Power Factor Correction

PhiCap Capacitors for Power Quality Solutions

Based on the well-proven MKP-technology with stacked winding, PhiCap© capacitors are found in numberless industrial and semi-industrial surroundings all over the world. The cost-effective design offers a broad output range from 0.7 to 6.0 kvar for single-phase capacitors and 0.5 to 30 kvar for three-phase capacitors. The voltage range covers 230 to 525 V.

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
- Output range 0.5 ... 30 kvar
- Voltage range 230 ... 525 V AC

Safety

- Self-healing
- Overpressure disconnector
- Optimized capacitor safety terminal for B32344E series

Electrical

- Up to 30 kvar per case for three-phase applications
- Up to 6 kvar per case for single-phase applications
- Long life expectancy up to 135 000 hours at temperature class –40/C
- High pulse current withstand capability (up to 200 • I_R)

Mechanical and maintenance

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

www.tdk-electronics.tdk.com

PhiCap PFC Capacitors

Biodegradable soft resin impregnated ● Stacked winding ● Dual safety system

EPCOS

General

PhiCap capacitors are a tried and tested series of MKP (metalized polypropylene) capacitors from TDK 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.

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- Automatic capacitor banks
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Features

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- Stacked winding
- MKP technology
- Voltage range 230 … 525 V
- Output range 0.5 … 30 kvar

Electrical

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- Up to 6 kvar per case for single-phase applications
- Long life expectancy of up to 135 000 hours
- High pulse current withstand capability (up to 200 · I_R)

Mechanical and maintenance

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

Safety

- Self-healing
- Overpressure disconnector
- Shock hazard protected optimized capacitor safety terminal for B32344 series

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EPCOS

Technical data and limit values		
Standards IEC 60831-1+2, IS: 13340/41, GOST		
Overvoltage	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)
Overcurrent	I_{max}	up to 1.5 · I_R including combined effects of harmonics, overvoltages and capacitance
Inrush current	I_S	up to 200 · I_R
Losses: **– Dielectric** **– Total***		 < 0.2 W/kvar < 0.45 W/kvar
Rated frequency	f	50/60 Hz
Capacitance tolerance		–5% / 10%
Test voltage, terminal / terminal	V_{TT}	2.15 · V_R, AC, 2 s
Test voltage, terminal / case	V_{TC}	3000 V AC, 10 s
Mean life expectancy	$t_{LD(Co)}$	up to 135 000 h (temperature class –40/C) up to 100 000 h (temperature class –40/D)
Ambient temperature		–40/D; max. temp. +55 °C; max. mean 24 h = +45 °C; max. mean 1 year = +35 °C; lowest temperature = –40 °C
Cooling		natural or forced
Humidity	H_{rel}	max. 95%
Altitude		max. 4000 m above sea level
Mounting position		upright
Mounting and grounding		threaded M12 (10 Nm) for case size diam. > 53 mm M8 (4 Nm) for case size diam. ≤ 53 mm
Safety		self-healing technology, overpressure disconnector, maximum allowed fault current 10 000 A in accordance with UL 810 standard
Discharge resistors time		60 s to 75 or less
Case		extruded aluminum can
Enclosure		IP00 for B32340/B32343, indoor mounting (IP54 for B32344 with plastic terminal cap; for other series please refer to page 53)
Dielectric		polypropylene film
Impregnation		biodegradable soft resin, semi-dry
Terminals		optimized capacitor safety terminals for B32344 series, max. current 50 A, max. 16 mm² cable cross section, fast-on terminals for B32340 and B32343 series
Number of switching operations		max. 5000 switchings per year according to IEC 60831-1+/2

* Without discharge resistor

PhiCap PFC Capacitors

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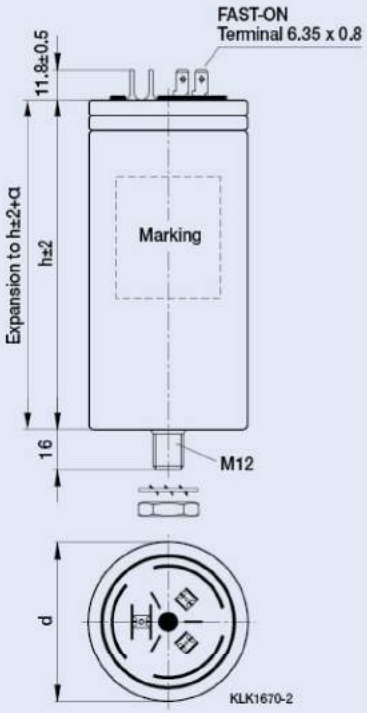
Dimensional drawings: three-phase capacitors

Capacitor B32343 series



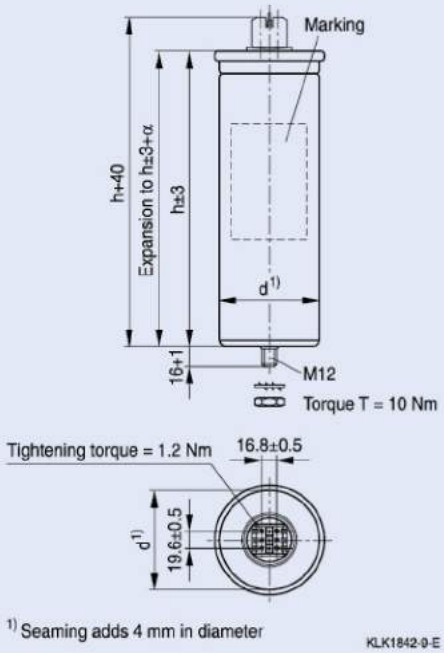
Creepage distance	10.5 mm (ø 53) 10.0 mm (ø 63.5)
Clearance	13.0 mm (ø 53) 16.5 mm (ø 63.5)
Diameter (ø)	53.0 mm 63.5 mm
Expansion α	max. 12 mm

Mounting

	M12 (ø 63.5 mm)	M8 (ø 53.0 mm)
Torque	T = 10 Nm	T = 4 Nm
Toothed washer	J12.5 DIN 6797	J8.0 DIN 6797
Hex nut	BM12 DIN 439	BM 8 DIN 439

Dimensional drawings: three-phase capacitors

Capacitor B32344 series



Creepage distance	9.6 mm
Clearance	12.7 mm
Diameter d (ø)	75.0 mm / 85.0 mm
Expansion α	max. 13 mm

Mounting

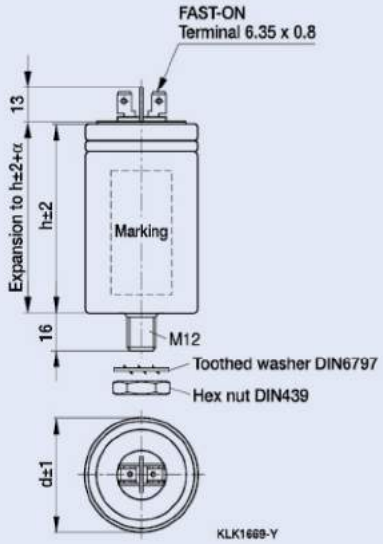
	M12
Torque	T = 10 Nm
Toothed washer	J12.5 DIN 6797
Hex nut	BM12 DIN 439

PhiCap PFC Capacitors

Biodegradable soft resin impregnated ● Stacked winding ● Dual safety system

Dimensional drawings: single-phase capacitors

Capacitor B32340 series

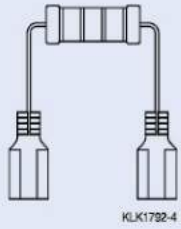


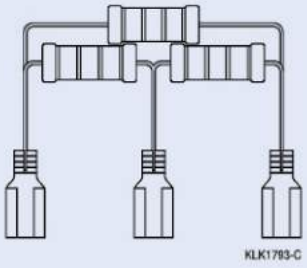
Creepage distance	10.0 mm
Clearance	16.5 mm
Diameter (ø)	63.5 mm
Expansion α	max. 12 mm

Mounting

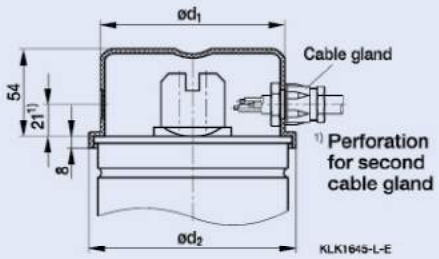
	M12
Torque	T = 10 Nm
Toothed washer	J12.5 DIN 6797
Hex nut	BM12 DIN 439

Discharge resistors for B32340 and B32343 series





Protective cover for terminal, protection class IP54



Ø in mm	Ordering code
53.0	B44066K0530A000*
63.5	B44066K0635A000*
75	B44066K0795A000
85	B44066K0895A000

* For B32340 and B32343 series (diameter 53.0 and 63.5 mm), terminal covers with cable entry on top

For IP54 additional cable gland at cable entry required.

Discharge resistor for B32344 series refer to page 30.

PhiCap PFC Capacitors

Biodegradable soft resin impregnated ● Stacked winding ● Dual safety system

EPCOS

Three-phase capacitors

Type	50 Hz		60 Hz		C_R	d x h	Weight	Ordering code	Packing unit*
	Output kvar	I_R A	Output kvar	I_R A	µF	mm	kg		
Rated voltage 230 V AC, 50 / 60 Hz, delta connection									
MKP230-D-0.5	0.5	1.3	0.6	1.6	3 · 10	53 x 114	0.3	B32343C2002A530	12
MKP230-D-0.7	0.7	1.9	0.9	2.3	3 · 15	53 x 114	0.3	B32343C2002A730	12
MKP230-D-1.0	1.0	2.5	1.2	3.0	3 · 20	63.5 x 129	0.3	B32343C2012A030	12
MKP230-D-1.5	1.5	3.8	1.8	4.6	3 · 30	63.5 x 129	0.4	B32343C2012A530	12
MKP230-D-2.0	2.0	5.0	2.4	6.0	3 · 42	75 x 138	0.4	B32344E2022A030	6
MKP230-D-2.5	2.5	6.3	3.0	7.5	3 · 50	75 x 138	0.4	B32344E2022A530	6
MKP230-D-5.0	5.0	12.6	6.0	15.1	3 · 100	75 x 198	0.6	B32344E2052A030	4
MKP230-D-7.5	7.5	18.8	9.0	22.6	3 · 150	85 x 198	0.8	B32344E2072A530	4
MKP230-D-10.0	10.0	25.1	12.0	30.2	3 · 200	85 x 273	1.2	B32344E2102A030	4
MKP230-D-12.5	12.5	31.4	15.0	37.7	3 · 250	85 x 348	1.5	B32344E2122A530	4
MKP230-D-15.0	15.0	37.7	–	–	3 · 300	85 x 348	1.5	B32344E2152A030	4
Rated voltage 400 V AC, 50 / 60 Hz, delta connection									
MKP400-D-1.0	1.0	1.4	1.2	1.7	3 · 7	53 x 114	0.3	B32343C4012A000	12
MKP400-D-1.5	1.5	2.2	1.8	2.6	3 · 10	53 x 114	0.3	B32343C4012A500	12
MKP400-D-2.0	2.0	2.9	2.4	3.5	3 · 13	63.5 x 129	0.4	B32343C4022A000	12
MKP400-D-2.5	2.5	3.6	3.0	4.3	3 · 17	63.5 x 129	0.4	B32343C4022A500	12
MKP400-D-5.0	5.0	7.2	6.0	8.6	3 · 33	63.5 x 129	0.4	B32343C4052A000	12
MKP400-D-6.3	6.3	9.1	7.5	11.0	3 · 42	75 x 160	0.5	B32344E4071A500	6
MKP400-D-7.5	7.5	10.8	9.0	13.0	3 · 50	75 x 160	0.5	B32344E4072A500	6
MKP400-D-8.3	8.3	12.0	10.0	14.5	3 · 55	75 x 160	0.5	B32344E4101A000	6
MKP400-D-10.0	10.0	14.5	12.0	17.3	3 · 67	75 x 198	0.6	B32344E4102A000	4
MKP400-D-12.5	12.5	18.1	15.0	21.7	3 · 83	85 x 198	0.8	B32344E4122A500	4
MKP400-D-15.0	15.0	21.7	18.0	26.0	3 · 100	85 x 198	0.8	B32344E4152A000	4
MKP400-D-16.7	16.7	24.1	20.0	28.9	3 · 111	85 x 198	0.8	B32344E4201A000	4
MKP400-D-20.0	20.0	28.9	24.0	34.7	3 · 133	85 x 273	1.1	B32344E4202A000	4
MKP400-D-25.0	25.0	36.1	–	–	3 · 166	85 x 273	1.5	B32344E4252A000	4
MKP400-D-30.0	30.0	43.3	–	–	3 · 199	90 x 348	2.5	B32344E4302A000	4
Rated voltage 415 V AC, 50 / 60 Hz, delta connection									
MKP415-D-1.0	1.0	1.4	1.2	1.6	3 · 6	53 x 114	0.3	B32343C4012A010	12
MKP415-D-1.5	1.5	2.1	1.8	2.4	3 · 9	53 x 114	0.3	B32343C4012A510	12
MKP415-D-2.0	2.0	2.8	2.4	3.4	3 · 12	53 x 114	0.4	B32343C4022A010	12
MKP415-D-2.5	2.5	3.5	3.0	4.2	3 · 15	63.5 x 129	0.4	B32343C4022A510	12
MKP415-D-5.0	5.0	7.0	6.0	8.4	3 · 31	63.5 x 154	0.4	B32343C4052A010	12
MKP415-D-6.3	6.3	8.8	7.5	10.6	3 · 39	75 x 160	0.5	B32344E4071A510	6
MKP415-D-7.5	7.5	10.4	9.0	12.5	3 · 46	75 x 198	0.6	B32344E4072A510	4
MKP415-D-10.0	10.0	13.9	12.0	16.7	3 · 62	75 x 198	0.6	B32344E4102A010	4
MKP415-D-12.5	12.5	17.4	15.0	20.9	3 · 77	85 x 198	0.8	B32344E4122A510	4
MKP415-D-15.0	15.0	20.9	18.0	25.1	3 · 92	85 x 273	1.2	B32344E4152A010	4
MKP415-D-20.0	20.0	27.9	24.0	33.4	3 · 123	85 x 273	1.2	B32344E4202A010	4
MKP415-D-25.0	25.0	34.8	–	–	3 · 154	85 x 348	1.5	B32344E4252A010	4

PhiCap PFC Capacitors

Biodegradable soft resin impregnated ● Stacked winding ● Dual safety system

EPCOS

Three-phase capacitors

Type	50 Hz		60 Hz		C_R	d x h	Weight	Ordering code	Packing unit*
	Output kvar	I_R A	Output kvar	I_R A	µF	mm	kg		
Rated voltage 440 V AC, 50 / 60 Hz, delta connection									
MKP440-D-10.0	10.0	13.1	12.0	15.8	3 · 55	75 x 198	0.6	B32344E4102A040	4
MKP440-D-15.0	15.0	19.7	18.0	23.6	3 · 82	85 x 273	1.2	B32344E4152A040	4
MKP440-D-20.0	20.0	26.4	24.0	31.6	3 · 110	85 x 273	1.2	B32344E4202A040	4
MKP440-D-25.0	25.0	32.8	30.0	40.0	3 · 137.5	85 x 348	1.5	B32344E4252A040	4
MKP440-D-30.0	30.0	39.0	36.0	46.8	3 · 164.5	85 x 348	1.6	B32344E4302A040	4
Rated voltage 480 V AC, 50 / 60 Hz, delta connection									
MKP480-D-1.5	1.5	1.8	1.8	2.2	3 · 7	63.5 x 129	0.4	B32343C4012A580	12
MKP480-D-2.0	2.0	2.4	2.4	2.9	3 · 9	63.5 x 129	0.4	B32343C4022A080	12
MKP480-D-2.5	2.5	3.0	3.0	3.6	3 · 11	63.5 x 129	0.4	B32343C4022A580	12
MKP480-D-4.2	4.2	5.1	5.0	6.1	3 · 19	63.5 x 154	0.5	B32343C4051A080	12
MKP480-D-5.0	5.0	6.0	6.0	7.2	3 · 23	75 x 160	0.5	B32344E4052A080	6
MKP480-D-6.3	6.3	7.6	7.6	9.1	3 · 29	75 x 160	0.5	B32344E4071A580	6
MKP480-D-7.5	7.5	9.0	9.0	10.8	3 · 35	75 x 198	0.6	B32344E4072A580	4
MKP480-D-8.3	8.3	10.0	10.0	12.0	3 · 38	75 x 198	0.6	B32344E4101A080	4
MKP480-D-10.4	10.4	12.5	12.5	15.0	3 · 48	85 x 198	0.8	B32344E4121A580	4
MKP480-D-12.5	12.5	15.1	15.0	18.1	3 · 58	85 x 198	0.8	B32344E4151A080	4
MKP480-D-15.0	15.0	18.1	18.0	21.7	3 · 69	85 x 273	1.2	B32344E4152A080	4
MKP480-D-16.7	16.7	20.1	20.0	24.1	3 · 77	85 x 273	1.2	B32344E4162A780	4
MKP480-D-20.8	20.8	25.0	25.0	30.1	3 · 96	85 x 273	1.2	B32344E4202A080	4
MKP480-D-25.0	25.0	30.1	30.0	36.1	3 · 115	85 x 348	1.5	B32344E4252A080	4
MKP480-D-30.0	30.0	36.1	–	–	3 · 138	90 x 348	1.5	B32344E4302A080	4
Rated voltage 525 V AC, 50 / 60 Hz, delta connection									
MKP525-D-1.0	1.0	1.1	1.2	1.3	3 · 4	53 x 114	0.3	B32343C5012A020	12
MKP525-D-1.5	1.5	1.6	1.8	2.0	3 · 6	53 x 114	0.3	B32343C5012A520	12
MKP525-D-2.0	2.0	2.2	2.4	2.6	3 · 8	63.5 x 129	0.4	B32343C5022A020	12
MKP525-D-2.5	2.5	2.7	2.7	3.0	3 · 9	63.5 x 129	0.4	B32343C5022A520	12
MKP525-D-5.0	5.0	5.5	6.0	6.6	3 · 19	75 x 160	0.3	B32344E5061A020	6
MKP525-D-6.3	6.3	6.9	7.6	8.3	3 · 24	75 x 160	0.5	B32344E5071A520	6
MKP525-D-8.3	8.3	9.1	10.0	11.0	3 · 32	75 x 198	0.6	B32344E5101A020	4
MKP525-D-10.4	10.4	11.5	12.5	13.7	3 · 40	85 x 198	0.8	B32344E5121A520	4
MKP525-D-12.5	12.5	13.8	15.0	16.5	3 · 48	85 x 273	1.2	B32344E5151A020	4
MKP525-D-16.7	16.7	18.3	20.0	21.9	3 · 64	85 x 273	1.2	B32344E5201A020	4
MKP525-D-20.8	20.8	22.9	25.0	27.5	3 · 80	85 x 348	1.5	B32344E5202A020	4
MKP525-D-25.0	25.0	27.5	30.0	33.0	3 · 96	85 x 348	1.5	B32344E5252A020	4

PhiCap PFC Capacitors

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EPCOS

Single-phase capacitors

Type	50 Hz		60 Hz		C_R	d x h	Weight	Ordering code	Packing unit*
	Output kvar	I_R A	Output kvar	I_R A	µF	mm	kg		
Rated voltage 230 V AC, 50 / 60 Hz									
MKP230-I-0.8	0.8	3.6	1.0	4.3	50	63.5 x 105	0.30	B32340C2002A830	12
MKP230-I-1.7	1.7	7.2	2.0	8.7	100	63.5 x 142	0.40	B32340C2012A730	12
MKP230-I-2.5	2.5	10.9	3.0	13.1	150	63.5 x 142	0.50	B32340C2022A530	12
Rated voltage 400 V AC, 50 / 60 Hz									
MKP400-I-0.8	0.8	2.0	1.0	2.3	15	63.5 x 68	0.30	B32340C3001A880	12
MKP400-I-1.7	1.7	4.2	2.0	5.0	33	63.5 x 68	0.30	B32340C4012A700	12
MKP400-I-2.5	2.5	6.3	3.0	7.5	50	63.5 x 105	0.40	B32340C4022A500	12
MKP400-I-3.3	3.3	8.4	4.0	10.0	66	63.5 x 105	0.40	B32340C4032A300	12
MKP400-I-4.2	4.2	10.4	5.0	12.5	84	63.5 x 142	0.40	B32340C4051A000	12
MKP400-I-5.0	5.0	12.4	6.0	15.0	99	63.5 x 142	0.50	B32340C4052A000	12
Rated voltage 415 V AC, 50 / 60 Hz									
MKP415-I-0.8	0.8	2.0	1.0	2.4	15	63.5 x 68	0.35	B32340C4082A810	12
MKP415-I-1.7	1.7	4.0	2.0	4.8	31	63.5 x 105	0.45	B32340C4012A710	12
MKP415-I-2.5	2.5	6.0	3.0	7.2	46	63.5 x 105	0.50	B32340C4022A510	12
MKP415-I-3.3	3.3	8.0	4.0	9.7	62	63.5 x 142	0.50	B32340C4032A310	12
MKP415-I-5.0	5.0	12.0	6.0	14.5	91	63.5 x 142	0.60	B32340C4052A010	12
Rated voltage 440 V AC, 50 / 60 Hz									
MKP440-I-0.7	0.7	1.6	0.8	1.9	11	63.5 x 68	0.30	B32340C4001A840	12
MKP440-I-1.4	1.4	3.2	1.7	3.8	23	63.5 x 68	0.30	B32340C4011A740	12
MKP440-I-2.1	2.1	4.7	2.5	5.7	34	63.5 x 105	0.40	B32340C4021A540	12
MKP440-I-2.8	2.8	6.4	3.3	7.6	46	63.5 x 105	0.40	B32340C4031A340	12
MKP440-I-3.3	3.3	7.6	4.0	9.1	55	63.5 x 142	0.50	B32340C4032A340	12
MKP440-I-4.2	4.2	9.5	5.0	11.4	68	63.5 x 142	0.50	B32340C4051A040	12
MKP440-I-5.0	5.0	11.4	6.0	13.6	82	63.5 x 142	0.60	B32340C4052A040	12
Rated voltage 480 V AC, 50 / 60 Hz									
MKP480-I-0.7	0.7	1.5	0.8	1.7	10	63.5 x 105	0.30	B32340C4001A880	12
MKP480-I-1.4	1.4	2.9	1.7	3.5	19	63.5 x 105	0.30	B32340C4011A780	12
MKP480-I-2.1	2.1	4.3	2.5	5.2	29	63.5 x 105	0.50	B32340C4021A580	12
MKP480-I-2.8	2.8	5.8	3.3	6.9	38	63.5 x 142	0.50	B32340C4031A380	12
Rated voltage 525 V AC, 50 / 60 Hz									
MKP525-I-1.4	1.4	2.6	1.7	3.1	16	63.5 x 105	0.30	B32340C5011A720	12
MKP525-I-2.8	2.8	5.2	3.3	6.2	31	63.5 x 142	0.50	B32340C5031A330	12
MKP525-I-3.3	3.3	6.3	4.0	7.6	38	63.5 x 142	0.60	B32340C5032A320	12
MKP525-I-4.2	4.2	8.0	5.0	9.5	48	63.5 x 142	0.70	B32340C5051A020	12

Types for voltages 220, 240, 600, 660 V and other kvar-values available upon request.

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

Power Factor Controller

Characteristics

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)
- Input Phase correction angle detection
- Number of capacitor bank connected

Three bank selection mode
- Control series (upto 20)
- User defined capacitor bank kvar
- Auto detected capacitor bank kvar

Features

Display	- Large and multifunctional LCD (2 × 16 characters)
	- Graphic and alphanumeric
	- LCD illumination
System parameters displayed	- Line voltage (V AC)
	- Reactive power (kvar)
	- Active power (kW)
	- Frequency
	- Apparent power (kVA)
	- Line current (A)
	- Temperature (°C)
	- Real-time cos phi
	- Difference to PF
	- THD – V / THD - I in % upto 31st
	- Individual Harmonics in % upto 31st for V & I
	- Energy kWh (Import/ Export)
	- Energy kVAh
	- Energy kVARh (Inductive / Capacitive)
	- Demand kVA /Current
	- Run Hour – Number of hours load is connected

	- On Hour – Hours for which power supply is ON - No of interruption – Number of interruption for power supply.
Alarm output	- Out of Bank (Under Compensation) - Overcompensation - Under Voltage - Over Voltage - Undercurrent - Overcurrent - Over temperature - Under / Over Frequency - Excess Harmonics (V-THD / I-THD)
Recall recorded values	- Maximum / Minimum Voltage - Maximum / Minimum Current - Maximum / Minimum Frequency - Maximum Active Power - Maximum Apparent Power - Maximum Reactive Power - Maximum / Minimum Temperature - Maximum THD(V/I) - Switching count of Capacitor - Operation time of capacitor
Warning Messages	- Capacitor switching count exceed the limit - Capacitor Health Fault

Technical Data

Weight	0.57 kg
Case	Panel-mounted instrument, 144 × 144 × 56 mm (cut out $142^{+0.8}$ × $142^{+0.8}$ mm)
Ambient conditions	
- Over-voltage class	III
- Pollution degree	2
- Operating temperature	–10 ... +60 °C
- Storage temperature	–20 ... +65 °C
- Sensitivity to EMC	IEC61326-1
- Safety guidelines	IEC 61010-1:2010
- Mounting position	Flush Mounting
- Humidity class	15% ... 95% non-condensing
Protection class	
- Front plate	IP54 to IEC60529

- Rear side	IP20 to IEC60529
Operation	
- Auxiliary Supply voltage	110 V AC – 550VAC
- Auxiliary Supply Frequency	40 to 70 Hz
- Target cos phi	0.8 ind. … 0.8 cap.
- Switching On & Off	10 s … 30 min
- Discharge Time	60 s … 30 min
- Control modes	self-optimized intelligent control mode
Measurement	
- Measurement voltage range	30 ... 550 V AC (L–L / L–N)
- Fundamental frequency	50 / 60 Hz
- Measurement current (CT)	x/5 and x/1 Ampere onsite programmable
- **Minimum operating current**	2 mA
- Maximum current	6 A (sinusoidal)
- Accuracy	Current, voltage: 0.5% of nominal value
	Active, apparent power: 1% of nominal value
	Active Energy : 1%
	Apparent Energy : 1%
	Reactive Energy : 2%
	THD : ± 4%
Switching outputs	
Relay outputs	
- Number of outputs	6 / 8 / 12 steps available
- Switching voltage/Power	Max. 250 VAC / 1000W
Alarm relay	Potential-free contact (Max. 250 VAC / 1000W)

Reactors – Antiresonance Harmonic Filter

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)

Technical data and limit values

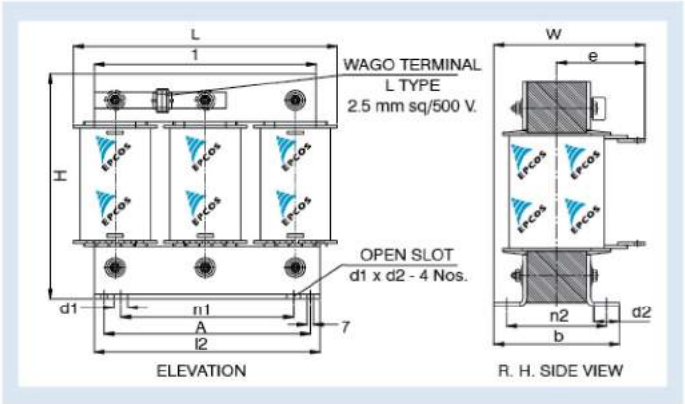
Filter reactors	
Harmonics*	V_3 = 0.5% V_R (duty cycle = 100%) V_5 = 6.0% V_R (duty cycle = 100%) V_7 = 5.0% V_R (duty cycle = 100%) V_{11} = 3.5% V_R (duty cycle = 100%) V_{13} = 3.0% V_R (duty cycle = 100%)
Effective current	$I_{rms} = \sqrt{(I_1^2+I_3^2 \ldots I_{13}^2)}$
Fundamental current	$I_1 = 1.06 \cdot I_R$ (50 Hz or 60 Hz current of capacitor)
Temperature protection	microswitch (NC)
Dimensional drawings and terminals	see specific datasheets

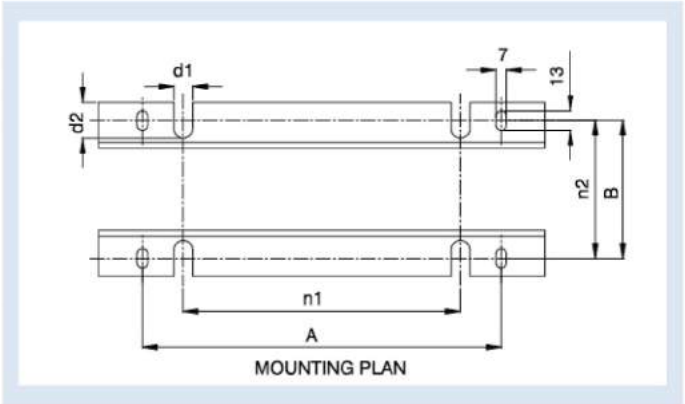
Three-phase filter reactors to VDE 0532 / EN 60289	
Frequency	50 Hz or 60 Hz
Voltage	400, 440
Output	10 … 100 kvar
Detuning	5.67%, 7%, 14%
Cooling	natural
Ambient temperature	+40 °C
Class of protection	I
Enclosure	IP00

* According to DIN ENV VV61000-2-2

Reactors – Antiresonance Harmonic Filter

Characteristics											
Power kVAr	Odering code	Inductance mH	I_{rms}	Dimensions (mm)					Weight kg	Capacitor /volt	Terminal
				L	H	W	n1	n2			
Rated voltage V=400V, f=50Hz, p=5.67%											
10	B44066D5010M400	3,06	18,5	225	165	145	150	95	15		busbars
12,5	B44066D5012M400	2,45	23	220	162	136	150	95	15		busbars
20	B44066D5020M400	1,53	36,9	225	200	140	150	95	18		busbars
25	B44066D5025M400	1,23	46,1	240	210	135	150	90	19		busbars
40	B44066D5040M400	0,77	73,7	260	235	155	150	102	28		busbars
50	B44066D5050M400	0,61	92,1	300	235	165	150	120	34		busbars
75	B44066D5075M400	0,41	138,2	300	265	185	150	135	45		busbars
100	B44066D5100M400	0,31	183,8	300	325	185	150	135	54		busbars
Rated voltage V=400V, f=50Hz, p=7%											
8,9	B44066D7009K400N1	4,31	14,6	175	225	120	100	78	15	10/440	10 mm^2 Kl
12,5	B44066D7012K400N1	3,01	20,5	220	162	136	150	95	15		10 mm^2 Kl
20	B44066D7020K400N1	1,92	32,7	225	200	136	150	95	17		busbars
26,7	B44066D7027E400N1	1,435	43,73	240	205	140	150	97	17	30/440	busbars
35,5	B44066D7035E400N1	1,079	58,15	260	240	190	150	165	26	40/440	busbars
44,4	B44066D7044E400N1	0,863	72,73	285	210	190	150	165	26	50/440	busbars
53	B44066D7053E400N1	0,719	87,3	285	235	190	150	165	26	60/440	busbars
89	B44066D7089E400N1	0,431	145,8	335	270	185	150	136	51	100/440	busbars
Rated voltage V=400V, f=50Hz, p=14%											
10	B44066D1410M400	8,29	15,4	225	205	110	150	70	13		busbars
12,5	B44066D1412M400	6,64	19,2	260	180	150	150	100	22		busbars
20	B44066D1420M400	4,15	30,8	260	180	150	150	100	22		busbars
25	B44066D1425M400	3,32	38,5	260	235	150	150	100	28		busbars
40	B44066D1440M400	2,07	61,6	300	235	185	150	135	38		busbars
50	B44066D1450M400	1,66	77	300	235	185	150	135	40		busbars
75	B44066D1475M400	1,11	115,5	360	280	210	265	155	58		busbars
100	B44066D1499M400	0,83	153,9	360	315	210	265	155	66		busbars





Discharge Reactor

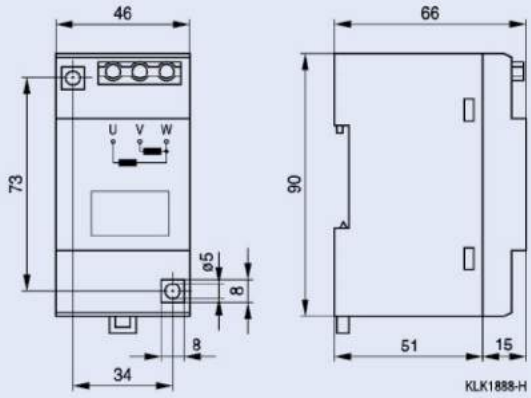
General

The losses of discharge reactors are substantially lower than those of discharging resistors. They satisfy the requirement for permanently connected discharging device and for a discharge time of a few seconds. Fast discharging allows a fast re-switching in automatic PFC equipment. However, max. 5000 switching operations (according to IEC 60831) should not be exceeded.

Features and dimensional drawings

- Fast discharge for fast reconnection of capacitors
- Reduced losses
- Shockproof case for DIN rail mounting

Dimensions in mm



Technical data

Ordering code		**B44066E9900L001**
Voltage	V_R	230 ... 690 V
Frequency	f	50 / 60 Hz
Internal configuration		2 windings in V arrangement
Resistance	R	7.5 kΩ
Discharge time	t	230 V up to 25 kvar < 10 s / up to 50 kvar < 20 s / up to 100 kvar < 40 s 400 ... 525 V up to 25 kvar < 5 s / up to 50 kvar < 10 s / up to 100 kvar < 20 s 525 ... 690 V up to 25 kvar < 3 s / up to 50 kvar < 6 s / up to 100 kvar < 12 s
Power loss	P_{LOSS}	< 1.6 W
Free-wheeling current	I	< 3.4 mA
Accepted discharge number		1× / minute and 100 kvar
Insulation class	R_{INS}	Ta = +40 °C/B
Cable diameter	ø	0.75 ... 2 x 2.5 mm²
Terminals		fixing torque 0.5 Nm
Installation location		indoor
Ambient temperature		–25 ... +55 °C
Cooling		natural
Dimensions	h x w x d	90 x 46 x 66 mm
Weight		0.5 kg

PQSine S Series
Active Harmonic Filter and Power Optimizer

General information

The PQSine S Series is an active harmonic filter system designed to eliminate harmonic oscillations and consequently reduce costs. AHF PQSine S Series monitors the current signal and compensates the unwanted elements of the measured current. Thus, the filter ensures harmonic suppression independently of the number of loads. It also corrects the power factor, improving the system efficiency while reducing harmonic pollution.

Features

- Harmonic compensation up to 50th harmonic (individually selectable)
- Ultra-fast reactive power compensation (inductive and capacitive)
- Load balancing between phases and unloaded neutral wire
- Compact design, three level topology
- Modular system extendable
- Grid resonance detection
- Digital Control of FFT algorithm, intelligent FFT algorithm, instantaneous reactive algorithm
- Ethernet and Ethercat system for interconnection
- User-friendly menu operation
- High performance and reliability
- Insensitive to network conditions

Typical applications

Fast current harmonics and reactive power suppression e.g. for:

- Data centers
- UPS systems
- Green power generation (e.g. photovoltaics and wind turbines)
- Sensitive equipment manufacturing (e.g. silicon wafer production, semiconductor production)
- Industrial production machines
- Electrical welding systems
- Plastic industry machinery (extruders, injection molders)
- Office buildings and shopping centers (3rd and triple harmonic cancellation and neutral conductor unloading)

Safety features

- Highest safety and reliability
- Overload protection
- Internal short-circuit protection
- Overheating protection
- Overvoltage and undervoltage protection
- Inverter bridge protection
- Resonance protection
- Fan fault alarm

PQSine S Series
Active Harmonic Filter and Power Optimizer

EPCOS

Technical data and specifications

Rated voltage	380 V (228 … 456 V)	480 V (384 … 552 V)	690 V (483 … 793 V)
Mains frequency	50/60 Hz (range: 45 … 62 Hz)		
Filter current	25, 35, 50, 60, 100, 150 A	75, 90 A	75, 90 A
Neutral filtering capability	3 times the rated filter current (in case of 4 wire device)		
Harmonic current compensation range	2nd to 50th harmonic order, or specified harmonics 0 to110%		
Rate of harmonic reduction	> 97%[1)]		
Typical power losses	< 3% (depending of the load)		
Target power factor	Adjustable from –1 to 1		
Switching / Control frequency	20 kHz/20 kHz		
Reaction time	Approx. 20 µs		
Overall response time	< 5 ms		
Harmonic compensation	Available		
Reactive power compensation	Available		
Unbalance compensation	Available		
Display	All systems include a 7" TFT color control / display unit (touch screen)		
Communication ports	RS485 and network port (RJ45)		
Communication protocols	Modbus RTU, TCP/IP (Ethernet)		
Fault alarm	Available, max. 500 alarm records		
Noise level	< 56 dB upto 100 A, < 65 dB for 150 A	< 65 dB (depending on the model)	
Protection functions	Overvoltage, undervoltage, short-circuit, inverter bridge inverse, overcompensation		
Operating temperature	–10 to +40 °C without derating		
Relative humidity	5 to 95%, non-condensation		
Cooling	75,151,300,405 L/sec (25-35,50-60,75-100, 150 A)	359 L/sec	
Protection class	IP 20 according to IEC 529 (customizable)		
Panel color	RAL7035 light grey		
Altitude	1500. Between 1500 to 4000 m the power decreases by 1% for every additional 100 m, according to GB/T3859.2		
Qualifications	CE, IEEE 61000	CE, ETL (UL 508 and CSA C22.2 # 2014), IEEE 61000	
Compliance with standards	IEEE 519, ER G5/4		

[1)] For typical harmonic order distortions

Wall-mounted panel

Floor-mounted panel

Horizontal module

Vertical module

TDK