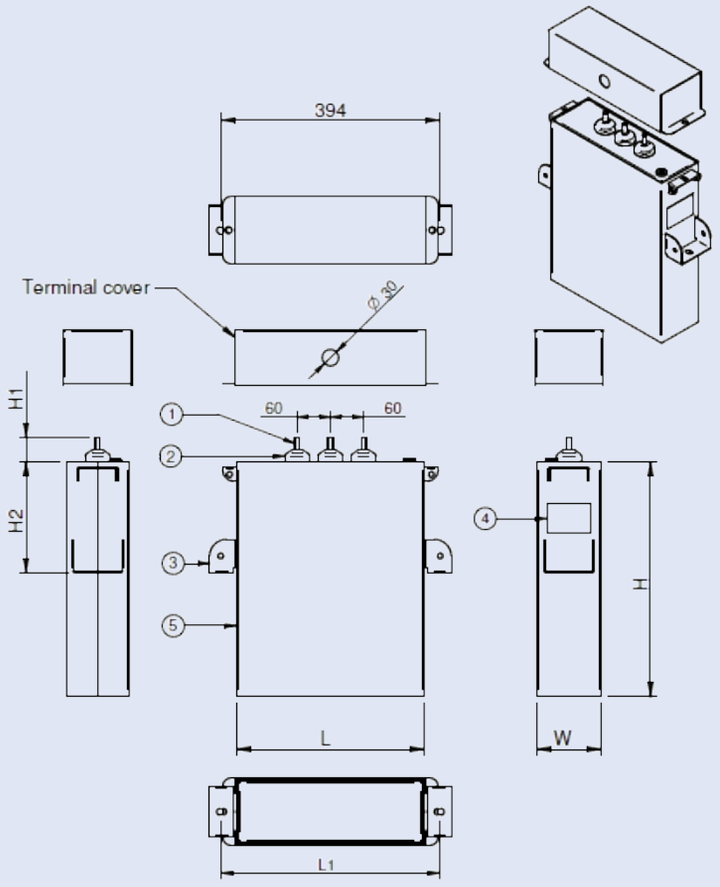
Film Capacitors

PFC Capacitors and Key Components

DuraCube™ Heavy Duty Capacitors

Ordering code	Rated Output (QN)	Rated capacitance (C_N)	Rated current (I_N)
Rated Voltage 440 V			
B25160D4010T040	10.0	82.2	13.1
B25160D4015T040	15.0	123.3	19.7
B25160D4020T040	20.0	164.4	26.2
B25160D4025T040	25.0	205.5	32.8
B25160D4033T040	33.0	271.3	43.3
B25160D4040T040	40.0	328.8	52.5
B25160D4050T040	50.0	411.0	65.6
Rated Voltage 480 V			
B25160D4010T080	10.0	69.1	12.0
B25160D4015T080	15.0	103.6	18.0
B25160D4020T080	20.0	138.2	24.1
B25160D4025T080	25.0	172.7	30.1
B25160D4027T080	27.0	186.5	32.5
B25160D4030T080	30.0	207.2	36.1
B25160D4033T080	33.0	228.0	39.7
B25160D4040T080	40.0	276.3	48.1
B25160D4050T080	50.0	345.4	60.1
Rated Voltage 525 V			
B25160D5010T025	10.0	57.7	11.0
B25160D5015T025	15.0	86.6	16.5
B25160D5020T025	20.0	115.5	22.0
B25160D5025T025	25.0	144.4	27.5
B25160D5030T025	30.0	173.2	33.0
B25160D5033T025	33.1	191.1	36.4
B25160D5040T025	40.0	231.0	44.0
B25160D5050T025	50.0	288.7	55.0

Dimensional Drawing



1	TERMINAL M10 (2 NUTS, 2PW)	BRASS (TIN PLATED)	3
2	BUSHING	POLYMERIC	3
3	MOUNTING BRACKET	CRCA	2
4	RATING STICKER	ALUMINUM	1
5	CONTAINER	CRCA	1

Film Capacitors

PFC Capacitors and Key Components

AgriCap Capacitors

Series	AgriCap Capacitors B32454
Technical data	• Voltage range: 440 V • Output range: 1 to 15 kvar
Features	• Compact size • Life expectancy of up to 80 000 hours at temperature class -25/D Self-healing • Overpressure disconnector • Internal discharge resistors • Insulated flexible wire terminals
Specification	Conformance to Standards IS 13340.
Applications	• Power Factor Correction of Agriculture loads

AgriCap Capacitors

Technical data : AgriCap Capacitors

Series type	B32454F
Power-kvar	1 to 15 kvar
Rated voltage-V (AC)	440
Frequency	50 Hz
Connection	Delta
Transient peak current (Maximum permissible)	100 • IR***
Maximum permissible temperature category	-25/D
Dielectric losses	0.2 W / kvar
Total Losses (without discharge resistor)	≤ 0.5 W / 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	1.3 • I_R***
Safety	Self-healing, overpressure disconnector
Impregnation	Non PCB, soft biodegradable resin
Life expectancy	Up to 80 000 hours
Cooling	Natural or forced
Case/Shape	Extruded round aluminum can with stud having mounting clamp
Terminal	Insulated flexible wire terminals
Mounting and grounding	Threaded stud at bottom of can (max. torque 4 Nm for M8 and 10 Nm for M12)
Enclosure	IP 20
Discharge resistor	Provided with internal discharge resistor
Dielectric	Polypropylene film (metallised)
No. of switching per annum	Max. 5000 switching
Reference standard	IS 13340

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

Film Capacitors

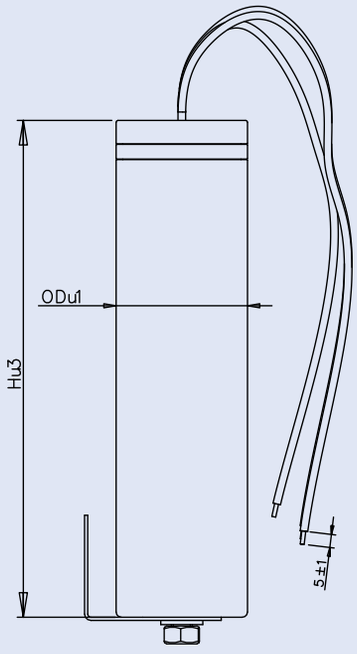
PFC Capacitors and Key Components

AgriCap

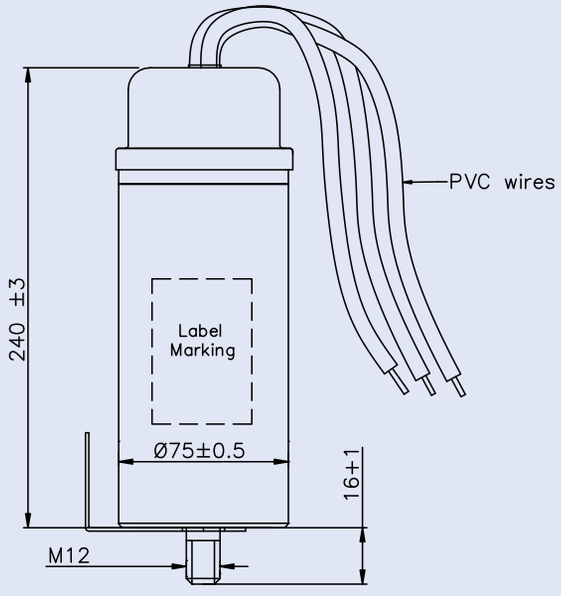
Ordering code	Rated capacitance C_N	Rated voltage V_N	Output & Rated current at 50 Hz		Dimensions (D x H)
	µF	V	kvar	I_N A	mm
Rated Voltage 440 V AC, delta connection					
B32454F5001T010	3 x 5.5	440	1.0	1.3	40 x 117
B32454F5002T010	3 x 11.0	440	2.0	2.6	40 x 157
B32454F5003T010	3 x 16.4	440	3.0	3.9	40 x 189
B32454F5004T010	3 x 21.9	440	4.0	5.2	45 x 189
B32454F5005T010	3 x 27.4	440	5.0	6.6	50 x 189
B32454F5006T010	3 x 32.9	440	6.0	7.9	55 x 189
B32454F5007T010	3 x 38.4	440	7.0	9.2	55 x 189
B32454F5008T010	3 x 43.9	440	8.0	10.5	63.5 x 189
B32454F5010T010	3 x 54.8	440	10.0	13.1	68 x 189
B32454F5012T510	3 x 68.5	440	12.5	16.4	75 x 195
B32454F5015T010	3 x 82.2	440	15.0	19.7	75 x 195

Dimensional drawings: AgriCap

For 1 to 10 kvar



For 12.5 to 15 kvar



Length of connection wire: 300 -5/+15 mm
Stud M8 for D ≤ 53mm
Stud M12 for D > 53mm

Film Capacitors

PFC Capacitors and Key Components

PFC Capacitors for Air Conditioners

Series	PFC Capacitors for Air Conditioners B3244T
Technical data	• Voltage range: 480 V • Output range: 1, 1.5, 1.8, 2.8 kvar
Features	• Life expectancy of up to 100 000 hours at temperature class -25/60 • Self-healing • Overpressure disconnector
Specification	Conformance to Standards IS 13340.
Applications	• Power Factor Correction of Domestic and commercial air conditioners

PFC Capacitors for Air Conditioners

Technical data : PFC Capacitors for Air Conditioners

Series type	B32344T
Power-kvar	1 to 2.8 kvar
Rated voltage-V (AC)	480
Frequency	50 Hz
Connection	Delta
Transient peak current (Maximum permissible)	200 • IR***
Maximum permissible temperature category	-25/60
Dielectric losses	0.2 W / kvar
Total Losses (without discharge resistor)	≤ 0.5 W / 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	1.3…1.5 • I_R***
Safety	Self-healing, overpressure disconnector
Impregnation	Non PCB, soft biodegradable resin
Life expectancy	Up to 100 000 hours
Cooling	Natural or forced
Case/Shape	Extruded round aluminum can with stud
Terminal	Fast on terminals with insulated flexible connection wires
Mounting and grounding	Threaded stud at bottom of can (max. torque 4 Nm for M8 and 10 Nm for M12)
Enclosure	IP 54
Discharge resistor	Provided with discharge resistor
Dielectric	Polypropylene film (metallised)
No. of switching per annum	Max. 5000 switching
Reference standard	IS 13340

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

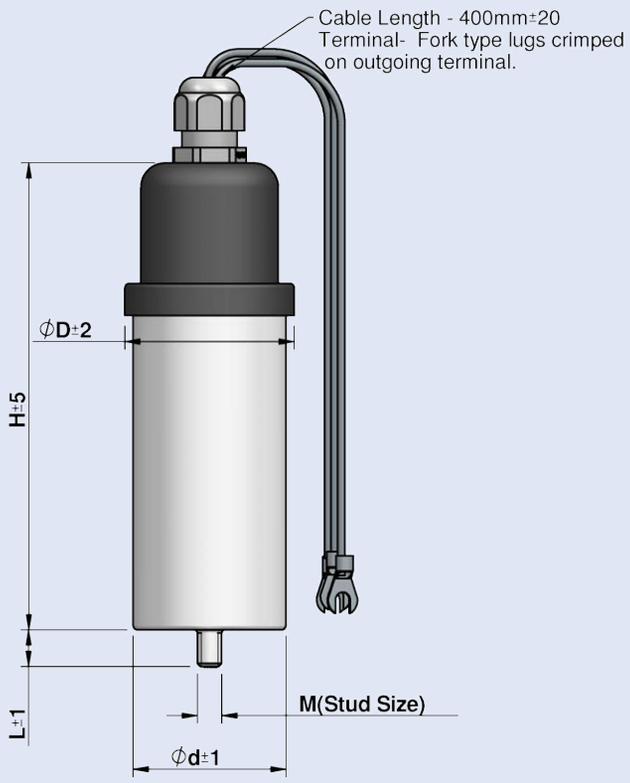
Film Capacitors

PFC Capacitors and Key Components

Capacitors for Air conditioners

Ordering code	Rated capacitance C_N	Rated voltage V_N	Output & Rated current at 50 Hz		Dimensions with cap (D x H)	Diameter d	Cable Size	Terminals (Cable ends)	Stud Size & length
	mF	V	kvar (Qn)	I_N A	mm	mm	Sq mm		M/L mm
B32344T4012A080	3 x 4.6	480	1.0	1.2	55 x 130	50	1	Soldered tips	M8 / 12
B32344T4012A580	3 x 6.9	480	1.5	1.8	55 x 154	50	1	Soldered tips	M8 / 12
B32344T4012A880	3 x 8.3	480	1.8	2.2	60 x 154	55	1	Fork type lug	M12 / 16
B32344T4022A880	3 x 12.9	480	2.8	3.4	67 x 151	63.5	1.5	Fork type lug	M12 / 16 mm

Dimensional drawings: Capacitors for Air conditioners



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Superior Solutions

for MV Reactive Power Compensation.

Station-type RPC

- Fixed, switched or auto switched in multiple steps
- 3.3 to 33 KV
- 100 to 10,000 kvar with customized configuration
- Series reactors
- Control and protection features

Pole-mounted APFC

- 12 KV, 3-phase
- 100 to 1200 kvar in single step
- Built-in CT, PT and controller
- Auto-manual mode of operation
- Control based on load current, power factor or time of the day

Pad-mounted APFC

- 3.3 to 12 KV, 3-phase
- 100 to 3600 kvar in multi-step configuration

PQS

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Power Factor (PF) Controllers

Various types of PF controllers • User-friendly • Customized solutions

Overview

State-of-the-art controllers of today feature a microprocessor that analysis the signal from a current transformer and delivers a command to switch the contactor – or in dynamic PFC – the thyristor to add or remove capacitor steps. This ensures a well-balanced utilization of the capacitor steps, reduces the number of switchings and in the long run will extent the service life of the PFC system.

The number of steps is determined by the required capacitor output to select the particular PF controller. In general, the number of steps depends on the number of loads. The higher the quantity of small loads, the higher the number of controller steps should be.

The range of PF controllers offers a broad variety of types that allow to select the perfect device for the customer's requirements. Starting with 4 outputs in the smallest version of BR604, BR6000 series up to 15 outputs for the BR5000 series, a tailor made solution will satisfy the demands.

TDK is offering PF controllers for standard applications with slowly changing loads and for dynamic PFC

for applications with rapidly changing loads, such as elevators, welding machines, cranes or presses. The dynamic types are designed to switch thyristor modules of the TSM series, also available from .Particular types are suited for hybrid applications, e.g. standard and dynamic.

Overview of series

BR6000: R6: 06 relay outputs, standard compensation
BR6000: R12: 12 relay outputs, standard compensation and optional RS485 features
BR6000:T6: 6 transistor outputs for dynamic compensation
BR5000: 08 and 16 relay for standard & Transistor outputs for dynamic compensation optional RS 485 features.
BR5000: 16 step three phase for GSM and thee phase controller with 3 CT sensing (1 ph X 3 -% steps)
BR4000 : 4,6 and 8 step controllers with
BR2100 : 6 and 12 relay outputs for standard compensation.

Film Capacitors

PFC Capacitors and Key Components

Power Factor Controller

Series	Power Factor Controller BR 6000
Technical data	• Steps - 6 and 12 outputs (in both relay and transistorised versions) • Current Input - 1A or 5 A • Supply Voltage - 1Ph - 230 V AC • Measurement Voltage :1Ph 30V - 525V AC (L-N) or (L-L) • Operating temperature: -20 to +60 °C • Compact 144 x 144 mm front fascia
Important display parameters	• Voltage • Real time PF • Current • Power KW, KVA, kvar • Temperature • Harmonics % ITHD, %VTHD, individual up to 31st • Energy KWh, KVAh, kvarh
Features	• Microcontroller logic for measurements • Self explanatory menu navigation in several languages • Self optimizing control capability • Control modes : LIFO, FIFO and Self optimized Intelligent Control. • Large and multifunctional LCD with backlit display (2 X 16 characters) • Single CT sensing for balanced loads • Dual target Power Factor setting (available in 12 stage) - useful for utility and DG mode operation available optional • Automatic synchronization possible • Display and storage of maximum values, number of switching operations and operating time • Recall function of recorded values • RS 232 Interface optional • Alarm output optional • Dynamic Power Factor Controller (Transistorised) available in 6 and 12 steps • Cascading possible with master slave versions • Protective earth terminal to reduce noise and unwanted interference signals • EMI/ EMC type tested • Individual Harmonic measurement upto 19th order.
Specification	Conformance to Standards IS 13340.

Type	Steps	Voltage V	Description	Material Code
Power Factor Controller				
Contr - BR6000	6	230	BR6000 SERIES 6STP RELAY 230 V	B44066R6006R230
Contr - BR6000	12	230	BR6000 SERIES 12 STP RELAY 230 V	B44066R6012R230
Contr - BR6000	12	230	BR6000 SERIES T12 TRANSISTOR O/P RELAY	B44066R6112R230
Contr - BR6000	6	230	BR6000 SERIES T6 TRANSISTOR O/P RELAY	B44066R6106R230
Contr - BR6000	12	230	BR6000 SERIES (RS485 interface) 12 STP RELAY	B44066R6412R230

Film Capacitors

PFC Capacitors and Key Components

Power Factor Controller

Series	Power Factor Controller BR 5000
Technical data	• Steps - 8 and 16 relay outputs • Current Input - 1A or 5 A • Supply Voltage - 1Ph 415 V AC (-40% to +20%) • Measurement Voltage : 3Ph 3 wire 415 V AC (-40% to +20%) • Operating temperature : 0 to 70 ºC • 144 x 144 mm front fascia Supply frequency 50 Hz
Important display parameters	• Voltage • Real time PF • Current • Power KW, kVA, kvar • Temperature • Harmonics % ITHD, %VTHD, individual up to 31st • Energy KWh, KVAh, kvarh
Features	In addition to BR 4000ER • Three CT sensing for unbalanced loads • Dual target Power Factor setting - useful for utility and DG mode operation • Automatic synchronization possible • Separate 3 CT monitoring of healthiness of Capacitor within Panel • Data logging • RS 232 in front and RS 232/485 switchable connection at rear • Step operation indication on LCD display plus LED which facilitates viewing from a distance • Unique facility of including 'Fixed Capacitor Bank' for purpose of Transformer compensation. This can be set such that the controller doesn't 'see' this capacitor. • Unique external temperature sensing by PT100 • Settable alarm facility - undervoltage, overvoltage and so on • Settable auxiliary outputs - 2 Nos for Alarm, etc. • Dynamic Power Factor Controller (Transistorised) available in16 steps without PT100 facility available • Special 8/16 step Controller for Medium Voltage application available • EMI/EMC type tested.
Specification	Conformance to Standards IS 13340.

Type	Steps	Voltage V	Description	Ordering Code
Power Factor Controller				
Contr - BR5000	16	415	PFC CONTROLLER-BR-5000-16 ST-RELAY 415 V	B44066R5916A415
Contr - BR5000	8	415	PFC CONTROLLER-BR-5000-08 ST-RELAY 415 V	B44066R5908A415
Contr - BR5000	16	415	PFC CONTROLLER BR5000-16ST- TX 415 V	B44066R5716A415
Contr - BR5000	5 x 3	240	PFC CONTROLLER BR5916S - 1 Ph x 3 - 5 steps per	B44066R5916S240
Contr - BR5000	5	240	BR5100-5STEP-3CT,3PH-4 W,415 V RELAY	B44066R5905R415
Contr - BR5000	16	415	PFC CONTROLLER BR5100 - 16ST 3PH 415 V with GSM	B44066R5916S415
Contr - BR5000	6	240	BR5100-6STEP-3CT,3PH-4W,415 V AC	B44066R5906S415
Contr - BR5000	8	240	BR5100-8STEP-3CT,3PH-4W,415 V AC RELAY O/P	B44066R5908R415

Film Capacitors

PFC Capacitors and Key Components

Power Factor Controller

Series	Power Factor Controller BR 4000
Technical data	• Steps - 4, 6 and 8 relay outputs • Current Input - 1A or 5 A • Supply Voltage - 110 V AC-550 V AC • Measurement Voltage : 30...550 V AC (L-L/L-N) • Operating temperature : 0 to 60 ° C • Compact 96 x 96 x 75 mm • Adapter plate for 144 x 144 cut out can be provided
Important display parameters	• Voltage • Real time PF • Current • Power KW, KVA, kvar • Temperature • Harmonics % ITHD, %VTHD, individual up to 31st • Energy KWh, KVAh, kvarh
Features	• Intelligent control • Large measurement and input voltage range • User friendly operation • Individual harmonics up to 31st order • Four quadrant operations RS 485 communication/real time clock (optional) • 4 steps variant upgradable to 6 and 8 with additional module. • Configurable alarm output for variousparameters • Recall recorded values for 10 various important parameters.
Specification	Conformance to Standards IS 13340.

Type	Steps	Voltage V	Description	Ordering Code
Power Factor Controller				
Contr - BR4000	4	230	PFC CONTROLLER-BR-4904-04 ST RELAY 230V	B44066R4904A230
Contr - BR4000	8	230	PFC CONTROLLER-BR-4000-08 ST RELAY 230V	B44066R4808A230N 1
Contr - BR4000-ER	4	240	BR4000-ER SERIES 4 STEP RELAY OUTPUT240V	B44066R4004R240
Contr - BR4000-ER	6	240	BR4000-ER SERIES 6 STEP RELAY OUTPUT240V	B44066R4006R240
Contr - BR4000-ER	8	240	BR4000-ER SERIES 8 STEP RELAY OUTPUT240V	B44066R4008R240
Contr - BR4000-S	4	240	BR4000-S 4ST RLY O/P240V,with144x144 Adaptor plate	B44066R4104R240
Contr - BR4000-S	6	240	BR4000-S 6ST RLY O/P240V,with144x144 Adaptor plate	B44066R4106R240
Contr - BR4000-S	8	240	BR4000-S 8ST RLY O/P240V,with144x144 Adaptor plate	B44066R4108R240

Film Capacitors

PFC Capacitors and Key Components

Power Factor Controller

Series	Power Factor Controller BR 2100
Technical data	• Steps - 6,8 and 12 relay outputs • Current Input - 1A or 5 A • Supply Voltage - 110 VAC-550 VAC • Operating temperature : -10 to 60 ºC • Compact 144 x 144 mm front fascia
Important display parameters	• Voltage • Real time PF • Current • Power KW, KVA, kvar • Temperature • Harmonics % ITHD, %VTHD, individual up to 31st • Energy KWh, KVAh, kvarh
Features	• Intelligent control • Menu driven handling in English language • Test-run possible • Large voltage measuring range • Recall function of recorded values • Four-quadrant operation Potential free contact alarm output (Optional) • RS485 communication interface (Optional) • Real Time Clock (Optional) • Log of Time date stamping for last 3 system faults enabled • Auto Initialization function • Input voltage connection detection \(L-N\L-L) • Three bank selection mode • Control series (upto 20)
Specification	Conformance to Standards IS 13340.

Type	Steps	Voltage V	Description	Ordering Code
Power Factor Controller				
Contr - BR2100	6	240	BR2100-6ST RLY O/P240 V, ALARM 144 x 144	B44066R2006R240
Contr - BR2100	8	240	BR2100-8ST RLY O/P240 V,ALARM 144 x 144	B44066R2008R240
Contr - BR2100	12	240	BR2100-12ST RLY O/P240 V,ALARM 144 x 144	B44066R2012R240

Attracting Tomorrow

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Superior Solutions

for Power Quality & Harmonic Filtering.

PFC capacitors

PhaseCap® Energy
MKK capacitors with high service life expectation and enhanced inrush current capability.

PhaseCap® Premium
The premium MKK capacitors for many years – sold in millions.

PhaseCap® Compact
Improved capacitors based on the successful PhaseCap MKK design.

DeltaCap™
LV PFC capacitors in industrial applications; design in MKD technology.

PhiCap™
Established capacitors to meet quality and cost effectiveness.

Key components

EPCOS

Power factor controllers
For real 1- or 3-phase measuring and phase-specific PFC.

Measuring devices
3 different types of multi-measuring devices for 1- and 3-phase measuring MMI-series; grid analysis tool MC7000-3 for 3-phase measuring and evaluation of values via PC.

Thyristor modules
10 to 200 kvar and 230 to 690 V AC; the TSM range for dynamic PFC covers it all.

Capacitor contactors
Up to 100 kvar at 400 V AC with highest reliability and minimal space requirements.

Harmonic filters
Detuned and tuned passive filtering.

PQSine™ S series
Active harmonic filters and power optimizers.

PQvar™ series
Active power factor correction and load balancing.

PQS

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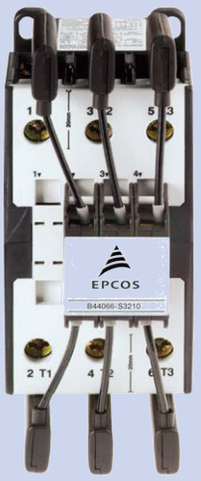
Switching Devices – Capacitor Contactors

Specially designed for damping of inrush current in LV PFC systems

General

When a capacitor is switched to an AC voltage, the result is a resonant circuit damped to a greater or lesser degree. The switching of capacitors can cause high inrush currents, particularly when they are switched in parallel to others already activated in the power line, and if high short-circuit powers are present on the line.

Capacitor contactors with damping resistors make use of pre- switching auxiliary contacts. They close before the main contacts and pre-load the capacitor thus avoiding current peak values. This influences positively the life expectancy of the capacitor significantly in addition to the positive impact on the power quality (avoiding transients and voltage sags that otherwise may be caused by switching in capacitors).



Applications

- Damping of inrush current in low-voltage PFC systems
- For PFC systems with and without reactors

Features

- Excellent damping of inrush current
- Improved power quality (e.g. avoidance of voltage sags)
- Longer useful service life of main contacts of capacitor contactor
- Soft switching of capacitor and thus longer useful service life
- Enhanced mean life expectancy of PFC system
- Reduced ohmic losses
- Leading contacts with wiper function
- Tamper-proof and protected resistors
- Easy access for cable connection
- Voltage range: 400 … 690 V
- Output range: 7 … 100 kvar
- AC6b utilization category

Film Capacitors

PFC Capacitors and Key Components

Capacitor - Duty Contactor

Series	Capacitor Duty Contactor J110/J230/C24*
Technical data	• Rating: 7 kvar to 100 kvar • Optional Voltage Range (380 V to 690 V) • Operational ambient temperature up to 60 °C
Features	• Largest range • Excellent damping of inrush current by the use of leading contacts with wiper function and special resistors • Longer useful life of main contacts of capacitor Contactor • Soft switching of contactor and thus longer useful life • Weld resistant up to a possible peak inrush current of 200 times the rated capacitor current • Enhance mean life expectancy of PFC systems • Reduce Ohmic losses • Tamper proof and protected resistors • Suitable for use with or without detuned reactors • Easy access for cable connection • Type tested at CPRI • AC-6b Utilisation category.
Specification	Technical data according to Standards IEC 947-4-1, IEC 947-5-1, EN 60947-4-1EN 60947-5-1 and VDE 0660

Technical Data (B44066*****C240)

		...0711...	..1011...	..1211...	..1611...	..2011...	..2511...	..3312...	..4012...	..5012...	..6012...	..7512...	..8012...	..9912...
Capacitor Power at 55°C 220..240 V	KVAR	0 ... 4 0 ... 7.5 0 ... 9	0 ... 5.5 0 ... 10 0 ... 12.5	0 ... 6.7 0 ... 12.5 0 ... 18	0 ... 8.5 0 ... 16.7 0 ... 24	0 ... 10 0 ... 20 0 ... 30	0 ... 15 0 ... 25 0 ... 36	0 ... 20 0 ... 33.3 0 ... 48	0 ... 25 0 ... 40 0 ... 58	0 ... 27 0 ... 40 0 ... 58	0 ... 40 0 ... 60 2 ... 92	0 ... 45 0 ... 75 4 ... 120	0 ... 48 0 ... 80 4 ... 100	0 ... 60 0 ... 100 5 ... 143
Max. current AC6b at 50/60 Hz 50°C Coil Voltage at 50/60 Hz	A V AC	8 204...264	14 204...264	18 204...264	24 204...264	29 204...264	36 204...264	48 204...264	58 204...264	70 204...264	92 204...264	108 204...264	116 204...264	144 204...264
Inrush/Sealed VA of contactor at max. rated capacitor current	VA	70/8	70/8	70/8	70/8	100/8.5	100/8.5	246/26	246/26	246/26	246/26	246/26	350/28	350/28
Rated insulation Voltage VI VIS	VAC	690 (1)	690 (1)	690 (1)	690 (1)	690 (1)	690 (1)	690 (1)	690 (1)	690 (1)	690 (1)	690 (1)	690 (1)	690 (1)
Max. frequency of operations	1/h	240	240	240	240	240	240	240	240	100	100	100	100	100
Contact life	Million operations	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cable cross section • Flexible with cable and sleeve - 1 conductor	mm2	2.5	2.5	2.5	4	4	6	6	16	16	25	25	25	25
• Flexible with cable sleeve-2 conductors		1.5	1.5	1.5	2.5	4	4	16	6	6	25	25	25	25
• Solid without cable end sleeve-1 conductor	mm2 (max)	4	4	4	6	10	10	16	25	25	25	50	50	50
• Solid without cable end sleeve-2 conductor		4	4	4	6	6	6	10	16	16	16	35	35	35
Weight : Type...C...	KG	0.43	0.43	0.43	0.45	0.6	0.63	1.3	1.3	1.65	1.65	1.65	2.58	2.58
Type/ Auxiliary contacts	Normal Open (NO)	1	1	1	1	1	1	1	1	1	1	1	1	1
	Normal Closed (NC)	1	1	1	1	1	1	2	2	2	2	2	2	2

Film Capacitors

PFC Capacitors and Key Components

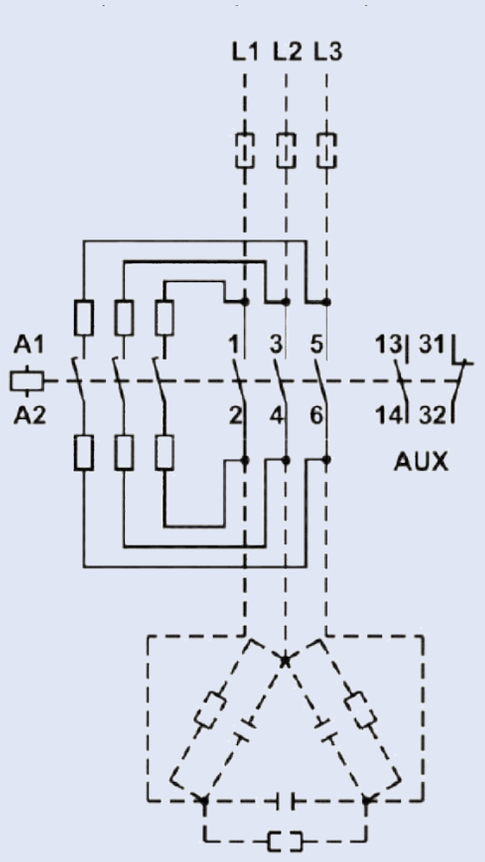
Technical Data (B44066*****C240)

		...0711...	..1011...	..1211...	..1611...	..2011...	..2511...	..3312...	..4012...	..5012...	..6012...	..7512...	..8012...	..9912...
Rated operational current, utilization category AC15: • 220...240 V • 380...400 V • 440 V	A	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09
	A	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
	A	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Thermal rated current at ambient temperature : • 40°C • 60°C														
	A	10	10	10	10	10	10	10	10	10	10	10	10	10
	A	8	8	8	8	8	8	8	8	8	8	8	8	8
Short circuit protection Max. fuse size, slow, gL (gG)	A	10	10	10	10	10	10	10	10	10	10	10	10	10

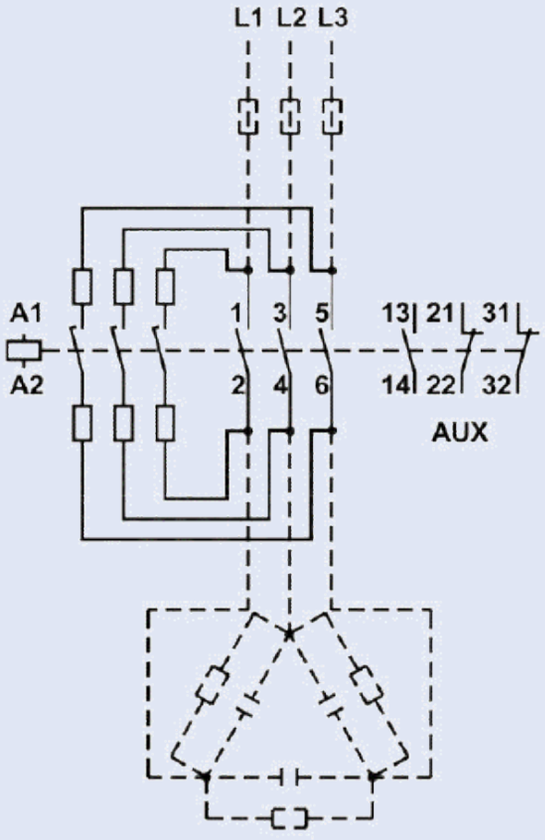
Type	kvar	Voltage V	Description	Material Code
Capacitor Duty Contactor - Standard Series				
Contactor - Standard series	7.0	240	7 kvar Cap.DutyCont.1NO 1NC 240 V	B44066S 711C240
Contactor - Standard series	10	240	10 kvar Cap.DutyCont.1NO 1NC 240 V	B44066S1011C240
Contactor - Standard series	12.5	240	12.5 kvar Cap.DutyCont.1NO 1NC 240 V	B44066S1211C240
Contactor - Standard series	16	240	16 kvar Cap.DutyCont.1NO 1NC 240 V	B44066S1611C240
Contactor - Standard series	20	240	20 kvar Cap.DutyCont.1NO 1NC 240 V	B44066S2011C240
Contactor - Standard series	25	240	25 kvar Cap.DutyCont.1NO 1NC 240 V	B44066S2511C240
Contactor - Standard series	33	240	33 kvar Cap.DutyCont.1NO 1NC 240 V	B44066S3312C240
Contactor - Standard series	40	240	40 kvar Cap.DutyCont.1NO 1NC 240 V	B44066S4012C240
Contactor - Standard series	50	240	50 kvar Cap.DutyCont.1NO+2NC 240 V AC 50/60 Hz EXP	B44066S5012C242
Contactor - Standard series	60	240	60 kvar Cap.DutyCont.1NO 2NC 240 V	B44066S6012C240
Contactor - Standard series	75	240	75 kvar Cap.DutyCont.1NO+2NC 240 V AC 50/60 Hz EXP	B44066S7512C242
Contactor - Standard series	80	240	80 kvar Cap.DutyCont.1NO+2NC 240 V AC 50 Hz EXP	B44066S8012C241
Contactor - Standard series	100	240	100 kvar Cap.DutyCont.1NO+2NC 240 V AC 50 Hz EXP	B44066S9912C241
Capacitor Duty Contactor - Premium Series				
Contactor - Premium series	12.5	230	Capacitor Contactor 50"C 0-12.5 kvar	B44066S1811J230
Contactor - Premium series	25	230	Capacitor Contactor 50"C 0-25 kvar	B44066S3211J230
Contactor - Premium series	33.3	230	Capacitor Contactor 50"C 0-33.3 kvar	B44066S5011J230
Contactor - Premium series	50	230	Capacitor Contactor 50"C 0-50 kvar	B44066S6211J230
Contactor - Premium series	75	230	Capacitor Contactor 50"C 0-75 kvar	B44066S7411J230
Contactor - Premium series	100	230	Capacitor Contactor 50"C 0-100 kvar	B44066S9911J230

Connection diagrams

Connection diagram for all types B44066S…1C240 0711…, 1011…, 1211…, 1611…, 2011…, 2511…



Connection diagram for all types B44066S…2C240 … 3312…, 4012…, 5012…,6012…,7512…, 8012…, 9912…

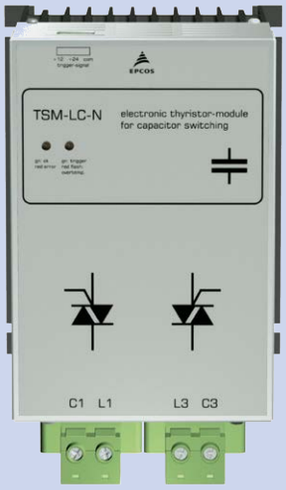


Switching Devices – Thyristor Modules for Dynamic PFC, TSM-Series

General

Conventional systems for power factor correction are used to optimize the power factor and reduce the level of harmonics in the grid. The usage of new technologies in modern industry has negative impacts on electric power quality of the main supply networks, e.g. frequent high load fluctuations and harmonic oscillation. Excessive currents, increased losses and flickering will not only influence the supply capacity but will also have a significant impact on the operation of sensitive electronic devices The solution for this are dynamic power factor correction systems. With the thyristor module series TSM-LC, we provide the main component – “the electronic switch” – for dynamic power factor correction.

The TSM module series offers fast electronically controlled, self observing thyristor switches for capacitive loads up to 200 kvar, that are capable to switch PFC capacitors within a few milliseconds nearly without a limitation to the number of switchings during the capacitor life time.



Film Capacitors

PFC Capacitors and Key Components

Thyristor Switch and Discharge Resistor

Series	Thyristor Module TSM-LC-N
Technical data	• Suitable for 10, 25, 50 and 100 kvar • Rated Voltage 400, 415, 440 and 690 V
Features	• Suitable for real time power factor correction. • Easy Installation: It can be used identically as a Contactor. • Reaction time: 5 milli seconds. • Permanent self - controlling of : Voltage Parameter, Capacitor Current Temperature of the thyristor switch • Alarm output per module. • Manual operation possible. • Automatic switch off in case of over current and over temperature. • Display of: Operations, Faults & Activation

Type	Rating kvar	Voltage V (AC)	Description	Ordering Code
Thyristor Switch and Discharge Resistor				
TSM 10	10	440	PFC Thyristor Module 440 V 10 kvar	B44066T0010R440
TSM 25	25	440	PFC Thyristor Module 440 V 25 kvarTSMLC-N	B44066T3025R442
TSM 50	50	440	PFC Thyristor Module 440 V 50 kvarTSMLC-N	B44066T3050R442
TSM 100	100	440	PFC Thyristor Module 440 V100 kvarTSMLC100	B44066T0100I440
TSM 50	50	690	PFC Thyristor Module 690 V 50 kvar TSMLCN	B44066T3050E690
EW22-Resistor	-	440	Discharge Resistor 22K, 50W, 5%	B44066T 22S400
Output Buffer Card, 24V	-	24	Buffer Card	B44066R1116R230

Detuned Filter Reactors

General

The increasing use of modern power electronic apparatus (drives, uninterruptible power supplies, etc) produces nonlinear current and thus influences and loads the network with harmonics (line pollution).

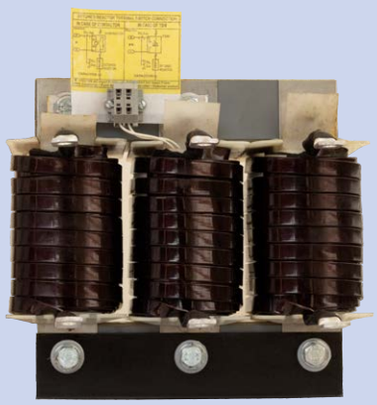
The power factor correction or capacitance of the power capacitor forms a resonant circuit in conjunction with the feeding transformer. Experience shows that the self resonant frequency of this circuit is typically between 250 and 500 Hz, i.e. in the region of the 5th and 7th harmonics.

Such a resonance although can lead to the following undesirable effects:
– overloading of capacitors,
– overloading of transformers and transmission equipment,
– interference with metering and control systems, computers and electrical gear,
– resonance elevation, i.e. amplification of harmonics,
– voltage distortion.

These resonance phenomena can be avoided by connecting capacitors in series with filter reactors in the PFC system. These so called “detuned” PFC systems are scaled in a way that the self-resonant frequency is below the lowest line harmonic. The detuned PFC system is purely inductive seen by harmonics above this frequency. For the base line frequency (50 or 60 Hz usually), the detuned system on the other hand acts purely capacitive, thus correcting the reactive power.

Applications
- Avoidance of resonance conditions
- Tuned and detuned harmonic filters
- Reduction of harmonic distortion (network clearing)
- Reduction of power losses

Features
- High harmonic loading capability
- Very low losses
- High linearity to avoid choke tilt
- Low noise
- Convenient mounting
- Long expected life time
- Temperature protection (NC contact)



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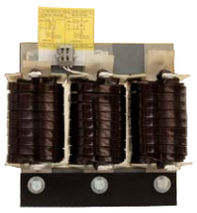
Film Capacitors

PFC Capacitors and Key Components

Detuned Filter Reactor



Series	Three Phase Reactor B44066
Technical data	• Effective Filter out put 5 kvar to 100 kvar • Filtering factor: - (5.67%,7% and 14% corresponding to tuning frequencies of 210 Hz, 189 Hz and 134 Hz, for fundamental frequency of 50 Hz) • Rated Voltage: (230 V to 690 V) • Available in three designs 1. Aluminum Strip Wound 2. Aluminum Foil Wound 3. Copper Conductor wound
Features	• Highest linearity, low risk of reactor tilting • Low losses and noise level • High over loading capability • Low weight in case of aluminum windings • Safety device - temperature micro switch • Type tested at CPRI.

Power kvar	D capacitance 3nf	Inductance mH	Irms (Ieff) A	Losses1 W	Weight Kg	Terminal	Ordering code
Rated voltage V = 400 V, f = 50 Hz, p = 5.67% (fr = 210 Hz) / Linearity: L 0.95 · LR for current up to 2.08 · I1							
10	62	3.06	18.5	70	9	10 mm2 Kl.	B44066D5010*400
12.5	78	2.45	23	90	9	10 mm2 Kl.	B44066D5012*400
20	125	1.53	36.9	110	16	16 mm2 Kl.	B44066D5020*400
25	156	1.23	46.1	120	17	16 mm2 Kl.	B44066D5025*400
50	312	0.61	92.1	210	25	M6 AL flat	B44066D5050*400
75	496	0.41	138.2	300	39	M6 AL flat	B44066D5075*400
100	625	0.31	183.8	360	47	M6 AL flat	B44066D5100*400
Rated voltage V = 400 V, f = 50 Hz, p = 7% (fr = 189 Hz) / Linearity: L 0.95 · LR for current up to 1.73 · I1							
10	61	3.84	16.4	60	9	10 mm2 Kl.	B44066D7010*400
12.5	77	3.01	20.5	75	9	10 mm2 Kl.	B44066D7012*400
20	123	1.92	32.7	105	16	Cu bars	B44066D7020*400
25	154	1.53	40.9	120	17	Cu bars	B44066D7025*400
50	308	0.77	81.8	195	26	Cu bars	B44066D7050*400
75	462	0.51	122.7	270	41	Cu bars	B44066D7075*400
100	617	0.38	163.3	330	51	Cu bars	B44066D7100*400
Rated voltage V = 400 V, f = 50 Hz, p = 14% (fr = 135 Hz) / Linearity: L 0.95 · LR for current up to 1.37 · I1							
10	57	8.29	15.4	90	9	10 mm2 Kl.	B44066D1410*400
12.5	71	6.64	19.2	110	12	10 mm2 Kl.	B44066D1412*400
20	114.4	4.15	30.8	150	27	Cu bars	B44066D1420*400
25	142.3	3.32	38.5	210	27	Cu bars	B44066D1425*400
50	285	1.66	77	290	41	Cu bars	B44066D1450*400
Rated voltage V = 440 V, f = 50 Hz, p = 5.67% (fr = 210 Hz) / Linearity: L 0.95 · LR for current up to 2.08 · I1							
10	51	3.71	16.8	65	9	10 mm2 Kl.	B44066D5010*440
12.5	64	2.97	21	75	9	10 mm2 Kl.	B44066D5012*440
25	129	1.48	41.8	120	18	16 mm2 Kl.	B44066D5025*440
50	258	0.74	83.65	200	25	M6 AL flat	B44066D5050*440
75	387	0.49	125.6	300	38	M8 AL flat	B44066D5075*440
100	517	0.37	168	360	51	M8 AL flat	B44066D5100*440

Film Capacitors

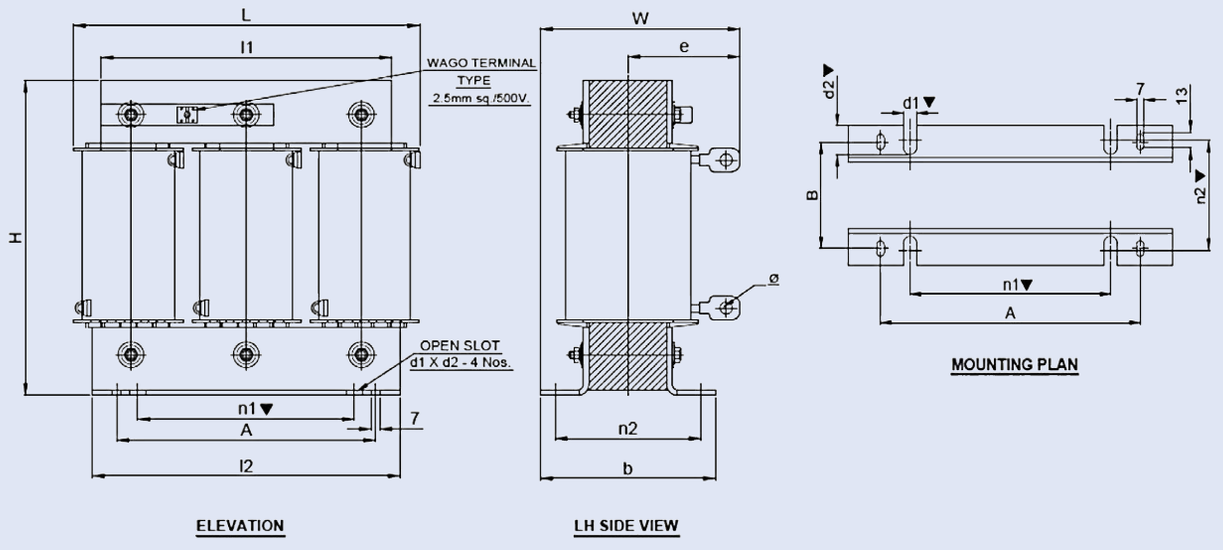
PFC Capacitors and Key Components

Power kvar	D capacitance 3nf	Inductance mH	Irms (Ieff) A	Losses1 W	Weight Kg	Terminal	Ordering code
Rated voltage V = 440 V, f = 50 Hz, p = 7% (fr = 189 Hz) / Linearity: L 0.95 · LR for current up to 1.73 · I1							
10	50	4.64	14.9	65	9	10 mm2 Kl.	B44066D7010*440
12.5	63	3.71	18.7	75	9	10 mm2 Kl.	B44066D7012*440
25	127	1.87	37.2	120	18	Cu bars	B44066D7025*440
50	254	0.93	74.3	200	25	Cu bars	B44066D7050*440
75	382	0.62	111.4	300	41	Cu bars	B44066D7075*440
100	509	0.46	148.7	360	51	Cu bars	B44066D7100*440
Rated voltage V = 440 V, f = 50 Hz, p = 14% (fr = 135 Hz) / Linearity: L 0.95 · LR for current up to 1.37 · I1							
10	47	10.04	14	120	16	10 mm2 Kl.	B44066D1410*440
12.5	58	8.03	17.5	120	16	10 mm2 Kl.	B44066D1412*440
25	117	4.02	35	180	28	Cu bars	B44066D1425*440
50	235	2.01	70	330	42	Cu bars	B44066D1450*440
75	353	1.34	105	490	83	Cu bars	B44066D1475*440
100	471	1	140	540	83	Cu bars	B44066D1499*440

1) Total max. losses, considering max. specified over voltage and harmonic currents

- TDK offers reactors with slightly different specifications (e.g. dimensions) that can be used for the same application although sometimes with slightly different resulting performances. These types are distinguished by different letters at digit 12 of the product code. Thus this digit is not specified here.
- Other Voltage, rating and dimensions on request

Dimensional diagram of B44066D7050K440:- 50 kvar 7% 440 V (* Dimentiones will be provided on request)



Dimensions			
L/mm	275	b/mm	185
H/mm	238	e/mm	135±5
W/mm	230±5	d1/mm	10.8
l1/mm	235	d2/mm	15.5
l2/mm	235	A	175
n1/mm	150	B	165
n2/mm	168±3	Ø	8.5

Capacitor (kvar) selection chart

Current (ACTUAL) Tan j	cos j	achievable (TARGET) cos j 0.80	0.82	0.85	0.88	0.90	0.92	0.94	TARGET Cos j = 0.96 Q Cos j ≤1 Q_c	0.96	0.98	1.00
		Factor F										
3.18	0.30	2.43	2.48	2.56	2.64	2.70	2.75	2.82		2.89	2.98	3.18
2.96	0.32	2.21	2.26	2.34	2.42	2.48	2.53	2.60		2.67	2.76	2.96
2.77	0.34	2.02	2.07	2.15	2.23	2.28	2.34	2.41		2.48	2.56	2.77
2.59	0.36	1.84	1.89	1.97	2.05	2.10	2.17	2.23		2.30	2.39	2.59
2.43	0.38	1.68	1.73	1.81	1.89	1.95	2.01	2.07		2.14	2.23	2.43
2.29	0.40	1.54	1.59	1.67	1.75	1.81	1.87	1.93		2.00	2.09	2.29
2.16	0.42	1.41	1.46	1.54	1.62	1.68	1.73	1.80		1.87	1.96	2.16
2.04	0.44	1.29	1.34	1.42	1.50	1.56	1.61	1.68		1.75	1.84	2.04
1.93	0.46	1.18	1.23	1.31	1.39	1.45	1.50	1.57		1.64	1.73	1.93
1.83	0.48	1.08	1.13	1.21	1.29	1.34	1.40	1.47		1.54	1.62	1.83
1.73	0.50	0.98	1.03	1.11	1.19	1.25	1.31	1.37		1.45	1.63	1.73
1.64	0.52	0.89	0.94	1.02	1.10	1.16	1.22	1.28		1.35	1.44	1.64
1.56	0.54	0.81	0.86	0.94	1.02	1.07	1.13	1.20		1.27	1.36	1.56
1.48	0.56	0.73	0.78	0.86	0.94	1.00	1.05	1.12		1.19	1.28	1.48
1.40	0.58	0.65	0.70	0.78	0.86	0.92	0.98	1.04		1.11	1.20	1.40
1.33	0.60	0.58	0.63	0.71	0.79	0.85	0.91	0.97		1.04	1.13	1.33
1.30	0.61	0.55	0.60	0.68	0.76	0.81	0.87	0.94		1.01	1.10	1.30
1.27	0.62	0.52	0.57	0.65	0.73	0.78	0.84	0.91		0.99	1.06	1.27
1.23	0.63	0.48	0.53	0.61	0.69	0.75	0.81	0.87		0.94	1.03	1.23
1.20	0.64	0.45	0.50	0.58	0.66	0.72	0.77	0.84		0.91	1.00	1.20
1.17	0.65	0.42	0.47	0.55	0.63	0.68	0.74	0.81		0.88	0.97	1.17
1.14	0.66	0.39	0.44	0.52	0.60	0.65	0.71	0.78		0.85	0.94	1.14
1.11	0.67	0.36	0.41	0.49	0.57	0.63	0.68	0.75		0.82	0.90	1.11
1.08	0.68	0.33	0.38	0.46	0.54	0.59	0.65	0.72		0.79	0.88	1.08
1.05	0.69	0.30	0.35	0.43	0.51	0.56	0.62	0.69		0.76	0.85	1.05
1.02	0.70	0.27	0.32	0.40	0.48	0.54	0.59	0.66		0.73	0.82	1.02
0.99	0.71	0.24	0.29	0.37	0.45	0.51	0.57	0.63		0.70	0.79	0.99
0.96	0.72	0.21	0.26	0.34	0.42	0.48	0.54	0.60		0.67	0.76	0.96
0.94	0.73	0.19	0.24	0.32	0.40	0.45	0.51	0.58		0.65	0.73	0.94
0.91	0.74	0.16	0.21	0.29	0.37	0.42	0.48	0.55		0.62	0.71	0.91
0.88	0.75	0.13	0.18	0.26	0.34	0.40	0.46	0.52		0.59	0.68	0.88
0.86	0.76	0.11	0.16	0.24	0.32	0.37	0.43	0.50		0.57	0.65	0.86
0.83	0.77	0.08	0.13	0.21	0.29	0.34	0.40	0.47		0.54	0.63	0.83
0.80	0.78	0.05	0.10	0.18	0.26	0.32	0.38	0.44		0.51	0.60	0.80
0.78	0.79	0.03	0.08	0.16	0.24	0.29	0.35	0.42		0.49	0.57	0.78
0.75	0.80		0.05	0.13	0.21	0.27	0.32	0.39		0.46	0.55	0.75
0.72	0.81			0.10	0.18	0.24	0.30	0.36		0.43	0.52	0.72
0.70	0.82			0.08	0.16	0.21	0.27	0.34		0.41	0.49	0.70
0.67	0.83			0.05	0.13	0.19	0.25	0.31		0.38	0.47	0.67
0.65	0.84			0.03	0.11	0.16	0.22	0.29		0.36	0.44	0.65
0.62	0.85				0.08	0.14	0.19	0.26		0.33	0.42	0.62
0.59	0.86				0.05	0.11	0.17	0.23		0.30	0.39	0.59
0.57	0.87					0.08	0.14	0.21		0.28	0.36	0.57
0.54	0.88					0.06	0.11	0.18		0.25	0.34	0.54
0.51	0.89					0.03	0.09	0.15		0.22	0.31	0.51
0.48	0.90						0.06	0.12		0.19	0.26	0.48
0.46	0.91						0.03	0.10		0.17	0.25	0.46
0.43	0.92							0.07		0.14	0.22	0.43
0.40	0.93							0.04		0.11	0.19	0.40
0.36	0.94									0.07	0.16	0.36
00..33	95										0.13	0.33

$Q_c = P_A \times (\tan \varphi_1 - \tan \varphi_2)$

Q_c (kvar) = $P_A \times F$ = active power (kW) x factor "F"

$P_A = S \times \cos \varphi$ = apparent power x cos j

$\tan \varphi_1 + \varphi_2$ according to cos j values ref. Table

Example:

ACTUAL motor power	P = 100 kW	Capacitor reactive power Qc
Actual cos j	0.61	Qc = 100 x 1.01 = 101.0 kvar
TARGET cos j	0.96	
Factor F from table	1.01	

Individual PFC for Motors

Motor nominal rating kW	Capacitor power rating (1500 r.p.m.*) kvar	Capacitor power rating (1000 r.p.m.*) kvar	Capacitor power rating (750 r.p.m.*) kvar
Approximate values (specified by the German Electricity Association VDEW) for fixed PFC of motors			
1 …1.9	0.5	0.5	0.6
2 …2.9	1	1.1	1.2
3 …3.9	1.5	1.6	1.7
4 …4.9	2	2.1	2.3
5 …5.9	2.5	2.6	2.9
6 …7.9	3	3.2	3.5
8 …10.9	4	4.2	4.6
11…13.9	5	5.3	5.8
14… 17.9	6	6.3	6.9
18… 21.9	7.5	8.0	8.6
22… 29.9	10	10.5	11.5
30… 39.9	approx. 40% of the motor power		
40 and above	approx. 35% of the motor power		
*r.p.m.: revolutions per minute			

The capacitor output should be approx. 90% of the apparent power of the motor when idle.
This means a power factor of 0.9% at full load and 0.95 to 0.98 during
idling. Important: The capacitor output must not be rated too high for individual compensated machines where the capacitor is directly connected with the motor clamp. This especially applies when the machine has a big oscillating weight and still continues to rotate after switching off.

The capacitor placed in parallel may act as generator for the motor which will cause serious overvoltages. The consequence could be heavy damage to the capacitor as well as to the motor.

Individual PFC for Transformers

Rated apparent power of transformer kW	Rated capacitor power for oil immersed transformers kvar	Rated capacitor power for cast resin transformers kvar
Standard values for transformer power factor correction		
10	1.0	1.5
20	2.0	1.7
50	4.0	2.0
75	5.0	2.5
100	5.0	2.5
160	7.0	4.0
200	7.5	5.0
250	8.0	7.5
315	10.0	8.0
400	12.5	8.5
500	15.0	10.0
630	17.5	12.5
800	20.0	15.0
1000	25.0	16.7
1250	30.0	20.0
1600	35.0	22.0
2000	40.0	25.0
2500	50.0	35.0
3150	60.0	50.0

For an exact calculation of the right capacitor value, following formula can be used:

$$Q_C = I_0\% \cdot \frac{A_N}{100}$$

There are regional differences in the guidelines of power suppliers concerning the admissible size of capacitors directly connected with a transformer. Therefore a consultation with the respective power supplier is recommended before installation of a compensation bank. Modern transformers have laminations which only need low capacity to reverse the magnetism. In case the capacitor output is too high, stress increase may occur during idling.

Qc = needed capacitor (kvar)
I_0% = magnetising current of the transformer (AS%)
A_N = apparent rated power of the transformer in kVA

PFC Basic Formulas

The following electrical formulas may be used to calculate basic PFC values.
Active power

The amount of input power converted to output power is the active power.

$P = V3 \cdot V \cdot I \cdot \cos j$ [W]
Formula 1

Reactive Power

The reactive power is the power consumed in an AC circuit due to the expansion and collapse of magnetic (inductive) and electrostatic (capacitive) fields.

$Q = V3 \cdot V \cdot I \cdot \sin j$ [VAr]
Formula 2

Apparent Power

The apparent power is the power delivered to an electric circuit.

$S = V3 \cdot V \cdot I$ [VA]
Formula 3

Power factor

The power factor of an AC electrical power system is defined as the ratio of the real (active) power to the apparent power.

$$\text{Power factor} = \frac{\text{Active power}}{\text{Apparentpower}} = \frac{P}{S}$$

Formula 4

Power Factor Correction

When the AC load is partly capacitive or inductive, the current waveform is out of phase with the voltage. This requires additional AC current to be generated that is not consumed by the load, creating I2R losses in power cables. Capacitors are used to supply reactive energy to inductive loads. Reactive energy must be produced as closely as possible to the loads to prevent unnecessary flow of current in the network. This is known as power factor correction.

$Q_C = P \cdot (\tan j_1 - \tan j_2)$ [VAr]

Formula 5
Q_C: reactive power needed
P: total active power
j_1: actual angle of cos j actual
j_2: target angle of cos j target

Connection and rating of capacitors

The reactive power of the capacitor is a function of its rated voltage and current.

$Q_C = V_C \cdot I_C$ [VAr]

Formula 6

$$Q_c = \frac{V_c \cdot V_c}{X_c} = \frac{(V_c)^2}{X_c}$$

Formula 7

$$X_c = \frac{1}{w.c} = \frac{1}{2p.f.C}$$

Formula 8
f: frequency of network
X_C: impedance of capacitor
C: capacitance value

Formula (7) and (8) together

$Q_c = (V_c)^2 \cdot w \cdot C = (V_C)^2 \cdot 2\,p \cdot f \cdot C$
Formula 9

Detuned PFC

Important Facts and Instructions

Important design instructions to be followed for detuned PFC Systems

1. Determine the necessary effective power (kvar) of the capacitor bank in order to obtain the desired PF.
2. Design the capacitor stages in such a way that the sensibility of the bank is around 15–20% of the total available power. It's not useful to have a more sensitive bank that reacts with a 5 or 10% of the total power because this would lead to a high amount of switching operations, wasting the equipment unnecessarily when the real objective is to have a high average PF.
3. Try to design the bank with standard kvar values of effective power steps, preferably multiples of 25 kvar.
4. Measure the presence of harmonic currents in the main feeder cable of the system without capacitors at all possible load conditions. Determine frequency and maximum amplitude for every harmonic that could exist.
   Calculate the Total Harmonic Distortion of Current THD-I = $100 \cdot SQR [(I_3)2 + (I_5)^2 + ... + (I_R)^2]/I_I$
   Calculate every existing value for $THD\text{-}I_R = 100 \cdot I_R/I_I$
5. Measure the presence of harmonic voltages that might come from outside your system, if possible measure the HV side.
   Calculate the Total Harmonic Distortion of Voltage THD-V = $100 \cdot SQR [(V_3)^2 + (V_5)^2 + ... + (V_N)^2]/V_I$
6. Are there harmonics such as THD-I > 10% or THD-V > 3% (measured without capacitors)? If YES fi use PFC-DF and go to consideration 7.
   If NO fi use standard PFC and skip considerations 7, 8 and 9.
7. Is there 3rd harmonic content, $I_3 > 0.2 \cdot I_5$?
   If YES fi use PFC-DF with p = 14% and skip consideration 8.
   If NO fi use PFC-DF with p = 7% or 5.67% and go to consideration 8.
8. THD-V is:
   3–7% fi use PFC-DF with p = 7%
   >7% fi use PFC-DF with p = 5.67%
   >10% fi ask for special filter design
9. Select the proper components using TDK tables for PFC-DF and standard values for effective power, the voltage and frequency of your grid, and the determined detuned factor p.
10. Always use genuine TDK application- specific designed components for PFC-DF. Please observe that reactors are specified for their effective power at grid voltage and frequency. This power will be the real effective power of the whole LC set at fundamental frequency.
    Capacitors for PFC-DF must be selected for a higher rated voltage than the grid's because of the overvoltage caused by the series connection with the reactor.
    Contactors for capacitors are designed as application-specific to reduce inrush capacitors currents and to handle capacitive loads in a reliable way.

Note: These are general instructions. Conditions may differ depending on the application.
In case of doubts, please contact our local sales office.

Detuned PFC

Important Facts and Instructions

General

Conventional PFC systems quickly reach their limits when they have to deal with fast changing loads. Applications like rolling mills, steel presses, wind turbines, container cranes and large buildings include a huge amount of electric consumers that require a reactive power adjustment on the ms scale. Production equipment, elevators, chillers, and other electric devices not only require such dynamic reactions of the power factor compensation equipment, they also lead very soon to a total number of switchings that exceeds the specifications of standard electromechanical contactors by far.

In conventional PFC systems, standard capacitor contactors are used to switch capacitor steps on and off.

These electro mechanical devices offer between 100 000 and 200 000 switching operations in total during their life time which means that in such an application they reach their life expectancy after 1 to 2 years already. It has to be mentioned that capacitors are much stricter limited with regard to the permitted annual number of switching operations (IEC 60831). This typically results in destruction of their inrush current damping capability and may also damage the contacts in the main power circuit. Burnt main contacts may produce oscillation or “un- clean” (re-bouncing) switching operations.

This massive overload not only shortens the life expectancy of the capacitor, but also increases the risk of premature failure and in the worst case represents a potential safety risk. But furthermore the capacitor itself is specified for a limited number of switching operations per year. The standard IEC 60831 gives an | acceptable value of 5000 switching operations per year, a value far below switching numbers up to 100 000 that may be required per year in dynamic applications. Such large switching numbers and the respective overvoltages and overcurrents during each switching operation are likely to dam- age the capacitor and may lead to a very early capacitor failure.

In dynamic PFC systems, the capacitor contactors are replaced by thyristor modules that are suitable for a nearby unlimited number of switching operations as there is no mechanical wear-off. Thyristor modules feature electronic semiconductor switches that are able to react to a changing reactive power demand on the ms scale and that can switch capacitors without additional stress. The EPCOS TSM- thyristor switches keep the capacitors at the peak value of the grid voltage and connect them only when the grid reaches this peak voltage value. Thus the capacitors are switched current free and inrush currents that can reach values of 200 times the nominal current for conventional contactors are avoided. Additionally capacitor discharge times up to 75 s as necessary for conventional PFC are not required here.

In summary dynamic PFC does not only prevent wear-off of the capacitors and the switches and increases thus the lifetime of a PFC system and its safety. It also increases the power quality in the grid essentially as it can almost react in real time to reactive power demands. Fast enough for example, to take care of motor start up effects or spot welding requirements.

TDK offers all necessary key components to set up a dynamic PFC systems as the thyristor modules (TSM, see page 67), the required fast transistor output controllers (BR6000-T, page 54ff), and the EPCOS standard reactor (page 71) and of course capacitor series (page 13ff). A further help to compose such a system for a large number of situations is given by the dynamic PFC selection tables on page 114ff.

Note: The recommendations given in the selection tables are meant as a support tool. TDK does not take over any responsibility for the design as apart from the theoretical conditions the prevailing circumstances in the application have to be taken into account.

Cautions and Warnings

Temperature class of capacitors (according IEC 60831-1)

Temperature class	Temperature of capacitor surrounding air		
	Maximum	Maximum mean for 24 h	Maximum mean for 1 year
B	+45 °C	+35 °C	+25 °C
C	+50 °C	+40 °C	+30 °C
D	+55 °C	+45 °C	+35 °C

Enclosure of capacitors (IPxx)

Enclosure	First digit	Second digit
IP00	No protection against finger touch and ingress of solid foreign bodies	No protection against ingress of water
IP20	Protection against finger touch and solid foreign bodies [3] 12.5 mm diameter	No protection against ingress of water
IP41	Protection against tool touch & solid foreign bodies [3] 1 mm diameter	Drip-water protection
IP54	Protection against tool touch and solid foreign bodies [3] 1 mm diameter, protection against dust deposit	Splash water protection

Maximum admissible overvoltage

Frequency (50 / 60 Hz	Max. voltage (V_{RMS})	Max. duration	Remarks
Line frequency	$1.00 \cdot V_R$	Continuous duty	Highest mean during entire operating time of capacitor; exceptions (see below) are admissible for times of < 24 h
Line frequency	$1.10 \cdot V_R$	8 h daily	Line voltage fluctuations
Line frequency	$1.15 \cdot V_R$	30 min daily	Line voltage fluctuations
Line frequency	$1.20 \cdot V_R$	5 min daily	Line voltage fluctuations
Line frequency	$1.30 \cdot V_R$	1 min daily	Line voltage fluctuations
Line frequency with harmonics	Such that current does not exceed maximum admissible figure (Imax. = 1.3 · IR)		

Temperature class of capacitors to standard IEC 60831-1

Capacitors are divided into temperature classes. Each class is represented by a number followed by a letter, e.g.
–40/D. The number is the lowest ambient temperature at which a capacitor may operate. The upper limit temperature is indicated by the letter (see table above).

The useful life of a capacitor depends very much on temperature. Proper cooling of a capacitor must ensure that the maximum temperature is not exceeded, otherwise useful life is degraded. When configuring a circuit, one should make sure that capacitors are not subjected to heat from adjacent components (reactors, bus bars, etc). Forced cooling is preferable for compact designs. And it is highly inadvisable to arrange capacitors directly above reactors. Exceeding specified temperature limits may set in worst case the safety device out of operation.

Cautions and Warnings

Reactors – Antiresonance harmonic filter

During operation, all electrically active parts of this equipment such as windings, electronic components, leads, fuses and terminals carry a dangerous voltage which can lead to burns or electric shock.

Covers which protect these electrically active parts from being touched must not be opened or removed during operation.

Before any assembly or maintenance work is started, all installations and equipment must be disconnected from the power source.

Noncompliance with these instructions may lead to death, serious injury or major damage to equipment.

In order to exclude impermissible temperatures and thus overload of the insulation system, the following directions must additionally be observed:

1. Only those protective devices specified on the type plates, such as fuses and motor protection switches, may be used. It is mandatory to observe the set values specified for the motor protection switches. Any temperature-sensitive protective devices such as temperature switches and temperature sensors must be connected in accordance with the installation instructions.
2. High temperatures are permissible for the surfaces under rated operating conditions, and especially in the event of overload. Depending on the temperature class and type of loading, these may attain values of up to 260 °C and may also affect adjacent components which have been packed too densely
3. The insertion position should be selected so that any cooling ducts present within the winding are arranged vertically and that the current of cooling air is not impeded by adjacent components, connecting leads etc.
4. The maximum voltage of the insulating system specified on the type plate must not be exceeded.

Noncompliance with these instructions may lead to considerable damage to equipment or fire due to impermissibly high temperatures.

Thyristor modules (TSM-series)

- Live parts in the PFC equipment must not be touched!
- Warning signs in the PFC systems are required!
- Wait 10 minutes after the main switch is turned off until the voltage in the system has dropped to an uncritical value.
- In non-detuned systems (400 V grid) capacitors with a higher voltage rating (e.g. 440 V) are needed.
- In detuned systems (400 V grid) capacitors with a voltage of 525 V are needed.
- For discharging the capacitors, special high voltage resistors type EW-22 are required. Standard resistors cannot be used!
- In dynamic PFC systems discharge reactors cannot be used (this would be a short circuit of the high voltage DC)!
- In PFC systems without filter circuit reactors current limiting reactors are required (e.g. BD-series) for the TSM.
- For short circuit protection, superfast electronic fuses for protection of the thyristor are required, standard HRC fuses are not suitable. See selection table on pages 101 and 102.
- Failure to follow cautions may result, worst case, in premature failures or physical injury.

Capacitor contactors

In case auxiliary contacts are used for switching of discharge resistors (not in accordance with IEC 60831 standard), make sure that the current of the discharge resistors is not higher than the rated current of the auxiliary contacts.

Only flame-resistant and self extinguishing materials may be used in the proximity of capacitor contactors because abnormal temperatures cannot be ruled out in the area near the resistance spirals.

PF controllers (BR604, BR6000,BR2100, BR5000 and BR all series)

Controller hunting: When putting the capacitor bank into operation, it is required to avoid needless switching cycles (means permanent switching on and off of steps without significant change of consumer loads). This so called “controller hunting” would increase the number of switching operations of the connected contactors and capacitors, decrease the expected life cycle (wear out) and result, in worst case, in bursting and fire etc. This can be avoided by a proper programming of the PF controllers with the actual system parameters (current transformer prim. and sec., first kvar step, control series, switching time).

The “ZVEI General safety recommendations for power capacitors” must be observed in addition to the safety instructions given in this catalogue and in the particular data-sheets. They are available on the TDK website in the various product groups. They may also be called up from the ZVEI website.

Cautions and Warnings

Mean life expectancy
The mean life expectancy of power capacitors is mainly governed by the following factors:
- Duration of overload,
- Ambient temperature and the resulting case temperature,
- Maximum rms current and the resulting case temperature,
- Voltage intensity (With respect to Capacitor rated voltage) and duration.

Fuse protection
Power capacitors have to be protected against short circuits by fuses or thermal magnetic over current relays. The fuse rating should be 1.6 to 1.8 times the rated current of the capacitor. Magnetic short circuit relays should be set between 9 to 12 times rated current to prevent them from nuisance tripping. Maximum allowed fault current of 10000 A in accordance with UL 810 standard must be ensured by the application design.
HRC fuses must not be used for switching. Resulting electric arcing can be very dangerous. It may also cause capacitor failures, and result, worst case, in capacitor bursting and fire.

Switching of capacitors
When a capacitor is switched to an AC system, the result is a resonant circuit damped to a greater or lesser degree. In addition to the rated current, the capacitor accepts a transient current that is a multiple of its rated current. Special capacitor contactors with leading contacts that feature precharging resistors to damp inrush currents are recommended. As per IEC 60831 standard, a maximum of 5000 switching operations per year is acceptable.

Discharging
Capacitors must be discharged to a maximum of 10% of rated voltage before they are switched in again. This prevents an electric impulse discharge in the application, influences the capacitor's useful life in PFC systems, and protects against electric shock. The capacitor must be discharged to 50 V within 60 Sec. Caution: Discharge and short circuit capacitor before handling!

Capacitors in networks with harmonics
Most international standards limit THD-V on LV side to 5%. However it has to be noted that in many grids these levels are exceeded and even lower distortion, e.g. 3–4% THD-V can generate extreme over current in case of resonance condition. Maximum over current as specified under technical data of each series must not be exceeded.
Resonance must be avoided by appropriate panel design. Resonance may cause very high over current which can lead to capacitor failures, and worst case, to explosion and fire.

Connection:
Make sure connection cables are of flexible type or flexible copper bands are used. This is mandatory to allow the overpressure disconnector work and avoid mechanical stress on the terminals and feedthroughs.Avoid bending cable lugs, cables or other mechanical force on the terminals. Otherwise leakages may set the safety device out of operation.

Grounding:
The threaded bottom stud of the cylindrical capacitor has to be used for grounding, where as in case of SqureCap capacitor the designated earthing screw should be used for this purpose.

Storage and operating conditions:
Do not use or store capacitors in corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. In dusty environments regular maintenance and cleaning especially of the terminals is required to avoid conductive path between phases and / or phases and ground.

Please visit our website www.epcos.com for more information on 'Applications, warnings, installation and maintenance instructions'

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