TDK

EPCOS Product Profile (India) 2013

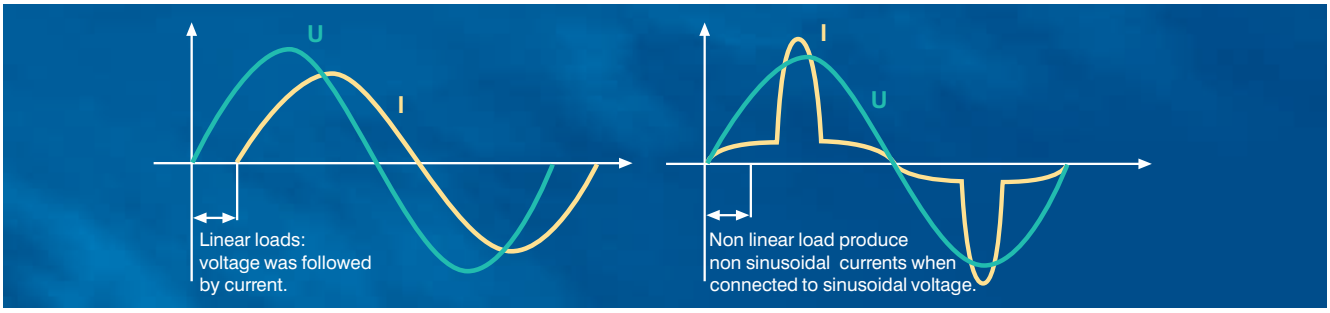
Power Factor Correction

Power Quality Solutions

www.epcos.com

Index

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 ⌀) and the optimization of voltage stability by generating reactive power – to improve voltage quality and reliability at distribution level.

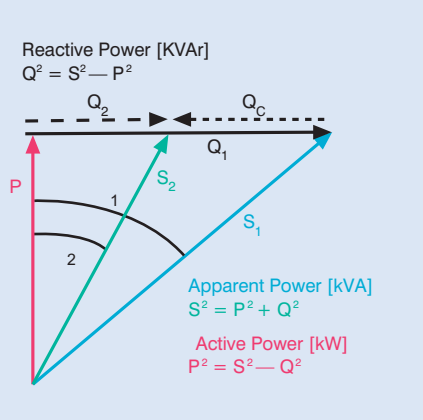
How reactive power is generated

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 $S = \sqrt{P^2 + Q^2}$
Active power $P = S * \cos \varphi$
Reactive power $Q = S * \sin \varphi$

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



Power factor
Low power factor (cos φ)

Low cos φ 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.

PFC Capacitor Series Overview

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

*Other voltages on request.

Important Notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application.** As a rule, EPCOS is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether an EPCOS product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified** In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements,some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous). Useful information on this will be found in our Material Data Sheets on the Internet (www.epcos.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time.** The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.

   We also reserve the right to discontinue production and delivery of products. Consequently, we cannot guarantee that all products named in this publication will always be available.

   The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
6. Unless otherwise agreed in individual contracts, **all orders are subject to the current version of the "General Terms of Delivery for Products and Services in the Electrical Industry" published by the German Electrical and Electronics Industry Association (ZVEI).**
7. The trade names EPCOS, BAOKE, Alu-X, CeraDiode, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, FormFit, MiniBlue, MiniCell, MKD,MKK, SquareCap, AgriCap, PoleCap, MLSC, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.epcos.com/trademarks.

PhiCap PFC Capacitors

Semi-dry biodegradable resin • Stacked winding • Dual safety system

EPCOS

General

PhiCap capacitors are a tried and tested series of MKP (metalized polypropylene) capacitors from EPCOS which have been used for PFC applications for more than 15 years.

The power range varies from 0.5 to 30.0 kvar and 0.7 to 6.0 kvar per single capacitor can, depending on a three-phase or single-phase capacitor design.

The PhiCap capacitor is especially intended for power factor correction in industrial applications.

The capacitors are manufactured using metalized polypropylene film as the dielectric and housed in a cylindrical aluminum case.

Available in two designs

- Normal Duty (ND) for linear inductive loads.
- Heavy Duty (HD) for loads having some amount of non-linearity (with detuning reactor) .

Applications

- Power Factor Correction (PFC), automatic capacitor banks
- Fixed PFC applications, e.g. motor compensation
- Detuned PFC systems
- Dynamic PFC systems

Features

- Compact design in cylindrical aluminum can with stud
- Stacked winding
- MKP technology
- Voltage range 230 … 525 V
- Output range 0.5 … 30 KVAr

Electrical

- Up to 30 KVAr per case for three-phase applications
- Up to 6 KVAr per case for single-phase applications
- Long life expectancy of up to 115 000 hours
- High pulse current withstand capability (up to 200 • I_R)

Mechanical and maintenance

- Reduced mounting costs, easy installation and connection
- Mounting position upright
- Low weight and compact volume
- Maintenance-free

Safety

- Self-healing
- Overpressure disconnector

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Technical data : PhiCap PFC Capacitors		
	PhiCap-ND	**PhiCap-HD**
Series type	B32343L (plastic top up to 5 KVAr) B32344B (metal top- 6 KVAr and onwards)	B32447 series (1and 2 KVAr) B32448 series (3 KVAr and onwards)
Power-KVAr	0.5 to 30 KVAr	1.0....30 KVAr
Rated voltage-V (AC)	230...525 V*	415...480 V*
Frequency	50 Hz	50 Hz
Transient peak current maximum permissible	200 • I_R	250 • I_R
Maximum permissible temperature category	-10/D	-10/D
Losses (without discharge resistor)	≤0.5 W/KVAr	≤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)**	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***	1.5 to 1.8 • I_R***
Safety	Self-healing, overpressure disconnector	Self-healing, overpressure disconnector
Impregnation	Non-PCB, semi-dry biodegradable resin	Non-PCB, semi-dry biodegradable resin
Life expectancy	Up to 100 000 hours	Up to 115 000 hours
Cooling	Natural or forced	Natural or forced
Case shape/finish	Extruded round aluminium can with stud	Extruded round aluminium can with stud
Terminal	6.3 mm fast-on terminals for plastic top -1 to 5 KVAr Screw terminal for metal top 6 KVAr and above	6.3 mm fast-on terminals for plastic top - 1 and 2 KVAr Optimized capacitor safety terminals 3 KVAr onwards
Mounting and grounding	Threaded stud at bottom of can (max. torque 4 Nm for M8 and 10Nm for M12)	Threaded stud at bottom of can (max. torque 4 Nm for M8 and 10Nm for M12)
Enclosure	IP 00, indoor mounting (optionally with terminal cap for IP54)	IP 00, indoor mounting (optionally with terminal cap for IP54)
Discharge resistor	Provided with discharge resistor	Provided with discharge resistor
Connection	Delta	Delta
Casing of capacitor cell	Extruded round aluminium can with stud	Extruded round aluminium can with stud
Dielectric	Polypropylene film (metallised)	Polypropylene film (metallised)
No. of switching per annum	Max. 5000 switching	Max. 6000 switching
Reference standard	IS : 13340/41(ISI mark applicable for 415 and 440V)	IS : 13340/41(ISI mark applicable for 415 and 440V)

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

PhiCap PFC Capacitors

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PhiCap Normal Duty (ND) Capacitors - 3 Phase

Rating KVAr	Voltage V (AC)	Material code	I_R A	C_N F	d x h mm	Packing units	MOQ	Approx. weight Kg
PhiCap Normal Duty - 415 V(AC) 3PH, 50Hz (Series B32343 and B32344)								
0.5	415	B32343L4002A510	0.7	3 x 3	53 x 117	12	12	0.3
1	415	B32343L4012A 10	1.4	3 x 6.5	53 x 117	12	12	0.3
1.5	415	B32343L4012A510	2.0	3 x 9.5	53 x 117	12	12	0.3
2	415	B32343L4022A 10	2.7	3 x 12.5	53 x 117	12	12	0.4
2.5	415	B32343L4022A510	3.4	3 x 15.5	63.5 x 129	12	12	0.4
3	415	B32343L4032A 10	4.1	3 x 18.5	63.5 x 129	12	12	0.4
4	415	B32343L4042A 10	5.5	3 x 25	63.5 x 152	12	12	0.4
5	415	B32343L4052A 10	6.9	3 x 31	63.5 x 152	12	12	0.5
6.3	415	B32344B4071A510	8.8	3 x 39	75 x 195	1	6	0.6
7.5	415	B32344B4072A510	10.4	3 x 46.5	75 x 195	1	6	0.7
8.3	415	B32344B4082A310	11.5	3 x 51.5	75 x 195	1	6	0.7
9	415	B32344B4092A 10	12.5	3 x 55.5	75 x 195	1	6	0.7
10	415	B32344B4102A 10	13.9	3 x 62	85 x 195	1	4	0.7
12.5	415	B32344B4122A510	17.3	3 x 77	85 x 270	1	4	1.0
15	415	B32344B4152A 10	20.8	3 x 92.5	85 x 270	1	4	1.8
20	415	B32344B4202A 10	27.8	3 x 123.5	85 x 345	1	4	1.8
25	415	B32344B4252A 10	34.7	3 x 154	85 x 345	1	4	2.0
PhiCap Normal Duty - 440 V(AC) 3PH, 50Hz (Series B32343 & B32344)								
1	440	B32343L4012A 40	1.3	3 x 5.5	53 x 117	12	12	0.3
1.5	440	B32343L4012A540	1.9	3 x 8.5	53 x 117	12	12	0.3
2	440	B32343L4021A540	2.8	3 x 11.5	53 x 117	12	12	0.4
2.5	440	B32343L4022A540	3.2	3 x 14	63.5 x 129	12	12	0.4
3	440	B32343L4032A 40	3.9	3 x 16.5	63.5 x 129	12	12	0.5
4.2	440	B32343L4051A 40	5.5	3 x 23	63.5 x 129	12	12	0.5
5	440	B32343L4052A 40	6.5	3 x 27.5	63.5 x 152	12	12	0.6
5.6	440	B32343L4052A640	7.3	3 x 31	63.5 x 188	12	12	0.6
6	440	B32344B4071A540	7.8	3 x 33	75 x 195	1	6	0.6
7	440	B32344B4072A 40	9.2	3 x 38.5	75 x 195	1	6	0.6
7.5	440	B32344B4072A540	9.8	3 x 41	75 x 195	1	6	0.6
8.3	440	B32344B4101A 40	10.8	3 x 45.5	75 x 195	1	6	0.6
9	440	B32344B4092A 40	11.8	3 x 49.5	75 x 195	1	6	0.6
10	440	B32344B4102A 40	13.1	3 x 55	85 x 195	1	4	0.6
11.2	440	B32344B4112A240	14.6	3 x 61.4	85 x 195	1	4	0.8
12.5	440	B32344B4151A 40	16.4	3 x 68.5	85 x 270	1	4	0.8
14	440	B32344B4142A 40	18.3	3 x 76.4	85 x 270	1	4	1.0
15	440	B32344B4152A 40	19.6	3 x 82.5	85 x 270	1	4	1.2
16.7	440	B32344B4201A 40	21.9	3 x 91.5	85 x 345	1	4	1.2
19	440	B32344B4192A 40	24.9	3 x 104.5	85 x 345	1	4	1.2
20	440	B32344B4202A 40	26.2	3 x 110	85 x 345	1	4	1.2
20.8	440	B32344B4251A 40	27.3	3 x 114	85 x 345	1	4	1.2
25	440	B32344B4252A 40	32.8	3 x 137.5	90 x 345	1	4	1.5
28	440	B32344B4282A 40	36.7	3 x 153.5	90 x 345	1	4	1.6
30	440	B32344B4302A 40	39.4	3 x 164.5	90 x 345	1	4	1.8

PhiCap PFC Capacitors

Semi-dry biodegradable resin • Stacked winding • Dual safety system

EPCOS

PhiCap Normal Duty (ND) Capacitors - 3 Phase								
Rating KVAr	**Voltage V (AC)**	**Material code**	**I_R A**	**C_N F**	**d x h mm**	**Packing units**	**MOQ**	**Approx. weight Kg**
PhiCap Normal Duty - 480 V(AC) 3PH, 50Hz (Series B32344)								
5	480	B32344B4052A 80	6.0	3 x 23	75 x 195	1	6	0.6
8.3	480	B32344B4082A380	10	3 x 28.2	75 x 270	1	6	0.6
10.4	480	B32344B4121A580	12.5	3 x 48	85 x 270	1	4	0.8
11.1	480	B32344B4112A180	13.4	3 x 51.1	75 x 270	1	6	0.9
12.5	480	B32344B4151A 80	15.0	3 x 58	85 x 345	1	4	0.9
13.8	480	B32344B4132A880	16.6	3 x 63.6	85 x 270	1	4	1.0
15	480	B32344B4152A 80	18.0	3 x 69	85 x 345	1	4	1.5
16.6	480	B32344B4162A680	20	3 x 76.5	85 x 345	1	4	1.5
20.8	480	B32344B4251A 80	25.0	3 x 96	85 x 345	1	4	1.5
22.1	480	B32344B4222A180	26.6	3 x 101.8	90 x 345	1	4	1.8
25	480	B32344B4252A 80	30.0	3 x 115	90 x 345	1	4	1.8
27.7	480	B32344B4272A780	33.3	3 x 127.6	90 x 345	1	4	1.8
30	480	B32344B4302A 80	36.0	3 x 138	90 x 345	1	4	1.9
PhiCap Normal Duty - 525 V(AC) 3PH, 50Hz (Series B32344)								
5	525	B32344B5052A 20	5.5	3 x 19	75 x 195	1	6	0.4
6.3	525	B32344B5071A520	6.9	3 x 24	75 x 195	1	6	0.5
8.3	525	B32344B5082A320	9.1	3 x 32	85 x 270	1	4	0.6
9.9	525	B32344B5092A920	10.9	3 x 38.1	75 x 270	1	6	0.6
10.4	525	B32344B5102A420	11.4	3 x 40	85 x 270	1	4	0.8
12.5	525	B32344B5151A 20	13.7	3 x 48	85 x 270	1	4	1.2
13.2	525	B32344B5132A220	14.5	3 x 50.8	85 x 270	1	4	1.3
16.7	525	B32344B5162A720	18.3	3 x 64	85 x 345	1	4	1.3
20.8	525	B32344B5202A820	22.8	3 x 80	90 x 345	1	4	1.5
26.5	525	B32344B5262A520	29.5	3 x 102.1	116 x 325	1	2	1.8
33.1	525	B32344B5332A120	36.4	3 x 127.5	116 x 325	1	2	2.0

Other voltages available on request.
Packing units for capacitors equal minimum order quantity. Orders will be rounded up to packing unit or multiple thereof.

PhiCap PFC Capacitors

Semi-dry biodegradable resin • Stacked winding • Dual safety system

EPCOS

Rating KVAr	Voltage V (AC)	Material code	I_R A	C_N F	d x h mm	Packing units	MOQ	Approx. weight Kg
PhiCap Heavy Duty (HD) Capacitors - 3 Phase								
PhiCap Heavy Duty - 415 V(AC) 3PH, 50Hz (Series B32447 & B32448)								
1	415	B32447A4012B 10	1.39	3 x 6.5	53 x 129	12	12	0.4
2	415	B32448A4022B 10	2.78	3 x 12.5	78.4 x 195	1	6	0.8
3	415	B32448A4032B 10	4.17	3 x 19	78.4 x 195	1	6	1.0
4	415	B32448A4042B 10	5.56	3 x 25	78.4 x 195	1	6	1.1
5	415	B32448A4052B 10	6.96	3 x 31	88.4 x 195	1	4	1.3
8	415	B32448A4082B 10	11.13	3 x 49.5	88.4 x 270	1	4	1.8
9	415	B32448A4092B 10	12.52	3 x 55.5	88.4 x 270	1	4	1.9
10	415	B32448A4102B 10	13.91	3 x 62	88.4 x 345	1	4	2.1
12.5	415	B32448A4122B510	17.39	3 x 77	88.4 x 345	1	4	2.3
PhiCap Heavy Duty - 440 V(AC) 3PH, 50Hz (Series B32447 & B32448)								
1	440	B32447A4012B 40	1.3	3 x 5.5	53 x 117	12	12	0.5
2	440	B32447A4022B 40	2.62	3 x 12.5	63.5 x129	12	12	0.8
3	440	B32448A4032B 40	3.94	3 x 16.5	75 x 195	1	6	1.1
4	440	B32448A4042B 40	5.25	3 x 22	75 x 195	1	6	1.1
5	440	B32448A4052B 40	6.56	3 x 27.5	75 x 195	1	6	1.2
6	440	B32448A4062B 40	7.8	3 x 33	85 x 195	1	4	1.3
7.5	440	B32448A4072B540	9.84	3 x 41.5	85 x 270	1	4	1.7
8	440	B32448A4082B 40	10.5	3 x 44	85 x 270	1	4	1.8
9	440	B32448A4092B 40	11.8	3 x 49.5	85 x 270	1	4	1.8
10	440	B32448A4102B 40	13.12	3 x 55	85 x 270	1	4	1.9
12.5	440	B32448A4122B540	16.4	3 x 68.5	95 x 270	1	4	2.0
15	440	B32448A4152B 40	19.68	3 x 82.5	100 x 280	1	4	2.5
20	440	B32448A4202B840	26.24	3 x 109.6	116 x 280	1	2	2.9
25	440	B32448A4252B 40	32.8	3 x 137	116 x 325	1	2	3.8
30	440	B32448A4302B 40	39.4	3 x 164.5	136 x 325	1	2	5.0
PhiCap Heavy Duty - 480 V(AC) 3PH, 50Hz (Series B32448)								
5	480	B32448A4052B 80	6.01	3 x 23	75 x 195	1	6	1.2
5.5	480	B32448A4052A580	6.6	3 x 25.3	75 x 195	1	6	1.2
8.3	480	B32448A4082A380	10	3 x 38.2	85 x 270	1	4	1.5
10	480	B32448A4102B 80	12.03	3 x 46	85 x 270	1	4	1.8
11.1	480	B32448A4112A180	13.4	3 x 51.1	85 x 270	1	4	1.9
12.5	480	B32448A4122B580	15.04	3 x 58	85 x 270	1	4	2.0
13.8	480	B32448A4132A880	16.6	3 x 63.6	90 x 270	1	4	2.0
14.5	480	B32448A4142B580	17.44	3 x 67	90 x 270	1	4	2.0
16.6	480	B32448A4162A680	20	3 x 76.5	85 x 345	1	4	2.3
20	480	B32448A4202B880	24.06	3 x 95.8	116 x 280	1	2	2.8
22.1	480	B32448A4222A180	26.6	3 x 101.8	116 x 280	1	2	2.8
25	480	B32448A4252B 80	30.07	3 x 115.1	116 x 325	1	2	3.1
27.7	480	B32448A4272A780	33.3	3 x 127.6	116 x 325	1	2	3.7
30	480	B32448A4302B 80	36.09	3 x 138.1	116 x 325	1	2	4.6

Other voltages available on request.
* Packing units for capacitors equal minimum order quantity. Orders will be rounded up to packing unit or multiple thereof.

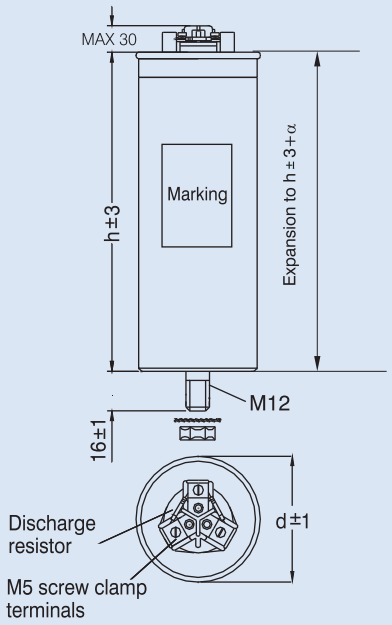
PhiCap PFC Capacitors

Semi-dry biodegradable resin • Stacked winding • Dual safety system

Dimensional drawings:

Capacitor B32344 series

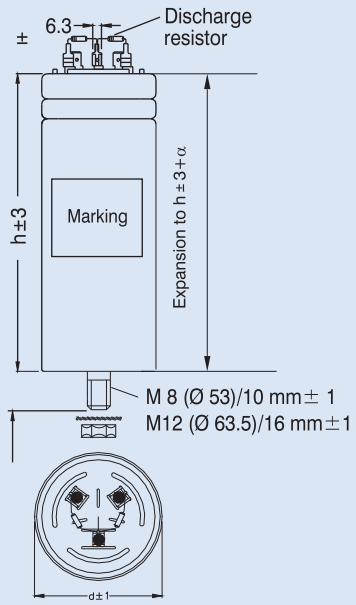
Capacitors with metal top



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

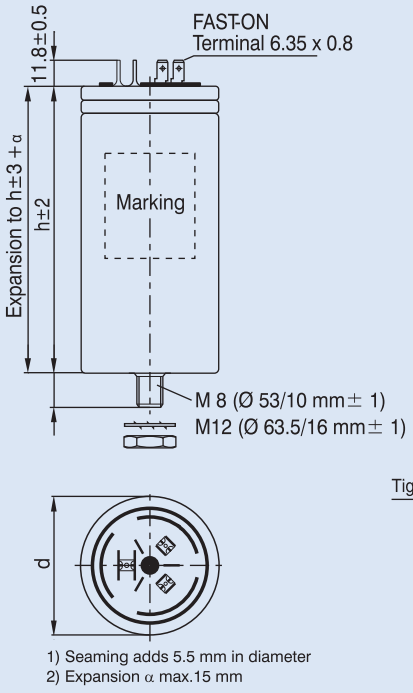
Capacitor B32343 series

Capacitors with plastic top



Capacitor B32447 series

Capacitors with plastic top

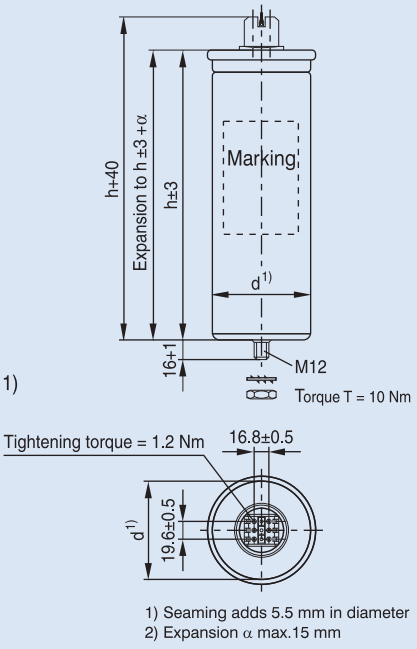


1) Seaming adds 5.5 mm in diameter
2) Expansion α max.15 mm

Capacitor B32448 series

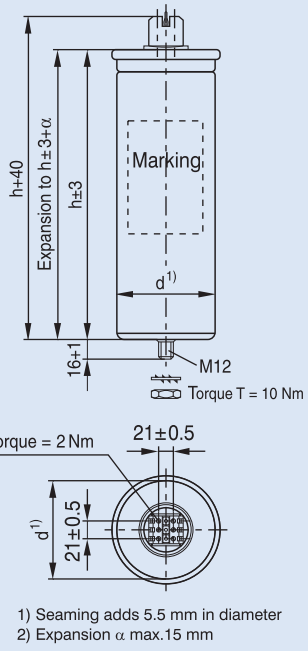
Capacitors with metal top

Can diameter up to 90 mm



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

Can diameter above 90 mm



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