



Film Capacitors – Power Factor Correction

PhiCap Heavy Duty capacitors

Series/Type: MKP
Ordering code: B32447H*/ B32448H*
Date: 2020-09-24
Version: 4.0

Construction

- Dielectric: Polypropylene film
- Non PCB, soft biodegradable resin
- Extruded round aluminum can with stud
- Provided with discharge resistors
- Overpressure disconnecter

Features

- Three phase, delta connected
- Self-healing technology
- Naturally air cooled (or forced air cooling)
- Indoor mounting

Typical applications

- For Power Factor Correction

Terminals

- 6.3 mm fast-on terminals for plastic top
- Sigut terminal for metal top

Mounting parts

- Threaded stud at bottom of can
(max. torque = 4 Nm for M8 & 10 Nm for M12)

Technical data and specifications

Characteristics	
Rated capacitance C_R	As per table in page 7 to 8
Tolerance	-5 /+10%
Connection	D (Delta)
Rated voltage V_R	As per table in page 7 to 8
Rated frequency f_R	50 Hz
Output	As per table in page 7 to 8
Rated current I_R	As per table in page 7 to 8
Dimensions (d x h)	As per table in page 7 to 8

Maximum ratings

Maximum permissible voltage (V_{max})	$V_R + 10\%$ (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 (I_{max})	Up to $1.8 \times I_R$ (A) (including combined effects of harmonics, overvoltages and capacitance tolerance)
Maximum inrush current (I_s)	$250 \times I_R$ (A) Max. 7500 switching's per year

Test data

Voltage test between terminals (V_{TT})	$2.15 \times V_R$ V AC / 50 Hz, 2s
Voltage test between terminals and container (V_{TC})	3600 V AC / 50 Hz, 2 s

Design data

Dielectric losses	≤ 0.2 W / kvar
* Total losses	≤ 0.5 W / kvar
Impregnation	Non PCB, soft biodegradable resin

* Without discharge resistor

Climatic category: -25/D

T_{min}	-25 °C
T_{max}	+55 °C
Ambient temperature	Class -25/D: Max. short time: +55 °C, max. mean 24 h: +45 °C; max mean 1 year: +35 °C; lowest temperature: - 25 °C
Storage temperature	-25 °C to +85 °C
Max. hotspot temperature	85 °C
Humidity	Average relative < 95%

Mean life expectancy


t_{LD}	Up to 130 000 hours (temperature class -25/D); $\Theta_{HS} \leq 70$ °C (Max. mean ambient temperature per year = +35 °C) Failure rate < 3%
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Terminals		
Degree of protection	IP20	
Plastic top – 1 to 6.3 kvar	6.3 mm fast-on	
	Ø 53 mm	Ø 63.5 mm
Creepage distance	10.5 mm	10.0 mm
Clearance	13.0 mm	16.5 mm

	Metal top – 6.3 kvar and above	
	Sigut terminal up to Ø 90 mm	above Ø 90 mm
Max. torque	1.2 Nm	2.0 Nm
Cable cross section	16 mm ² (without cable and lug)	25 mm ² (without cable and lug)
Maximum terminal current	50 A	80 A
Creepage distance (min)	12.7 mm	
Clearance (min)	9.6 mm	

Mounting	
Fixing	Threaded bolt M12 except M8 for d = 53 mm
Max. torque (Al can stud)	10 Nm except 4 Nm for d = 53 mm
Mounting position	Vertical upright
Maximum altitude	4000 m above sea level

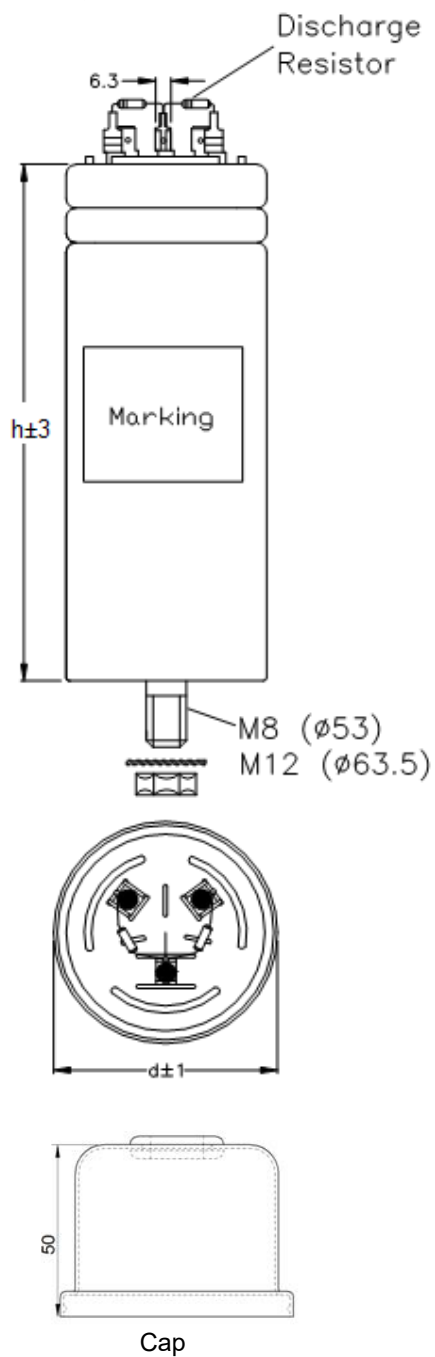
Safety	
Mechanical safety	Overpressure disconnecter
Discharge resistor time	≤ 3 min (75 V or less)

Approvals/Reference standards		
Approval mark	Standard of reference	Certificate
IS:13340 (Part1)/ IEC 60831-1  CM/L-1432640	IS 13340 (2012) / IEC 60831 (2002)	ISI mark applicable for 415 V, 440 V, 480 V & 525 V ratings

Dimensional drawings

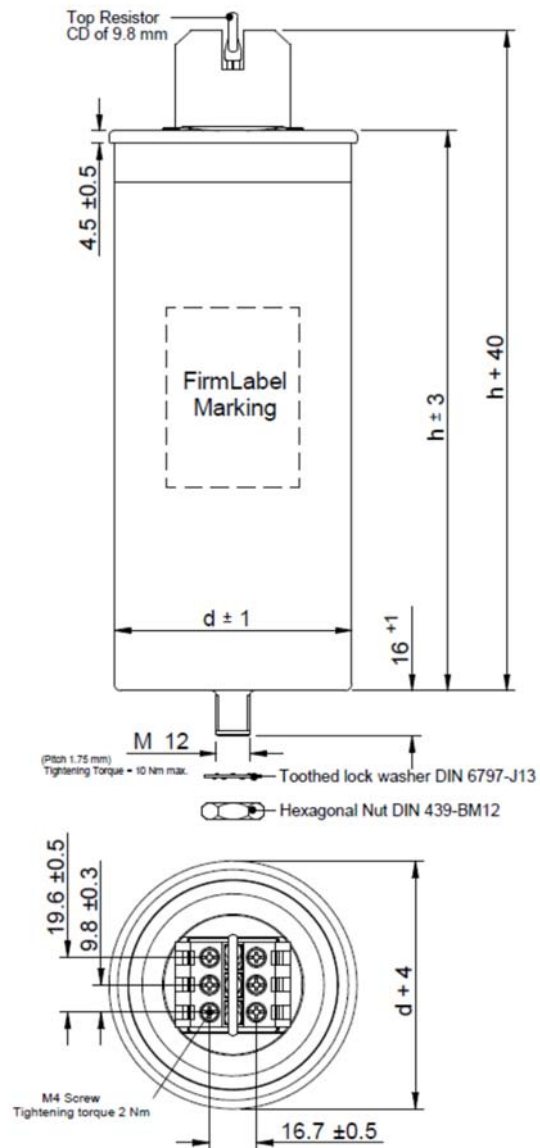
Capacitors with plastic top (B32447H)

Terminal type A

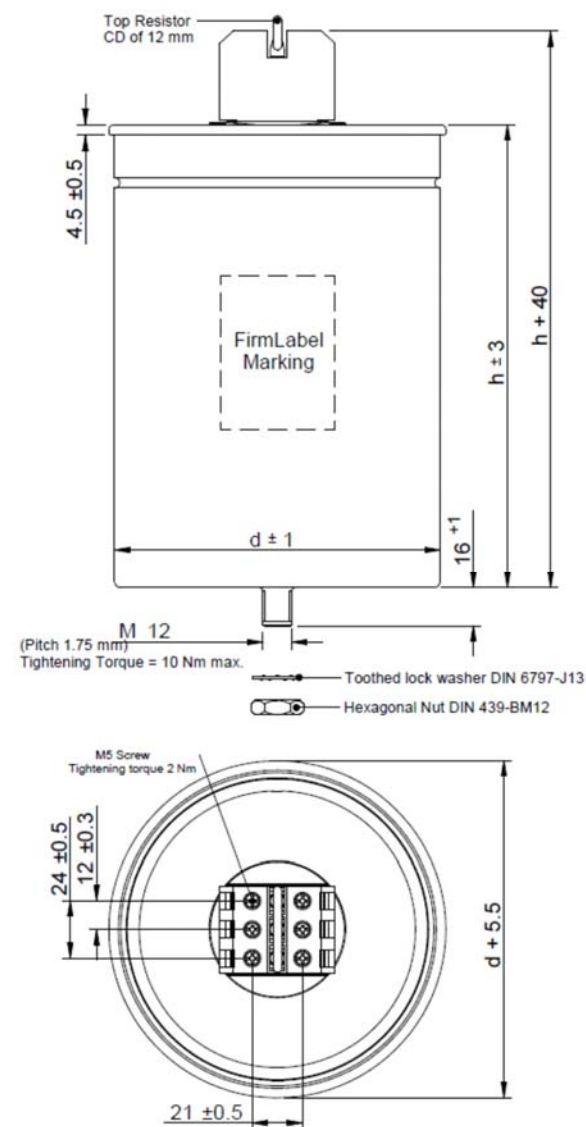


Capacitors with Metal Top (B32448H)

Terminal type B



Terminal type C



Ordering codes

Rated voltage V_R V	Power 50 Hz kvar	Rated capacitance C_R μF	Rated current I_R 50 Hz A	Dimensions d x h mm	Terminal type	Ordering code
415	1.0	3 x 6.2	1.4	53 x 117	A	B32447H4012A015
	2.0	3 x 12.3	2.8	53 x 117	A	B32447H4022A015
	3.0	3 x 18.5	4.2	53 x 152	A	B32447H4032A015
	4.0	3 x 24.6	5.6	53 x 152	A	B32447H4042A015
	5.0	3 x 30.8	7.0	63.5 x 129	A	B32447H4052A015
	7.5	3 x 46.2	10.4	75 x 160	B	B32448H4072A515
	8.0	3 x 49.3	11.1	75 x 160	B	B32447H4082A015
	9.0	3 x 55.4	12.5	75 x 160	B	B32447H4092A015
	10.0	3 x 61.6	13.9	75 x 197	B	B32448H4102A015
	12.5	3 x 77.0	17.4	75 x 197	B	B32448H4122A515
	15.0	3 x 92.4	20.9	75 x 270	B	B32448H4152A015
	20.0	3 x 123.2	27.8	75 x 270	B	B32448H4202A015
	25.0	3 x 154.0	34.8	85 x 270	B	B32448H4252A015
440	1.0	3 x 5.5	1.3	53 x 117	A	B32447H4012A040
	2.0	3 x 11.0	2.6	53 x 117	A	B32447H4022A040
	3.0	3 x 16.4	3.9	53 x 117	A	B32447H4032A040
	4.0	3 x 21.9	5.2	53 x 152	A	B32447H4042A040
	5.0	3 x 27.4	6.6	53 x 152	A	B32447H4052A040
	6.0	3 x 32.9	7.9	63.5 x 152	A	B32447H4062A040
	7.5	3 x 41.1	9.8	75 x 160	B	B32448H4072A540
	8.3	3 x 45.5	10.9	75 x 160	B	B32448H4082A340
	9.0	3 x 49.3	11.8	75 x 160	B	B32448H4092A040
	10.0	3 x 54.8	13.1	75 x 197	B	B32448H4102A040
	12.5	3 x 68.5	16.4	75 x 197	B	B32448H4122A540
	15.0	3 x 82.2	19.7	75 x 270	B	B32448H4152A040
	20.0	3 x 109.6	26.2	85 x 270	B	B32448H4202A040
	25.0	3 x 137.0	32.8	90 x 270	B	B32448H4252A040
	28.1	3 x 154.0	36.9	85 x 348	B	B32448H4282A140
30.0	3 x 164.4	39.4	90 x 348	B	B32448H4302A040	
480	5.0	3 x 23.0	6.0	63.5 x 152	A	B32447H4052A080
	5.5	3 x 25.3	6.6	63.5 x 152	A	B32447H4052A580
	6.3	3 x 29.0	7.6	63.5 x 152	A	B32447H4062A380
	8.3	3 x 38.2	10.0	75 x 160	B	B32448H4082A380
	10.4	3 x 47.9	12.5	75 x 197	B	B32448H4102A480
	11.1	3 x 51.1	13.4	75 x 197	B	B32448H4112A180
	12.5	3 x 57.6	15.0	75 x 197	B	B32448H4122A580
	13.8	3 x 63.5	16.6	75 x 270	B	B32448H4132A880

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

Display of ordering codes for TDK Electronics products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications, on the company website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.** Detailed information can be found on the Internet under www.tdk-electronics.tdk.com/orderingcodes.

Cautions and warnings

- In case of dents of more than 1 mm depth or any other mechanical damage, capacitors must not be used at all.
- This applies also in cases of oil leakages.
- To ensure the full functionality of the overpressure disconnecter, elastic elements must not be hindered and a minimum space of 12 mm has to be kept above each capacitor.
- Do not handle the capacitor before it is discharged.
- Resonance cases must be avoided by appropriate application design in any case.
- Handle capacitors carefully, because they may still be charged even after disconnection due to faulty discharging devices.
- Protect the capacitor properly against over current and short circuit.
- Failure to follow cautions may result, worst case, in premature failures, bursting and fire.

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 service life and protects against electric shock. The capacitor must be discharged to 50 V or less within 60 seconds. There must be not any switch, fuse or any other disconnecting device in the circuit between the power capacitor and the discharging device. Phi cap-HD capacitors have a pre-mounted ceramic discharge module; alternatively discharge reactors are available from TDK. Discharge and short circuit capacitor before handling!

Service life expectancy

Electrical components do not have an unlimited service life expectancy; this applies to self-healing capacitors too. The maximum service life expectancy may vary depending on the application the capacitor is used in.

Safety

Electrical or mechanical misapplication of capacitors may be hazardous. Personal injury or property damage may result from bursting of the capacitor or from expulsion of oil or melted material due to mechanical disruption of the capacitor.

- Ensure good, effective grounding for capacitor enclosures.
- Provide means of disconnecting and insulating a faulty component/bank.
- The terminals of capacitors, connected bus bars and cables as well as other devices may also be energized.
- Follow good engineering practice.

Thermal load/over-temperature

After installation of the capacitor it is necessary to verify that maximum hot-spot temperature is not exceeded at extreme service conditions.

Overpressure disconnecter

To ensure full functionality of an overpressure disconnecter, the following must be observed:

1. The elastic elements must not be hindered, i.e.
 - Connecting lines must be flexible leads (cables).
 - There must be sufficient space (min. 12 mm) for expansion above the connections. This will enable a longitudinal extension of the can to secure the overpressure disconnecter work.
 - Folding beads must not be retained by clamps.
2. The maximum allowed fault current of 10000 A in accordance with UL 810 standard must be assured by the application.
3. Stress parameters of the capacitor must be within the IS 13340 specification.

Overcurrent and short circuit protection

- Use HRC fuses or MCCBs for short circuit protection. Short circuit protection and connecting cables should be selected so that 1.5 times the rated capacitor current can be permanently handled.
- HRC fuses do not protect a capacitor against overload – they are only for short circuit protection.
- The HRC fuse rating should be 1.6 to 1.8 times rated capacitor current.
- Do not use HRC fuses to switch capacitors (risk of arcing).
- Use thermal magnetic over current relays for overload protection.

Resonance cases

Resonance cases must be avoided by appropriate application design in any case. Maximum total RMS capacitor current (incl. fundamental harmonic current) specified in technical data must not be exceeded.

Re-switching vs. phase-opposition

In case of voltage interruption, a sufficient discharge time has to be ensured to avoid phase-opposition and resulting high inrush currents.

Vibration resistance

The resistance to vibration of capacitors corresponds to IEC 68, part 2–6.

Max. test conditions:

Test duration	6 h*
Frequency range 1	10 ... 55 Hz*
Displacement amplitude	0.75 mm*

*corresponding to max. 98.1 m/s or 10 g

These figures apply to the capacitor alone. Because the fixing and the terminals may influence the vibration properties, it is necessary to check stability when a capacitor is built in and exposed to vibration. Irrespective of this, you are advised not to locate capacitors where vibration amplitude reaches the maximum in strongly vibrating equipment.

Mechanical protection

The capacitor has to be installed in a way that mechanical damages and dents in the aluminum can be avoided.

Grounding

The threaded bottom stud of the capacitor has to be used for grounding. In case grounding is done via metal chassis that the capacitor is mounted to, the layer of varnish beneath the washer and nut should be removed. The maximum tightening torque is 4 Nm for M8 stud and 10 Nm for M12 stud.

Maintenance

- Check tightness of the connections/terminals periodically.
- Take current reading twice a year and compare with nominal current. Use a harmonic analyser or true effective RMS-meter.
- In case of current above the nominal current check your application for modifications.
- If a significant increase in the amount of non-linear loads has been detected, then a consultant has to be called in for a harmonic study.
- In case of the presence of harmonics installation of a de-tuned capacitor bank (reactors) must be considered.
- Check the temperature of capacitors directly after operation for a longer period, but make sure that the capacitors have been switched off. In case of excessive temperature of individual capacitors, it is recommended to replace these capacitors, as this should be an indication for loss factor increase, which is a sign for reaching end of life.

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.

Note

For detailed information about PFC capacitors and cautions, refer to the latest version of TDK PFC Product Profile.

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.**
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Important notes

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.

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