PhaseCap Premium PFC Capacitors

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

PhaseCap

General

PhaseCap capacitors in cylindrical aluminum cases have been designed for power factor correction in low-voltage plant. Loads like motors and transformers consume active power as well as reactive power. Generators, supply cables and other electrical distribution equipment, in turn, should be relieved of reactive power. The MKK (metalized plastic compact) AC series (> 5.0 to 33.0 kvar) is intended to increase packing density per bank and cut component costs. Improved thermal response and simplified installation are advantages of the cylindrical aluminum case.

Applications

- Automatic PFC equipment, capacitor banks
- Individual fixed PFC (e.g. motors, transformers, lighting)
- Group fixed PFC
- Tuned and detuned capacitor banks

Features

Electrical

- Long life expectancy
- High pulse current withstand capability (up to 200 · I_R)

Mechanical and maintenance

- Reduced mounting costs
- Maintenance-free

Safety

- Self-healing
- Overpressure disconnector
- Touch-proof terminals
- Longterm approved
- Ceramic discharge module pre-mounted

Environmental

- Dry design, inert gas
- No oil leakage

The compact PhaseCap capacitor is a self-healing, metalized polypropylene film capacitor. The current-carrying metal layer (electrode) is vapor-deposited onto one side of the film.

Compact design – low height, weight and volume

Three electrically separated capacitor elements are wound concentrically in a single operation onto an insulated metal core tube, which guarantees excellent winding precision. The electrodes are connected by metal spraying the face ends of the winding elements.

The compact MKK winding elements are housed in a cylindrical aluminum case and hermetically sealed by a press-rolled metal lid.

Triple safety system

- Dry technology: instead of a liquid impregnating agent, the capacitor is filled with gas. So there is no risk of leaking oil.
- Self-healing: the capacitor repairs itself after overload (to IEC 60831).
- Overpressure disconnector: refer to page 9.

Innovative and reliable SIGUT connection technology

SIGUT terminals ensure reliable and straightforward connection, even in a parallel capacitor circuit, with benefits like:

- protection against electric shock hazard (IP20 to VDE 0106 part 100)
- separate connection of discharge resistors
- clamping device to prevent loosening of screws
- cable cross-sections up to 16 mm^2
- max. 50 A total RMS current

Life expectancy of up to 115 000 h

After a long drying phase under vacuum to eliminate moisture from the active element, the capacitor is impregnated. The case is filled with inert gas and sealed. Then routine tests are performed for gas leakage.

This production process helps to avoid oxidation and partial discharges (corona effect), promoting capacitance stability over a long period, an essential in detuned PFC.

High inrush current withstand capability is crucial

Capacitors used for power factor correction undergo a lot of switching operations. The high inrush currents that go along with this must be handled without degrading life expectancy. The pulse strength of this technology comes in particular from the enlarged, sensitive contact area (improved metal spraying). The breakthrough came with a Siemens patent called the wavy cut, plus heavy-edge film design. PhaseCap capacitors can handle inrush currents of up to 200 times rated current (max. 5 000 switching operations p.a. according to IEC 60831 standard).

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Technical data and limit values

Standards IEC 60831-1+2, EN 60831-1+2, UL 810 5th edition		
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 1.3 · I_R (up to 1.5 · I_R including combined effects of harmonics, overvoltages and capacitance tolerance)
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_{R1}, AC, 10 s
Test voltage, terminal/case	V_{TC}	up to V_R ≤ 660 V: 3000 VAC, 10 s; above V_R = 660 V: 6000 VAC, 10 s
Mean life expectancy	$t_{LD(Co)}$	up to 115000 h
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		random
Mounting and grounding		threaded M12 stud on bottom of case
Safety		dry technology, overpressure disconnector, self-healing, maximum allowed fault current 10000 A in accordance with UL 810 standard
Discharge module		ceramic discharge module premounted, discharge time ≤ 75 V in 60 s; ≤ 75 V in 90 s for types marked with [4]
Case		extruded aluminum can
Enclosure		IP20, indoor mounting (optionally with terminal cap for IP54)
Dielectric		polypropylene film
Impregnation		inert gas, Nitrogen (N_2)
Terminals		SIGUT terminal strip with electric shock protection (IP20), (VDE 0106 part 100), max. 16 mm² cable cross-section, max. current 50 A
Certification		cUL file # E238746
Number of switching operations		max. 5000 switchings per year according to IEC 60831-1+/2

* Without discharge resistor

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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 VAC, 50/60 Hz, delta connection									
MKK230-D-5-01	5.0	13	6.0	16	3 · 100	121 x 164	1.3	B25667B3297A375	6
MKK230-D-7.5-01	7.5	19	9.0	23	3 · 150	121 x 164	1.3	B25667B2457A375	6
MKK230-D-10.4-01	10.4	26	12.5	31	3 · 209	121 x 164	1.5	B25667B2627A375	6
MKK230-D-12.5-01[4]	12.5	31	15.0	37	3 · 251	121 x 200	1.7	B25667B2757A375	4
Rated voltage 400 VAC, 50/60 Hz, delta connection									
MKK400-D-5-01	5.0	7	6.0	9	3 · 32	121 x 164	1.1	B25667B5966A375	6
MKK400-D-7.5-01	7.5	11	9.0	13	3 · 50	121 x 164	1.2	B25667B3147A375	6
MKK400-D-10-01	10.0	14	12.0	17	3 · 64	121 x 164	1.2	B25667B4197A375	6
MKK400-D-12.5-01	12.5	18	15.0	22	3 · 83	121 x 164	1.1	B25667B3247A375	6
MKK400-D-15-01	15.0	22	18.0	26	3 · 100	121 x 164	1.3	B25667B3297A375	6
MKK400-D-20-01	20.0	30	24.0	36	3 · 133	121 x 164	1.5	B25667B3397A375	6
MKK400-D-25-01	25.0	36	–	–	3 · 165	121 x 200	1.8	B25667B3497A375	4
Rated voltage 415 VAC, 50/60 Hz, delta connection									
MKK415-D-5-01	5.0	7	6.0	8	3 · 32	121 x 164	1.1	B25667B5966A375	6
MKK415-D-6.2-01	6.2	8	7.5	10	3 · 39	121 x 164	1.2	B25667B5127A375	6
MKK415-D-10.4-01	10.4	15	12.5	17	3 · 64	121 x 164	1.2	B25667B4197A375	6
MKK415-D-12.5-01	12.5	17	15.0	21	3 · 77	121 x 164	1.3	B25667B4237A375	6
MKK415-D-15-01	15.0	21	18.0	25	3 · 93	121 x 164	1.4	B25667B4287A375	6
MKK415-D-16.7-01	16.7	23	20.0	28	3 · 103	121 x 164	1.5	B25667B4307A375	6
MKK415-D-20-01	20.8	29	25.0[2]	35[2]	3 · 128	121 x 200	1.7	B25667B4387A375	4
MKK415-D-25-01[3]	25.0	35	–	–	3 · 154	142 x 200	2.1	B25667B4467A375	4
Rated voltage 440 VAC, 50/60 Hz, delta connection									
MKK440-D-5-01	5.0	7	6.0	8	3 · 27	121 x 164	1.2	B25667B4826A375	6
MKK440-D-7.5-01	7.5	10	9.0	12	3 · 41	121 x 164	1.2	B25667B4127A375	6
MKK440-D-10.4-01	10.4	14	12.5	16	3 · 57	121 x 164	1.3	B25667B4177A375	6
MKK440-D-12.5-01	12.5	16	15.0	20	3 · 69	121 x 164	1.4	B25667B4207A375	6
MKK440-D-14.2-01	14.2	19	17.0	22	3 · 77	121 x 164	1.3	B25667B4237A375	6
MKK440-D-15-01	15.0	20	18.0	24	3 · 83	121 x 164	1.4	B25667B4247A375	6
MKK440-D-16.7-01	16.7	22	20.0	26	3 · 92	121 x 200	1.8	B25667B4277A375	4
MKK440-D-18.8-01	18.8	25	22.6	30	3 · 103	121 x 164	1.5	B25667B4307A375	6
MKK440-D-20-01	20.0	26	24.0	31	3 · 111	121 x 200	1.7	B25667B4337A375	4
MKK440-D-25-01	25.0	33	30.0	39	3 · 137	142 x 200	2.0	B25667B4417A375	4
MKK440-D-28.1-01[3]	28.1	37	–	–	3 · 154	142 x 200	2.1	B25667B4467A375	4
MKK440-D-30-01[4]	30.0[1]	39[1]	–	–	3 · 164	142 x 200	2.4	B25667B4497A375	4
MKK440-D-33-01[3, 4]	33.0	43	–	–	3 · 181	142 x 200	2.5	B25667B4547A375	4

Customized products available upon request. Minimum order quantity 200 pieces.

[1] Temperature class deviation –40/C max. 50 °C
[2] Temperature class deviation –40/B max. 45 °C
[3] Useful life up to 100 000 h
[4] Discharge time ≤ 75 V in 90 s
* Packing units for capacitors equal minimum order quantity.
Orders will be rounded up to packing unit or multiple thereof.

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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 480 VAC, 50/60 Hz, delta connection									
MKK480-D-6.25-01	6.25	8	7.5	9	3 · 29	121 x 164	1.2	B25667B4866A375	6
MKK480-D-8.3-01	8.3	10	10.0	12	3 · 39	121 x 164	1.2	B25667B5127A375	6
MKK480-D-10.4-01	10.4	12	12.5	14	3 · 48	121 x 164	1.3	B25667B5147A375	6
MKK480-D-12.5-01	12.5	15	15.0	18	3 · 58	121 x 164	1.5	B25667B5177A375	6
MKK480-D-15-01	15.0	18	18.0	22	3 · 69	121 x 164	1.4	B25667B4207A375	6
MKK480-D-16.7-01	16.7	20	20.0	24	3 · 77	121 x 200	1.8	B25667B5237A375	4
MKK480-D-20-01	20.0	22	24.0	26	3 · 92	121 x 200	1.8	B25667B4277A375	4
MKK480-D-25-01	25.0	30	30.0	36	3 · 115	142 x 200	2.2	B25667B4347A375	4
MKK480-D-30-01[3]	30.0[1]	36[1]	–	–	3 · 138	142 x 200	2.4	B25667B4417A365	4
Rated voltage 525 VAC, 50/60 Hz, delta connection									
MKK525-D-8.3-01	8.3	9	10.0	11	3 · 32	121 x 164	1.1	B25667B5966A375	6
MKK525-D-10-01	10.0	11	12.0	13	3 · 39	121 x 164	1.2	B25667B5127A375	6
MKK525-D-12.5-01	12.5	14	15.0	17	3 · 48	121 x 164	1.3	B25667B5147A375	6
MKK525-D-15-01	15.0	17	18.0	20	3 · 58	121 x 164	1.5	B25667B5177A375	6
MKK525-D-16.7-01	16.7	18	20.0	21	3 · 64	121 x 164	1.6	B25667B5197A375	6
MKK525-D-20-01	20.0	22	24.0	26	3 · 77	121 x 200	1.8	B25667B5237A375	4
MKK525-D-25-01	25.0	28	–	–	3 · 96	142 x 200	2.3	B25667B5287A375	4
MKK525-D-30-01[4]	30.0[1]	33[1]	–	–	3 · 115	142 x 200	2.4	B25667B5347A375	4

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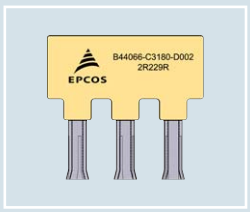
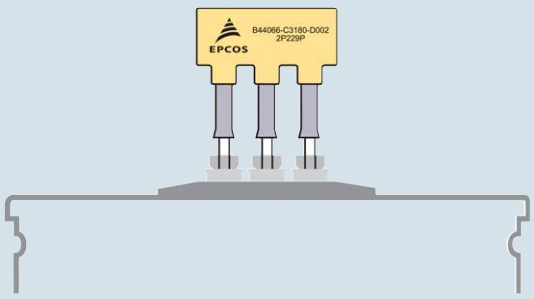
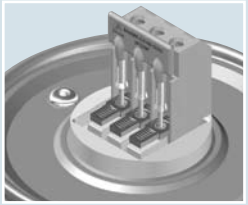
Discharge resistors pre-mounted







[1] Temperature class deviation –40/C max. 50 °C
[2] Temperature class deviation –40/B max. 45 °C
[3] Useful life up to 100 000 h
[4] Discharge time ≤ 75 V in 90 s
* Packing units for capacitors equal minimum order quantity.
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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 VAC, 50 / 60 Hz									
MKK230-I-5-01	5.2	23	6.2	28	313	121 x 164	1.1	B25667B2317A175	6
MKK230-I-6.6-01	6.6	29	7.9	34	397	121 x 164	1.4	B25667B2397A175	6
MKK230-I-7.5-01	7.5	32	9.0	38	457	121 x 164	1.3	B25667B2457A175	6
MKK230-I-8.3-01	8.3	36	10.0	43	502	121 x 164	1.3	B25667B2507A175	6
MKK230-I-9.1-01[1)]	9.1	38	–	–	548	121 x 164	1.4	B25667B2557A175	6
Rated voltage 400 VAC, 50 / 60 Hz									
MKK400-I-10.4-01	10.4	26	12.5	31	207	121 x 164	1.2	B25667B3207A175	6
MKK400-I-12.5-01	12.5	31	15.0	37	249	121 x 164	1.3	B25667B3247A175	6
Rated voltage 440 VAC, 50 / 60 Hz									
MKK440-I-6.9-01	6.9	16	8.3	19	116	121 x 164	1.3	B25667B5117A175	6
MKK440-I-8.3-01	8.3	19	10.0	23	144	121 x 164	1.5	B25667B5147A175	6
Rated voltage 525 VAC, 50 / 60 Hz									
MKK525-I-10-01	10.0	19	12.0	23	116	121 x 164	1.3	B25667B5117A175	6
MKK525-I-12.5-01	12.5	24	15.0	29	144	121 x 164	1.5	B25667B5147A175	6
MKK525-I-15-01[1)]	15.0	29	18.0	35	173	121 x 200	1.7	B25667B5177A175	4
MKK525-I-18.6-01[1)]	18.6	36	22.3	43	215	142 x 200	2.0	B25667B5217A175	4

Plastic protective case for capacitor

Capacitor Ø	For cable gland	Cable diameter outside	Dimensions				Ordering code
			l_1	l_2	l_3	h	
mm		mm	mm	mm	mm	mm	
121 x 164	IP54	9–13	134	110	177	243	B44066X9122A000
121 x 200 / 142 x 200	IP54	10–18	154.5	130.5	186	280	B44066X9142A000

Plastic protective terminal cover

Capacitor Ø	For cable gland	Cable diameter outside	Dimensions		Ordering code
			Ø d_1	Ø d_2	
mm		mm	mm	mm	
121 x 164	PG 13.5	9–13	116	125	B44066K1211
121 x 200	PG 16	10–14	116	125	B44066K1212
142 x 200	PG 21	14–18	137	145	B44066K1421

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[1)] Discharge time ≤ 75 V in 90 s

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Protective terminal cover

Protective case for capacitor

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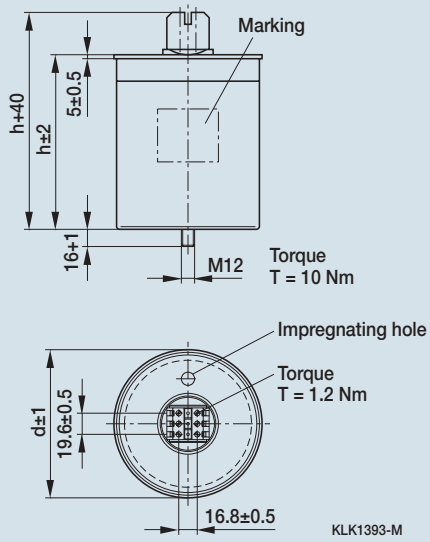
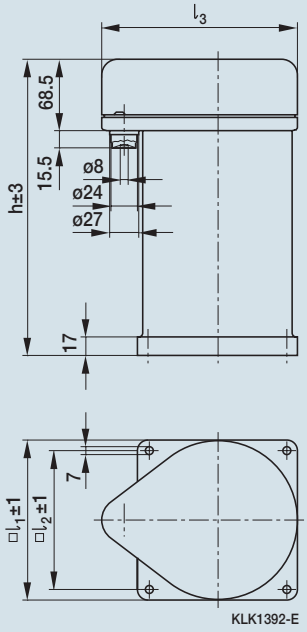
Dimensional drawings

Capacitor



Creepage distance 12.7 mm min.
Clearance 9.6 mm min.

Protective case for capacitor



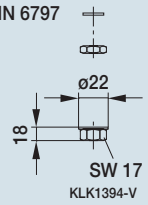
Mounting

Toothed washer J 12.5 DIN 6797

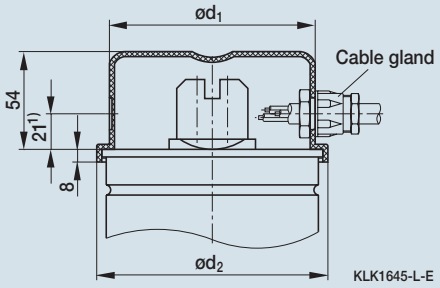
Hex nut BM12 DIN 439

or

nut C61010-A415-C15



Protective cover for terminal



¹⁾ Perforation for second cable gland