



02

TDK ELECTRONICS AG · 2022

EPCOS POWER QUALITY SOLUTIONS — PRODUCT PROFILE

Capacitors, PF controllers, contactors, thyristor modules, reactors, active filters and PFC fundamentals

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230 – 1000 V

capacitor rated voltage range

0.5 – 60 kvar

output per capacitor

500 · IR

inrush current capability of PhaseCap Energy Plus

300 000 h

life expectancy, DeltaCap X Black Premium

1 TDK Electronics AG · Product Profile 2022 · Power Quality Solutions

PREVIEW: REACTIVE POWER, PFC AND THE PQS STRATEGY

The increasing demand of electrical power and the awareness of the necessity of energy saving are very up to date; awareness of power quality is increasing too, and power factor correction (PFC) and harmonic filtering will be implemented on a growing scale. Enhancing power quality – improvement of the power factor – saves costs and ensures a fast return

on investment. In low- and medium-voltage networks PFC focuses on the power flow ($\cos \phi$) and on voltage stability by generating reactive power.

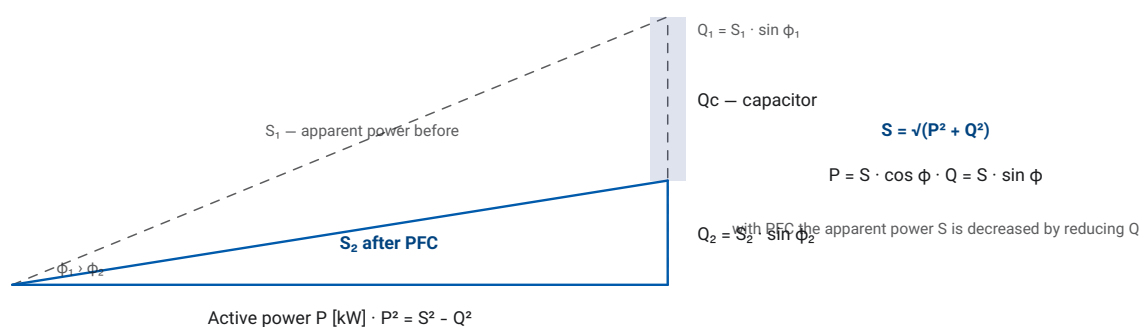
How reactive power is generated

Every electric load that works with magnetic fields (motors, chokes, transformers, inductive heating, arc welding, generators) produces a varying degree of electrical lag, called inductance. The phase shift between current and voltage means that during part of each cycle negative power is fed back into the network, and the same energy is needed again to build up the magnetic fields — this magnetic reversal energy is the reactive power. In 50/60 Hz networks the process repeats 50 or 60 times a second, so the obvious solution is to store the reversal energy briefly in capacitors and relieve the network of it. Automatic PFC systems (detuned or conventional) consist of a group of capacitor units that are cut in and out by a power factor controller.

Low power factor results in

- higher energy consumption and costs
- less power distributed via the network
- power loss in the network and higher transformer losses
- increased voltage drop in power distribution networks

Power triangle





Individual or fixed compensation

each reactive-power producer compensated individually (motors, transformers, lighting)



Group compensation

producers connected as a group and compensated as a whole



Central or automatic compensation

a PFC system at a central point, switched by a controller



Mixed compensation

combinations of the above

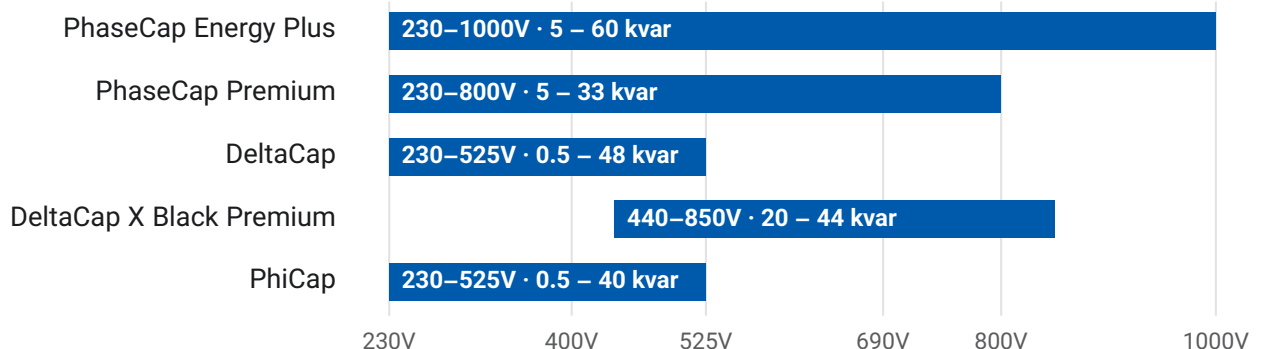


PQS strategy

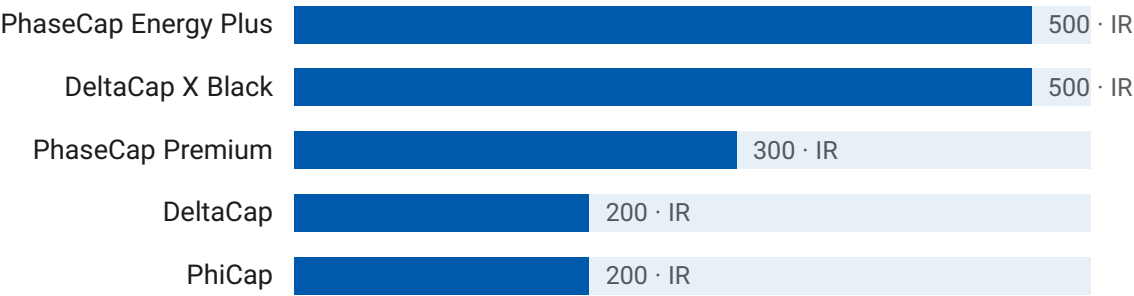
Users and decision-makers find it increasingly difficult to locate the best product and to make objective decisions: it is in most cases not fruitful to compare catalogues and data sheets, as many parameters are identical in line with the relevant standards, and operating times are specified on the basis of laboratory tests that may differ significantly from the field. Load structures have changed from mainly linear to non-linear, and the market calls for customised solutions. Power Quality Solutions offers all key components for an effective PFC system from a single source, together with application know-how, technical skills, extensive field experience, a worldwide network of partners, continuous development and sharing of information – TDK being not only the leading manufacturer of power capacitors for PFC but a PQS supplier with a century of field experience.

2 CAPACITOR SERIES AND KEY-COMPONENT OVERVIEW

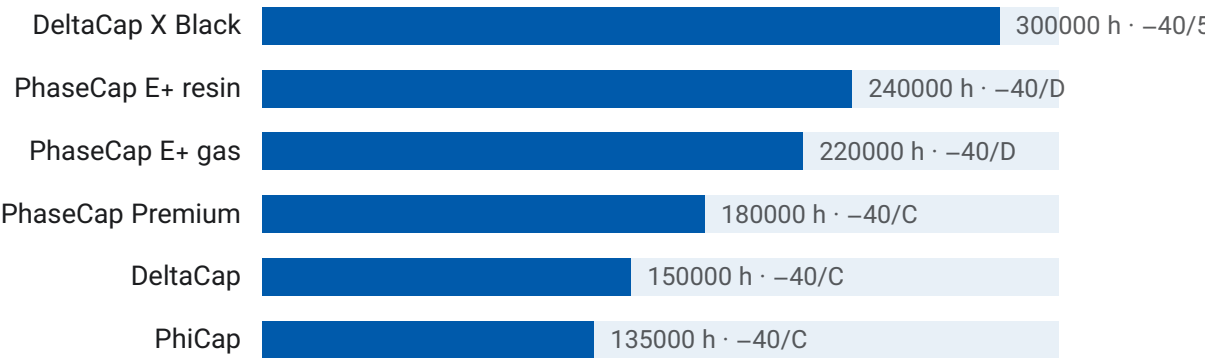
Rated voltage range by capacitor series



Inrush current capability (multiples of IR)



Mean life expectancy (best temperature class)



PFC capacitor series for power factor correction and detuned filters

PARAMETER	PHASECAP ENERGY PLUS	PHASECAP PREMIUM	DELTACAP	DELTACAP X BLACK PREMIUM	PHICAP
Power QR	5.0 ... 60.0 kvar	5.0 ... 33.0 kvar	0.5 ... 48 kvar	20 ... 44 kvar	0.5 ... 40 kvar
Rated voltage VR	230 ... 1000 V AC	230 ... 800 V AC	230 ... 525 V AC	440 ... 850 V AC	230 ... 525 V AC
Inrush current IS	up to 500 · IR	up to 300 · IR	up to 200 · IR	up to 500 · IR	up to 200 · IR
Temperature class	-40/60: max. +60 °C, mean 24 h +50 °C, mean 1 year +40 °C	-40/D: max. +55 °C, mean 24 h +45 °C, mean 1 year +35 °C	-40/D and -40/C (max. +50 °C)	-40/65: max. +65 °C, mean 24 h +55 °C, mean 1 year +45 °C	-40/D
Losses dielectric / total	< 0.2 / approx. 0.35 – 0.45 W/kvar	< 0.2 / < 0.45 W/kvar	< 0.2 / < 0.45 W/kvar	< 0.2 / < 0.5 W/kvar	< 0.2 / < 0.45 W/kvar

PARAMETER	PHASECAP ENERGY PLUS	PHASECAP PREMIUM	DELTACAP	DELTACAP X BLACK PREMIUM	PHICAP
Safety	self-healing, 3-phase overpressure disconnecter, dry technology (B25674C), touch-proof terminal	triple: self-healing, overpressure disconnecter, dry technology	self-healing, overpressure disconnecter, isolated terminal (B32304)	self-healing, overpressure disconnecter, isolated terminal	dual: self-healing, overpressure disconnecter
Impregnation	B25674C: non-flammable inert gas · B25675C: semi-dry biodegradable resin	non-flammable inert gas	biodegradable soft resin, semi-dry	biodegradable soft resin, semi-dry	biodegradable soft resin, semi-dry
Mean life expectancy	gas: 220 000 h (–40/D), 200 000 h (–40/60) · resin: 240 000 h (–40/D), 220 000 h (–40/60)	180 000 h (–40/C), 130 000 h (–40/D)	150 000 h (–40/C), 115 000 h (–40/D)	300 000 h (–40/55), 200 000 h (–40/60), 100 000 h (–40/65)	135 000 h (–40/C), 100 000 h (–40/D)
Connection	optimised isolated capacitor safety terminals IP20 (VDE 0106 part 100)	optimised capacitor safety terminal IP20	fast-on terminals (B32300/B32303); screw terminals max. 25 mm ² (B32301/B32304)	optimised isolated safety terminals IP20	fast-on (B32340/B32343); block-type safety terminal (B32344)
Enclosure	IP20 indoor, terminal cap for IP54 (ø 116 / 136)	IP20 indoor, terminal cap for IP54	IP00 (B32300/B32303), IP20 (B32301/B32304)	IP20, terminal cap for IP54	IP00; optionally IP54 for B32344 with cap
Standard	IEC 60831-1+2 Ed. 3.0 (2014), UL 810 5th ed., cUL E238746	IEC 60831-1+2, UL 810 5th ed., cUL E238746	IEC 60831-1+2, EN 60831-1+2, VDE approval	IEC 60831-1+2, UL 810 5th ed.	IEC 60831-1+2, UL 810 5th ed., cUL E106388, CSA C22.2 No190 MC 236094 (up to ø 85 mm), GOST
Ordering code	gas B25674C* · resin B25675C*	B25667C*	B32300*, B32301*, B32303*, B32304*	B32305A*	B32340C*, B32343C*, B32344E*

PQS key components – power factor controllers

	BR7000-I / -I/S485	BR7000-I-TH / /S485	BR7000 / BR7000-T	BR6000-R / -T	BR604
Supply voltage	110 ... 440 V AC ±15 %	110 ... 440 V AC ±15 %	110 ... 440 V AC ±15 %	110 ... 230 V AC ±15 %	230 V AC
Measurement voltage	30 ... 440 V (L-N), 50 ... 760 V (L-L)	30 ... 440 V (L-N), 50 ... 760 V (L-L)	3 × 30 ... 440 V (L-N), 3 × 50 ... 760 V (L-L)	30 ... 525 V AC (L-N) or (L-L)	230 V AC
Measurement current	X:5A / X:1A selectable	X:5A / X:1A	3 × X:5A / X:1A	X:5A / X:1A	X:5A / X:1A
Outputs (relay / transistor)	12+1 / –	12 / 12	15 / – · – / 15	6 or 12 / – · – / 6	4 / –
Dynamic PFC	no	yes	BR7000-T only	BR6000-T6 only	no
Ordering code	B44066R7012E230 · R7112E230	B44066R7412E230 · R7612E230	B44066R7415E230 · R7615E230	R6006E230 · R6012E230 · R6106E230	B44066R6004E230

Switching devices and reactors at a glance

PARAMETER	CAPACITOR CONTACTORS	THYRISTOR MODULES TSM	REACTORS – ANTIRESONANCE HARMONIC FILTER
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PARAMETER	CAPACITOR CONTACTORS	THYRISTOR MODULES TSM	REACTORS — ANTIRESONANCE HARMONIC FILTER
Voltage	230 ... 690 V	TSM-LC-I 230 ... 525 V · TSM-LC 380 ... 440 V · TSM-LC-S 200 ... 440 V · TSM-LC-N690 380 ... 690 V	400 and 440 V
Output range	12.5 ... 100 kvar	TSM-LC-I 10 ... 22 kvar · TSM-LC 10 ... 200 kvar, depending on the voltage	10 ... 100 kvar
Frequency	50/60 Hz	50/60 Hz	50 or 60 Hz
Detuning	—	suitable for detuned and conventional systems	factor 5.67, 7, 14 %
Ordering code	B44066S...J230/J110	TSM-LC-I B44066T1022E520 · TSM-LC B44066T...E402 · N480 B44066T3850E408 · N690 B44066T3050E690	B44066D...

3 PHASECAP ENERGY PLUS AND PHASECAP PREMIUM



PhaseCap Energy Plus — most comprehensive range, up to 60 kvar, up to 1000 V

The latest generation of PFC capacitors: on the basis of the well-proven MKK technology, this follow-on development offers an expected service life of up to 240 000 hours, an inrush current capability of up to 500 · IR and optimised can dimensions. Two versions: series B25674C is gas filled, series B25675C uses semi-dry biodegradable soft resin; both have self-healing properties and a three-phase overpressure disconnecter. A voltage range from 230 to 1000 V, outputs of 5.0 to 60.0 kvar and four terminal types allow selection of the customised capacitor.

✓ Applications

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

Features

- Robust, reliable and compact design; MKK technology with wavy cut and heavy edge
- Ultra long life expectancy up to 240 000 h at –40/D
- Very high inrush current capability up to 500 · IR; high pulse-current withstand
- High long-term stability; reduced mounting costs; maintenance-free; highest packing density

Safety

- Self-healing; 3-phase overpressure disconnecter
- Touch-proof IP20 safety terminal
- Safe discharging: pre-mounted ceramic base discharge resistor or discharge module
- cUL approval; dry nitrogen (B25674C) or biodegradable semi-dry resin (B25675C) impregnation

PhaseCap Energy Plus – technical data and limit values (IEC 60831–1+2, UL 810)

Overvoltage Vmax	VR + 10 % (up to 8 h daily) / + 15 % (30 min daily) / + 20 % (5 min daily) / + 30 % (1 min daily)
Overcurrent Imax	up to 2.0 · IR depending on the type, including combined effects of harmonics, overvoltages and capacitance tolerance
Inrush current IS	up to 500 · IR
Losses	dielectric < 0.2 W/kvar; total approx. 0.35 – 0.45 W/kvar (without discharge resistor)
Rated frequency · tolerance	50/60 Hz · –5 % / +5 %
Test voltages	terminal/terminal 2.15 · VR AC, 2 s; terminal/case 3600 V AC 2 s up to 525 V, 6000 V AC above
Mean life expectancy	B25674C up to 220 000 h (–40/D), 200 000 h (–40/60) · B25675C up to 240 000 h (–40/D), 220 000 h (–40/60)
Ambient · humidity · altitude	–40/60: max. +60 °C, mean 24 h +50 °C, mean 1 year +40 °C · max. 95 % · max. 4000 m
Mounting	upright / horizontal; threaded M12 stud on bottom of case
Safety	three-phase overpressure disconnecter, self-healing, max. fault current 10 000 A (UL 810)
Discharge device · case · dielectric	ceramic discharge module or discharge module block · extruded aluminium can · polypropylene film
Terminals	optimised capacitor safety terminal with electric shock protection (IP20)

Terminal types (PhaseCap Energy Plus)

TYPE	WHERE USED
A	small cans ø 75 – 85 mm
B	ø 100 – 136 mm
C / D	600 – 690 V series
E	800 / 900 / 1000 V resin series (B25675C)
F	40 – 60 kvar, ø 136 mm

Footnotes in the type tables: ⁽¹⁾ max. current $1.6 \times IR$ · ⁽²⁾ $1.7 \times IR$ · ⁽³⁾ $1.8 \times IR$ · ⁽⁴⁾ $1.9 \times IR$ · ⁽⁵⁾ $2.0 \times IR$. Packing units equal the minimum order quantity.



PhaseCap Premium – gas-impregnated, dry type, concentric winding, wavy cut, triple safety system

Compact design in a cylindrical aluminium can with stud, concentric winding, MKK technology with wavy cut and heavy edge, 230 – 800 V, 5.0 – 33 kvar. Long life expectancy, high pulse-current withstand, reduced mounting costs, maintenance-free; environmental: dry design with non-flammable inert gas, no oil leakage. Safety: self-healing, overpressure disconnect, shock-hazard-protected terminals, cUL approval, pre-mounted ceramic discharge resistor.

PhaseCap Premium – technical data and limit values (IEC 60831-1+2, EN 60831-1+2, UL 810 5th ed.)

Overcurrent · inrush	up to $1.6 \cdot IR$ · up to $300 \cdot IR$
Losses · tolerance	< 0.2 W/kvar dielectric, < 0.45 W/kvar total · –5 % / +10 %
Test voltages	$2.15 \cdot VR$ AC 2 s; terminal/case 3000 V AC 10 s (≤ 660 V), 6000 V AC 10 s above
Mean life expectancy	up to 180 000 h (–40/C), 130 000 h (–40/D)
Ambient	–40/D: max. +55 °C, mean 24 h +45 °C, mean 1 year +35 °C
Discharge	ceramic discharge resistor pre-mounted up to 660 V; external discharge module above
Terminals · switching	safety terminal IP20, max. 25 mm ² , max. 80 A · up to 7500 switchings per year
Enclosure · certification	IP20 indoor, terminal cap for IP54 · cUL E238746

4 DELTACAP, DELTACAP X BLACK PREMIUM AND PHICAP



DeltaCap

Based on the well-proven MKP technology with stacked windings, DeltaCap capacitors are developed for LV-PFC in industrial installations; the cost-effective design offers 0.5 to 33

kvar at 230 to 525 V. Up to 33 kvar per capacitor for three-phase applications, life expectancy up to 150 000 h (-40°C), inrush withstand up to $200 \cdot \text{IR}$; self-healing, overpressure disconnecter, isolated terminal (IP20) for B32301 and B32304 series; low weight and easy installation.

Standards	IEC 60831-1+2, IS 13340/41
Overcurrent · inrush	$1.3 \cdot \text{IR}$ ($1.5 \cdot \text{IR}$ incl. harmonics) · $200 \cdot \text{IR}$
Tolerance · test	$-5 / +10 \% \cdot 2.15 \cdot \text{VR}$ 2 s; 3000 V AC 10 s
Mounting	upright; M12 (10 Nm) for $\varnothing \geq 50 \text{ mm}$
Switching	max. 5000 per year (IEC 60831)

DeltaCap X Black Premium

The highly robust MKD design for harsh industrial installations: a selective output range of 20 to 44 kvar at 440 to 850 V, black cylindrical aluminium can, life expectancy up to 300 000 h ($-40/55$), inrush up to $500 \cdot \text{IR}$, ceramic discharge resistor pre-mounted, mounting upright or horizontal, maintenance-free. Applications: automatic PFC banks, fixed and dynamic PFC, tuned and detuned systems.

Standards	IEC 60831-1+2, UL 810 5th ed.
Overcurrent · inrush	$1.5 \cdot \text{IR} \cdot 500 \cdot \text{IR}$
Losses · tolerance	$< 0.2 / < 0.5 \text{ W/kvar} \cdot \pm 5 \%$
Life	300 000 h ($-40/55$), 200 000 h ($-40/60$), 100 000 h ($-40/65$)
Terminals · switching	safety terminal, max. 35 mm^2 , 100 A · max. 62 000 switchings per year

PhiCap

A tried and tested series of MKP (metallised polypropylene) capacitors used for PFC for more than 15 years: 0.5 to 30 kvar three-phase and 0.7 to 6.0 kvar single-phase, 230 – 525 V, housed in a cylindrical aluminium case. Dual safety system (self-healing, overpressure disconnecter), life expectancy up to 135 000 h, inrush up to $200 \cdot \text{IR}$.

Standards	IEC 60831-1+2, IS 13340/41, GOST
Overcurrent · inrush	$1.5 \cdot \text{IR} \cdot 200 \cdot \text{IR}$
Tolerance · test	$-5 / +10 \% \cdot 2.15 \cdot \text{VR}$ 2 s; 3000 V AC 10 s
Life	135 000 h (-40°C), 100 000 h (-40°D)

Mounting	upright; M12 (10 Nm) $\varnothing > 53$ mm, M8 (4 Nm) $\varnothing \leq 53$ mm
Terminals	fast-on 6.35 × 0.8 (B32340/B32343); block-type (B32344); covers B44066K0530/0635/0795/0895A000



Shared limit values

All series accept the IEC 60831 overvoltage profile VR + 10 % (8 h daily), + 15 % (30 min), + 20 % (5 min), + 30 % (1 min); rated frequency 50/60 Hz; polypropylene film dielectric; humidity max. 95 % non-condensing; altitude max. 4000 m; max. allowed fault current 10 000 A to UL 810.

5 CAPACITOR TYPE TABLES – ALL SERIES

Every three-phase and single-phase type of the five series, as printed in the catalogue. Filter by series and rated voltage, or search a type or ordering code. Types for other voltages (220, 240, 600, 660 V) and other kvar outputs are available upon request. Where the ordering code contains “#”, replace it with the right character before ordering.

All

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (μF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
PhaseCap Energy Plus · gas (N2) · three-phase · 230 V AC, delta connection										
MKK230-D-5.0-03	5	12.6 ⁽⁵⁾	6	15.1 ⁽²⁾	3 × 100.3	A	75 × 218	0.9	B25674C2052J030	9
MKK230-D-7.5-03	7.5	18.8	9	22.6	3 × 150.4	B	100 × 192	1.4	B25674C2072J530	6
MKK230-D-10.0-03	10	25.1 ⁽⁴⁾	12	30.1 ⁽²⁾	3 × 200.5	B	100 × 224	1.7	B25674C2102J030	4
MKK230-D-12.5-03	12.5	31.4 ⁽²⁾	15	37.7 ⁽¹⁾	3 × 250.7	B	116 × 207	2.1	B25674C2122J530	4
MKK230-D-15.0-03	15	37.7 ⁽¹⁾	—	—	3 × 300.8	B	125 × 207	2.4	B25674C2152J030	4
PhaseCap Energy Plus · gas (N2) · three-phase · 400 V AC, delta connection										
MKK400-D-5.0-03	5	7.2 ⁽⁵⁾	6	8.7 ⁽²⁾	3 × 33.2	A	75 × 164	0.7	B25674C4052J000	6
MKK400-D-6.3-03	6.3	9.1	7.6	11 ⁽²⁾	3 × 41.8	A	75 × 164	0.7	B25674C4062J300	6
MKK400-D-7.5-03	7.5	10.8 ⁽⁵⁾	9	13 ⁽²⁾	3 × 49.7	A	75 × 200	0.8	B25674C4072J500	6
MKK400-D-8.3-03	8.3	12 ⁽⁵⁾	10	14.4 ⁽²⁾	3 × 55.0	A	75 × 200	0.8	B25674C4082J300	6
MKK400-D-10.4-03	10.4	15 ⁽⁴⁾	12.5	18 ⁽¹⁾	3 × 69.0	A	75 × 218	0.9	B25674C4102J400	9
MKK400-D-12.5-03	12.5	18 ⁽⁴⁾	15	21.7 ⁽¹⁾	3 × 82.9	A	85 × 200	1.1	B25674C4122J500	9
MKK400-D-15.0-03	15	21.7 ⁽³⁾	18	26 ⁽¹⁾	3 × 99.5	A	85 × 218	1.2	B25674C4152J000	4
MKK400-D-16.7-03	16.7	24.1 ⁽²⁾	20	28.9 ⁽¹⁾	3 × 110.7	B	100 × 207	1.6	B25674C4162J700	6
MKK400-D-20.0-03	20	28.9 ⁽¹⁾	24	34.6 ⁽¹⁾	3 × 132.6	B	100 × 224	1.7	B25674C4202J000	4
MKK400-D-25.0-03	25	36.1 ⁽¹⁾	30	43.3 ⁽¹⁾	3 × 165.8	B	116 × 192	1.9	B25674C4252J000	4
MKK400-D-28.1-03	28.1	40.6 ⁽¹⁾	—	—	3 × 186.3	B	125 × 192	2.3	B25674C4282J100	4
MKK400-D-30.0-03	30	43.3 ⁽¹⁾	—	—	3 × 198.9	B	116 × 224	2.3	B25674C4302J000	4
MKK400-D-33.0-03	33	47.6 ⁽¹⁾	—	—	3 × 218.8	B	125 × 207	2.4	B25674C4332J000	4
PhaseCap Energy Plus · gas (N2) · three-phase · 415 V AC, delta connection										
MKK415-D-5.0-03	5	7 ⁽⁵⁾	6	8.3 ⁽²⁾	3 × 30.8	A	75 × 164	0.7	B25674C4052J015	6
MKK415-D-6.3-03	6.3	8.8	7.6	10.6 ⁽²⁾	3 × 38.8	A	75 × 164	0.7	B25674C4062J315	6

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (μF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
MKK415-D-7.5-03	7.5	10.4 ⁽⁵⁾	9	12.5 ⁽²⁾	3 × 46.2	A	75 × 200	0.8	B25674C4072J515	6
MKK415-D-8.3-03	8.3	11.5 ⁽⁵⁾	10	13.9 ⁽²⁾	3 × 51.1	A	75 × 200	0.8	B25674C4082J315	6
MKK415-D-10.4-03	10.4	14.5 ⁽⁵⁾	12.5	17.4 ⁽²⁾	3 × 64.1	A	75 × 200	0.8	B25674C4102J415	6
MKK415-D-12.5-03	12.5	17.4 ⁽⁴⁾	15	20.9 ⁽¹⁾	3 × 77.0	A	85 × 200	1.1	B25674C4122J515	9
MKK415-D-15.0-03	15	20.9 ⁽³⁾	18	25 ⁽¹⁾	3 × 92.4	A	85 × 200	1.1	B25674C4152J015	9
MKK415-D-16.7-03	16.7	23.2 ⁽²⁾	20	27.8 ⁽¹⁾	3 × 102.9	B	100 × 207	1.6	B25674C4162J715	6
MKK415-D-20.0-03	20	27.8 ⁽¹⁾	24	33.4 ⁽¹⁾	3 × 123.2	B	100 × 207	1.6	B25674C4202J015	6
MKK415-D-25.0-03	25	34.8 ⁽¹⁾	30	41.7 ⁽¹⁾	3 × 154.0	B	116 × 192	1.9	B25674C4252J015	4
MKK415-D-28.1-03	28.1	39.1 ⁽¹⁾	—	—	3 × 173.1	B	116 × 207	2.1	B25674C4282J115	4
MKK415-D-30.0-03	30	41.7 ⁽¹⁾	—	—	3 × 184.8	B	116 × 207	2.1	B25674C4302J015	4
MKK415-D-33.0-03	33	45.9 ⁽¹⁾	—	—	3 × 203.3	B	116 × 224	2.3	B25674C4332J015	4
PhaseCap Energy Plus · gas (N2) · three-phase · 440 V AC, delta connection										
MKK440-D-5.0-03	5	6.6 ⁽⁵⁾	6	7.9 ⁽²⁾	3 × 27.4	A	75 × 164	0.7	B25674C4052J040	6
MKK440-D-6.0-03	6	7.9	7.2	9.4	3 × 32.9	A	75 × 164	0.7	B25674C4062J040	6
MKK440-D-6.3-03	6.3	8.3 ⁽⁵⁾	7.6	10 ⁽²⁾	3 × 34.5	A	75 × 164	0.7	B25674C4062J340	6
MKK440-D-7.0-03	7	9.2 ⁽⁵⁾	8.4	11 ⁽²⁾	3 × 38.4	A	75 × 200	0.8	B25674C4072J040	6
MKK440-D-7.5-03	7.5	9.8 ⁽⁵⁾	9	11.8 ⁽²⁾	3 × 41.1	A	75 × 200	0.8	B25674C4072J540	6
MKK440-D-8.0-03	8	10.5 ⁽⁵⁾	9.6	12.6 ⁽²⁾	3 × 43.8	A	75 × 200	0.8	B25674C4082J040	6
MKK440-D-8.3-03	8.3	10.9 ⁽⁵⁾	10	13.1 ⁽²⁾	3 × 45.5	A	75 × 200	0.8	B25674C4082J340	6
MKK440-D-9.0-03	9	11.8 ⁽⁵⁾	10.8	14.2 ⁽²⁾	3 × 49.3	A	75 × 200	0.8	B25674C4092J040	6
MKK440-D-10.0-03	10	13.1 ⁽⁴⁾	12	15.7 ⁽¹⁾	3 × 54.8	A	75 × 200	0.8	B25674C4102J040	6
MKK440-D-10.4-03	10.4	13.6 ⁽⁴⁾	12.5	16.4 ⁽¹⁾	3 × 57.0	A	85 × 200	1.1	B25674C4102J440	9
MKK440-D-12.0-03	12	15.7 ⁽⁴⁾	14.4	18.9 ⁽¹⁾	3 × 65.8	A	85 × 200	1.1	B25674C4122J040	9
MKK440-D-12.5-03	12.5	16.4 ⁽⁴⁾	15	19.7 ⁽¹⁾	3 × 68.5	A	85 × 200	1.1	B25674C4122J540	9
MKK440-D-14.2-03	14.2	18.6 ⁽⁴⁾	17	22.3 ⁽¹⁾	3 × 77.8	A	85 × 200	1.1	B25674C4142J240	9
MKK440-D-15.0-03	15	19.7 ⁽³⁾	18	23.6 ⁽¹⁾	3 × 82.2	A	85 × 218	1.2	B25674C4152J040	4
MKK440-D-16.7-03	16.7	21.9 ⁽²⁾	20	26.2 ⁽¹⁾	3 × 91.5	B	100 × 207	1.6	B25674C4162J740	6
MKK440-D-18.8-03	18.8	24.7 ⁽²⁾	22.6	29.7 ⁽¹⁾	3 × 103.0	B	100 × 207	1.6	B25674C4182J840	6
MKK440-D-20.0-03	20	26.2	24	31.5 ⁽¹⁾	3 × 109.6	B	100 × 207	1.6	B25674C4202J040	6
MKK440-D-25.0-03	25	32.8 ⁽¹⁾	30	39.4 ⁽¹⁾	3 × 137.0	B	116 × 192	1.9	B25674C4252J040	4
MKK440-D-28.1-03	28.1	36.9 ⁽¹⁾	—	—	3 × 154.0	B	116 × 207	2.1	B25674C4282J140	4
MKK440-D-30.0-03	30	39.4 ⁽¹⁾	—	—	3 × 164.4	B	125 × 192	2.3	B25674C4302J040	4
MKK440-D-33.1-03	33.1	43.4 ⁽¹⁾	—	—	3 × 181.4	B	116 × 224	2.3	B25674C4332J140	4
PhaseCap Energy Plus · gas (N2) · three-phase · 480 V AC, delta connection										
MKK480-D-5.0-03	5	6 ⁽⁵⁾	6	7.2 ⁽²⁾	3 × 23.0	A	75 × 164	0.7	B25674C4052J080	6
MKK480-D-6.3-03	6.3	7.6 ⁽⁵⁾	7.6	9.1 ⁽²⁾	3 × 29.0	A	75 × 164	0.7	B25674C4062J380	6
MKK480-D-7.5-03	7.5	9 ⁽⁵⁾	9	10.8 ⁽²⁾	3 × 34.5	A	75 × 200	0.8	B25674C4072J580	6
MKK480-D-8.3-03	8.3	10 ⁽⁵⁾	10	12 ⁽²⁾	3 × 38.2	A	75 × 200	0.8	B25674C4082J380	6
MKK480-D-10.4-03	10.4	12.5 ⁽⁵⁾	12.5	15 ⁽²⁾	3 × 47.9	A	75 × 200	0.8	B25674C4102J480	6
MKK480-D-11.0-03	11	13.2 ⁽⁵⁾	13.2	15.9 ⁽²⁾	3 × 50.7	A	85 × 200	1.1	B25674C4112J080	9
MKK480-D-12.5-03	12.5	15 ⁽⁴⁾	15	18 ⁽¹⁾	3 × 57.6	A	85 × 200	1.1	B25674C4122J580	9
MKK480-D-13.8-03	13.8	16.6 ⁽⁴⁾	16.6	20 ⁽¹⁾	3 × 63.5	A	85 × 200	1.1	B25674C4132J880	9
MKK480-D-15.0-03	15	18 ⁽³⁾	18	21.7 ⁽¹⁾	3 × 69.1	B	100 × 207	1.6	B25674C4152J080	6
MKK480-D-16.7-03	16.7	20.1 ⁽²⁾	20	24.1 ⁽¹⁾	3 × 76.9	B	100 × 207	1.6	B25674C4162J780	6
MKK480-D-20.0-03	20	24.1 ⁽²⁾	24	28.9 ⁽¹⁾	3 × 92.1	B	100 × 207	1.6	B25674C4202J080	6
MKK480-D-20.8-03	20.8	25 ⁽¹⁾	25	30.1 ⁽¹⁾	3 × 95.8	B	116 × 207	2.1	B25674C4202J880	4
MKK480-D-22.0-03	22	26.5 ⁽¹⁾	26.4	31.8 ⁽¹⁾	3 × 101.3	B	116 × 207	2.1	B25674C4222J080	4

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (μF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
MKK480-D-25.0-03	25	30.1 ⁽¹⁾	30	36.1 ⁽¹⁾	3 × 115.1	B	116 × 192	1.9	B25674C4252J080	4
MKK480-D-28.1-03	28.1	33.8 ⁽¹⁾	—	—	3 × 129.4	B	116 × 207	2.1	B25674C4282J180	4
MKK480-D-30.0-03	30	36.1 ⁽¹⁾	—	—	3 × 138.1	B	125 × 192	2.3	B25674C4302J080	4
MKK480-D-31.0-03	31	37.3 ⁽¹⁾	—	—	3 × 142.7	B	125 × 192	2.3	B25674C4312J080	4
MKK480-D-33.0-03	33	39.7 ⁽¹⁾	—	—	3 × 154.0	B	116 × 224	2.3	B25674C4332J080	4
PhaseCap Energy Plus · gas (N2) · three-phase · 525 V AC, delta connection										
MKK525-D-5.0-03	5	5.5 ⁽⁵⁾	6	6.6 ⁽²⁾	3 × 19.2	A	75 × 164	0.7	B25674C5052J025	6
MKK525-D-6.3-03	6.3	6.9	7.6	8.4	3 × 24.2	A	75 × 164	0.7	B25674C5062J325	6
MKK525-D-7.5-03	7.5	8.2 ⁽⁵⁾	9	9.9 ⁽²⁾	3 × 28.9	A	75 × 185	0.8	B25674C5072J525	6
MKK525-D-8.3-03	8.3	9.1 ⁽⁵⁾	10	11 ⁽²⁾	3 × 31.9	A	75 × 200	0.8	B25674C5082J325	6
MKK525-D-10.4-03	10.4	11.4 ⁽⁵⁾	12.5	13.7 ⁽²⁾	3 × 40.0	A	85 × 185	1	B25674C5102J425	9
MKK525-D-12.5-03	12.5	13.7 ⁽⁵⁾	15	16.5 ⁽²⁾	3 × 48.1	A	85 × 200	1.1	B25674C5122J525	9
MKK525-D-13.2-03	13.2	14.5 ⁽⁵⁾	15.8	17.4 ⁽²⁾	3 × 50.8	A	85 × 200	1.1	B25674C5132J225	9
MKK525-D-15.0-03	15	16.5 ⁽⁴⁾	18	19.8 ⁽¹⁾	3 × 57.7	A	85 × 218	1.2	B25674C5152J025	4
MKK525-D-16.7-03	16.7	18.4 ⁽³⁾	20	22 ⁽¹⁾	3 × 64.3	B	100 × 207	1.6	B25674C5162J725	6
MKK525-D-20.0-03	20	22 ⁽²⁾	24	26.4 ⁽¹⁾	3 × 77.0	B	100 × 224	1.7	B25674C5202J025	4
MKK525-D-20.8-03	20.8	22.9 ⁽²⁾	25	27.5 ⁽¹⁾	3 × 80.1	B	100 × 224	1.7	B25674C5202J825	4
MKK525-D-25.0-03	25	27.5 ⁽¹⁾	30	33 ⁽¹⁾	3 × 96.2	B	116 × 207	2.1	B25674C5252J025	4
MKK525-D-26.5-03	26.5	29.1 ⁽¹⁾	31.8	35 ⁽¹⁾	3 × 102.0	B	116 × 207	2.1	B25674C5262J525	4
MKK525-D-28.1-03	28.1	30.9 ⁽¹⁾	—	—	3 × 108.2	B	125 × 192	2.3	B25674C5282J125	4
MKK525-D-30.0-03	30	33 ⁽¹⁾	—	—	3 × 115.5	B	125 × 207	2.4	B25674C5302J025	4
MKK525-D-33.1-03	33.1	36.4 ⁽¹⁾	—	—	3 × 127.4	B	136 × 192	2.7	B25674C5332J125	4
PhaseCap Energy Plus · gas (N2) · three-phase · 600 V AC, delta connection										
MKK600-D-5.3-03	5.3	5.1 ⁽⁵⁾	6.4	6.2 ⁽²⁾	3 × 15.6	C	75 × 185	0.8	B25674C6052J300	6
MKK600-D-6.2-03	6.2	6	7.4	7.1 ⁽²⁾	3 × 18.3	C	75 × 185	0.8	B25674C6062J200	6
MKK600-D-6.9-03	6.9	6.6 ⁽⁵⁾	8.3	8 ⁽²⁾	3 × 20.3	C	75 × 200	0.8	B25674C6062J900	6
MKK600-D-8.3-03	8.3	8 ⁽⁴⁾	10	9.6 ⁽¹⁾	3 × 24.5	C	75 × 218	0.9	B25674C6082J300	9
MKK600-D-10.4-03	10.4	10 ⁽⁴⁾	12.5	12 ⁽¹⁾	3 × 30.6	C	85 × 200	1.1	B25674C6102J400	9
MKK600-D-12.5-03	12.5	12 ⁽⁴⁾	15	14.4 ⁽¹⁾	3 × 36.8	D	100 × 192	1.4	B25674C6122J500	6
MKK600-D-13.9-03	13.9	13.4 ⁽⁴⁾	16.7	16.1 ⁽¹⁾	3 × 41.0	D	100 × 207	1.6	B25674C6132J900	6
MKK600-D-14.6-03	14.6	14 ⁽⁴⁾	17.5	16.8 ⁽¹⁾	3 × 43.0	D	100 × 207	1.6	B25674C6142J600	6
MKK600-D-16.7-03	16.7	16.1 ⁽³⁾	20	19.2 ⁽¹⁾	3 × 49.2	D	100 × 224	1.7	B25674C6162J700	4
MKK600-D-20.0-03	20	19.2 ⁽²⁾	24	23.1 ⁽¹⁾	3 × 58.9	D	116 × 207	2.1	B25674C6202J000	4
MKK600-D-20.8-03	20.8	20 ⁽²⁾	25	24.1 ⁽¹⁾	3 × 61.3	D	116 × 207	2.1	B25674C6202J800	4
MKK600-D-25.0-03	25	24.1 ⁽¹⁾	30	28.9 ⁽¹⁾	3 × 73.7	D	125 × 207	2.4	B25674C6252J000	4
MKK600-D-28.0-03	28	26.9 ⁽¹⁾	—	—	3 × 82.5	D	136 × 192	2.7	B25674C6282J000	4
MKK600-D-30.0-03	30	28.9 ⁽¹⁾	—	—	3 × 88.4	D	136 × 207	2.9	B25674C6302J000	4
PhaseCap Energy Plus · gas (N2) · three-phase · 690 V AC, delta connection										
MKK690-D-5.3-03	5.3	4.4 ⁽⁵⁾	6.4	5.4 ⁽²⁾	3 × 11.8	C	75 × 185	0.8	B25674C6052J390	6
MKK690-D-6.2-03	6.2	5.2	7.4	6.2	3 × 13.8	C	75 × 200	0.8	B25674C6062J290	6
MKK690-D-6.9-03	6.9	5.8 ⁽⁵⁾	8.3	6.9 ⁽²⁾	3 × 15.4	C	75 × 200	0.8	B25674C6062J990	6
MKK690-D-8.3-03	8.3	6.9 ⁽⁵⁾	10	8.4 ⁽²⁾	3 × 18.5	C	75 × 200	0.8	B25674C6082J390	6
MKK690-D-10.4-03	10.4	8.7 ⁽⁴⁾	12.5	10.5 ⁽¹⁾	3 × 23.2	C	75 × 200	0.8	B25674C6102J490	6
MKK690-D-12.5-03	12.5	10.5 ⁽⁴⁾	15	12.6 ⁽¹⁾	3 × 27.9	C	85 × 200	1.1	B25674C6122J590	9
MKK690-D-13.9-03	13.9	11.6 ⁽⁴⁾	16.7	14 ⁽¹⁾	3 × 31.0	C	85 × 200	1.1	B25674C6132J990	9
MKK690-D-14.6-03	14.6	12.2 ⁽⁴⁾	17.5	14.6 ⁽¹⁾	3 × 32.5	D	100 × 207	1.6	B25674C6142J690	6
MKK690-D-16.7-03	16.7	14 ⁽⁴⁾	20	16.7 ⁽¹⁾	3 × 37.2	D	100 × 192	1.4	B25674C6162J790	6

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (μF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
MKK690-D-20.0-03	20	16.7 ^(a)	24	20.1 ⁽¹⁾	3 × 44.6	D	100 × 207	1.6	B25674C6202J090	6
MKK690-D-20.8-03	20.8	17.4 ^(a)	25	20.9 ⁽¹⁾	3 × 46.3	D	100 × 224	1.7	B25674C6202J890	4
MKK690-D-25.0-03	25	20.9 ^(a)	30	25.1 ⁽¹⁾	3 × 55.7	D	116 × 192	1.9	B25674C6252J090	4
MKK690-D-28.0-03	28	23.4 ⁽¹⁾	—	—	3 × 62.4	D	116 × 207	2.1	B25674C6282J090	4
MKK690-D-30.0-03	30	25.1 ⁽¹⁾	—	—	3 × 66.8	D	125 × 192	2.3	B25674C6302J090	4
PhaseCap Energy Plus · resin · three-phase · 230 V AC, delta connection										
MKK230-D-5.0-04	5	12.6 ⁽⁵⁾	6	15.1 ⁽²⁾	3 × 100.3	A	75 × 218	1.1	B25675C2052J030	9
MKK230-D-7.5-04	7.5	18.8	9	22.6	3 × 150.4	B	100 × 192	1.8	B25675C2072J530	6
MKK230-D-10.0-04	10	25.1 ⁽⁴⁾	12	30.1 ⁽²⁾	3 × 200.5	B	100 × 224	2.1	B25675C2102J030	4
MKK230-D-12.5-04	12.5	31.4 ⁽²⁾	15	37.7 ⁽¹⁾	3 × 250.7	B	116 × 207	2.6	B25675C2122J530	4
MKK230-D-15.0-04	15	37.7 ⁽¹⁾	—	—	3 × 300.8	B	125 × 207	3	B25675C2152J030	4
PhaseCap Energy Plus · resin · three-phase · 400 V AC, delta connection										
MKK400-D-5.0-04	5	7.2 ⁽⁵⁾	6	8.7 ⁽²⁾	3 × 33.2	A	75 × 164	0.9	B25675C4052J000	6
MKK400-D-6.3-04	6.3	9.1	7.6	11 ⁽²⁾	3 × 41.8	A	75 × 164	0.9	B25675C4062J300	6
MKK400-D-7.5-04	7.5	10.8 ⁽⁵⁾	9	13 ⁽²⁾	3 × 49.7	A	75 × 200	1.1	B25675C4072J500	6
MKK400-D-8.3-04	8.3	12 ⁽⁵⁾	10	14.4 ⁽²⁾	3 × 55.0	A	75 × 200	1.1	B25675C4082J300	6
MKK400-D-10.4-04	10.4	15 ⁽⁴⁾	12.5	18 ⁽¹⁾	3 × 69.0	A	75 × 218	1.1	B25675C4102J400	9
MKK400-D-12.5-04	12.5	18 ⁽⁴⁾	15	21.7 ⁽¹⁾	3 × 82.9	A	85 × 200	1.3	B25675C4122J500	9
MKK400-D-15.0-04	15	21.7 ^(a)	18	26 ⁽¹⁾	3 × 99.5	A	85 × 218	1.5	B25675C4152J000	4
MKK400-D-16.7-04	16.7	24.1 ⁽²⁾	20	28.9 ⁽¹⁾	3 × 110.7	B	100 × 207	1.9	B25675C4162J700	6
MKK400-D-20.0-04	20	28.9 ⁽¹⁾	24	34.6 ⁽¹⁾	3 × 132.6	B	100 × 224	2.1	B25675C4202J000	4
MKK400-D-25.0-04	25	36.1 ⁽¹⁾	30	43.3 ⁽¹⁾	3 × 165.8	B	116 × 192	2.4	B25675C4252J000	4
MKK400-D-28.1-04	28.1	40.6 ⁽¹⁾	—	—	3 × 186.3	B	125 × 192	2.8	B25675C4282J100	4
MKK400-D-30.0-04	30	43.3 ⁽¹⁾	—	—	3 × 198.9	B	116 × 224	2.8	B25675C4302J000	4
MKK400-D-33.0-04	33	47.6 ⁽¹⁾	—	—	3 × 218.8	B	125 × 207	3	B25675C4332J000	4
MKK400-D-40.0-04	40	57.7 ⁽¹⁾	48	69.3 ⁽¹⁾	3 × 265.2	F	136 × 233	3.7	B25675C4402J000	4
MKK400-D-50.0-04	50	72.2 ⁽¹⁾	60	86.6 ⁽¹⁾	3 × 331.5	F	136 × 312	5	B25675C4502J000	2
PhaseCap Energy Plus · resin · three-phase · 415 V AC, delta connection										
MKK415-D-5.0-04	5	7 ⁽⁵⁾	6	8.3 ⁽²⁾	3 × 30.8	A	75 × 164	0.9	B25675C4052J015	6
MKK415-D-6.3-04	6.3	8.8	7.6	10.6 ⁽²⁾	3 × 38.8	A	75 × 164	0.9	B25675C4062J315	6
MKK415-D-7.5-04	7.5	10.4 ⁽⁵⁾	9	12.5 ⁽²⁾	3 × 46.2	A	75 × 200	1.1	B25675C4072J515	6
MKK415-D-8.3-04	8.3	11.5 ⁽⁵⁾	10	13.9 ⁽²⁾	3 × 51.1	A	75 × 200	1.1	B25675C4082J315	6
MKK415-D-10.4-04	10.4	14.5 ⁽⁵⁾	12.5	17.4 ⁽²⁾	3 × 64.1	A	75 × 200	1.1	B25675C4102J415	6
MKK415-D-12.5-04	12.5	17.4 ⁽⁴⁾	15	20.9 ⁽¹⁾	3 × 77.0	A	85 × 200	1.3	B25675C4122J515	9
MKK415-D-15.0-04	15	20.9 ^(a)	18	25 ⁽¹⁾	3 × 92.4	A	85 × 200	1.3	B25675C4152J015	9
MKK415-D-16.7-04	16.7	23.2 ⁽²⁾	20	27.8 ⁽¹⁾	3 × 102.9	B	100 × 207	1.9	B25675C4162J715	6
MKK415-D-20.0-04	20	27.8 ⁽¹⁾	24	33.4 ⁽¹⁾	3 × 123.2	B	100 × 207	1.9	B25675C4202J015	6
MKK415-D-25.0-04	25	34.8 ⁽¹⁾	30	41.7 ⁽¹⁾	3 × 154.0	B	116 × 192	2.4	B25675C4252J015	4
MKK415-D-28.1-04	28.1	39.1 ⁽¹⁾	—	—	3 × 173.1	B	116 × 207	2.6	B25675C4282J115	4
MKK415-D-30.0-04	30	41.7 ⁽¹⁾	—	—	3 × 184.8	B	116 × 207	2.6	B25675C4302J015	4
MKK415-D-33.0-04	33	45.9 ⁽¹⁾	—	—	3 × 203.3	B	116 × 224	2.8	B25675C4332J015	4
MKK415-D-40.0-04	40	55.6 ⁽¹⁾	48	66.8 ⁽¹⁾	3 × 246.4	F	136 × 217	3.7	B25675C4402J015	4
MKK415-D-50.0-04	50	69.6 ⁽¹⁾	60	83.5 ⁽¹⁾	3 × 308.0	F	136 × 279	4.5	B25675C4502J015	2
PhaseCap Energy Plus · resin · three-phase · 440 V AC, delta connection										
MKK440-D-5.0-04	5	6.6 ⁽⁵⁾	6	7.9 ⁽²⁾	3 × 27.4	A	75 × 164	0.9	B25675C4052J040	6
MKK440-D-6.0-04	6	7.9	7.2	9.4	3 × 32.9	A	75 × 164	0.9	B25675C4062J040	6
MKK440-D-6.3-04	6.3	8.3 ⁽⁵⁾	7.6	10 ⁽²⁾	3 × 34.5	A	75 × 164	0.9	B25675C4062J340	6

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (µF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
MKK440-D-7.0-04	7	9.2 ⁽⁵⁾	8.4	11 ⁽²⁾	3 × 38.4	A	75 × 200	1.1	B25675C4072J040	6
MKK440-D-7.5-04	7.5	9.8 ⁽⁵⁾	9	11.8 ⁽²⁾	3 × 41.1	A	75 × 200	1.1	B25675C4072J540	6
MKK440-D-8.0-04	8	10.5 ⁽⁵⁾	9.6	12.6 ⁽²⁾	3 × 43.8	A	75 × 200	1.1	B25675C4082J040	6
MKK440-D-8.3-04	8.3	10.9 ⁽⁵⁾	10	13.1 ⁽²⁾	3 × 45.5	A	75 × 200	1.1	B25675C4082J340	6
MKK440-D-9.0-04	9	11.8 ⁽⁵⁾	10.8	14.2 ⁽²⁾	3 × 49.3	A	75 × 200	1.1	B25675C4092J040	6
MKK440-D-10.0-04	10	13.1 ⁽⁴⁾	12	15.7 ⁽¹⁾	3 × 54.8	A	75 × 200	1.1	B25675C4102J040	6
MKK440-D-10.4-04	10.4	13.6 ⁽⁴⁾	12.5	16.4 ⁽¹⁾	3 × 57.0	A	85 × 200	1.3	B25675C4102J440	9
MKK440-D-12.0-04	12	15.7 ⁽⁴⁾	14.4	18.9 ⁽¹⁾	3 × 65.8	A	85 × 200	1.3	B25675C4122J040	9
MKK440-D-12.5-04	12.5	16.4 ⁽⁴⁾	15	19.7 ⁽¹⁾	3 × 68.5	A	85 × 200	1.3	B25675C4122J540	9
MKK440-D-14.2-04	14.2	18.6 ⁽⁴⁾	17	22.3 ⁽¹⁾	3 × 77.8	A	85 × 200	1.3	B25675C4142J240	9
MKK440-D-15.0-04	15	19.7 ⁽³⁾	18	23.6 ⁽¹⁾	3 × 82.2	A	85 × 218	1.5	B25675C4152J040	4
MKK440-D-16.7-04	16.7	21.9 ⁽²⁾	20	26.2 ⁽¹⁾	3 × 91.5	B	100 × 207	1.9	B25675C4162J740	6
MKK440-D-18.8-04	18.8	24.7 ⁽²⁾	22.6	29.7 ⁽¹⁾	3 × 103.0	B	100 × 207	1.9	B25675C4182J840	6
MKK440-D-20.0-04	20	26.2	24	31.5 ⁽¹⁾	3 × 109.6	B	100 × 207	1.9	B25675C4202J040	6
MKK440-D-25.0-04	25	32.8 ⁽¹⁾	30	39.4 ⁽¹⁾	3 × 137.0	B	116 × 192	2.4	B25675C4252J040	4
MKK440-D-28.1-04	28.1	36.9 ⁽¹⁾	—	—	3 × 154.0	B	116 × 207	2.6	B25675C4282J140	4
MKK440-D-30.0-04	30	39.4 ⁽¹⁾	—	—	3 × 164.4	B	125 × 192	2.8	B25675C4302J040	4
MKK440-D-33.1-04	33.1	43.4 ⁽¹⁾	—	—	3 × 181.4	B	116 × 224	2.8	B25675C4332J140	4
MKK440-D-40.0-04	40	52.5 ⁽¹⁾	48	63 ⁽¹⁾	3 × 219.2	F	136 × 217	3.7	B25675C4402J040	4
MKK440-D-50.0-04	50	65.6 ⁽¹⁾	60	78.7 ⁽¹⁾	3 × 274.0	F	136 × 279	4.5	B25675C4502J040	2
MKK440-D-56.0-04	56	73.5 ⁽¹⁾	—	—	3 × 306.9	F	136 × 312	5	B25675C4562J040	2
MKK440-D-60.0-04	60	78.7 ⁽¹⁾	—	—	3 × 328.8	F	136 × 312	5	B25675C4602J040	2
PhaseCap Energy Plus · resin · three-phase · 480 V AC, delta connection										
MKK480-D-5.0-04	5	6 ⁽⁵⁾	6	7.2 ⁽²⁾	3 × 23.0	A	75 × 164	0.9	B25675C4052J080	6
MKK480-D-6.3-04	6.3	7.6 ⁽⁵⁾	7.6	9.1 ⁽²⁾	3 × 29.0	A	75 × 164	0.9	B25675C4062J380	6
MKK480-D-7.5-04	7.5	9 ⁽⁵⁾	9	10.8 ⁽²⁾	3 × 34.5	A	75 × 200	1.1	B25675C4072J580	6
MKK480-D-8.3-04	8.3	10 ⁽⁵⁾	10	12 ⁽²⁾	3 × 38.2	A	75 × 200	1.1	B25675C4082J380	6
MKK480-D-10.4-04	10.4	12.5 ⁽⁵⁾	12.5	15 ⁽²⁾	3 × 47.9	A	75 × 200	1.1	B25675C4102J480	6
MKK480-D-11.0-04	11	13.2 ⁽⁵⁾	13.2	15.9 ⁽²⁾	3 × 50.7	A	85 × 200	1.3	B25675C4112J080	9
MKK480-D-12.5-04	12.5	15 ⁽⁴⁾	15	18 ⁽¹⁾	3 × 57.6	A	85 × 200	1.3	B25675C4122J580	9
MKK480-D-13.8-04	13.8	16.6 ⁽⁴⁾	16.6	20 ⁽¹⁾	3 × 63.5	A	85 × 200	1.3	B25675C4132J880	9
MKK480-D-15.0-04	15	18 ⁽³⁾	18	21.7 ⁽¹⁾	3 × 69.1	B	100 × 207	1.9	B25675C4152J080	6
MKK480-D-16.7-04	16.7	20.1 ⁽²⁾	20	24.1 ⁽¹⁾	3 × 76.9	B	100 × 207	1.9	B25675C4162J780	6
MKK480-D-20.0-04	20	24.1 ⁽²⁾	24	28.9 ⁽¹⁾	3 × 92.1	B	100 × 207	1.9	B25675C4202J080	6
MKK480-D-20.8-04	20.8	25 ⁽¹⁾	25	30.1 ⁽¹⁾	3 × 95.8	B	116 × 207	2.6	B25675C4202J880	4
MKK480-D-22.0-04	22	26.5 ⁽¹⁾	26.4	31.8 ⁽¹⁾	3 × 101.3	B	116 × 207	2.6	B25675C4222J080	4
MKK480-D-25.0-04	25	30.1 ⁽¹⁾	30	36.1 ⁽¹⁾	3 × 115.1	B	116 × 192	2.4	B25675C4252J080	4
MKK480-D-28.1-04	28.1	33.8 ⁽¹⁾	—	—	3 × 129.4	B	116 × 207	2.6	B25675C4282J180	4
MKK480-D-30.0-04	30	36.1 ⁽¹⁾	—	—	3 × 138.1	B	125 × 192	2.8	B25675C4302J080	4
MKK480-D-31.0-04	31	37.3 ⁽¹⁾	—	—	3 × 142.7	B	125 × 192	2.8	B25675C4312J080	4
MKK480-D-33.0-04	33	39.7 ⁽¹⁾	—	—	3 × 154.0	B	116 × 224	2.8	B25675C4332J080	4
MKK480-D-40.0-04	40	48.1 ⁽¹⁾	48	57.7 ⁽¹⁾	3 × 184.2	F	136 × 217	3.7	B25675C4402J080	4
MKK480-D-50.0-04	50	60.1 ⁽¹⁾	60	72.2 ⁽¹⁾	3 × 230.2	F	136 × 279	4.5	B25675C4502J080	2
MKK480-D-56.0-04	56	67.4 ⁽¹⁾	—	—	3 × 257.9	F	136 × 312	5	B25675C4562J080	2
MKK480-D-60.0-04	60	72.2 ⁽¹⁾	—	—	3 × 276.3	F	136 × 312	5	B25675C4602J080	2
PhaseCap Energy Plus · resin · three-phase · 525 V AC, delta connection										
MKK525-D-5.0-04	5	5.5 ⁽⁵⁾	6	6.6 ⁽²⁾	3 × 19.2	A	75 × 164	0.9	B25675C5052J025	6

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (μF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
MKK525-D-6.3-04	6.3	6.9	7.6	8.4	3 × 24.2	A	75 × 164	0.9	B25675C5062J325	6
MKK525-D-7.5-04	7.5	8.2 ⁽⁵⁾	9	9.9 ⁽²⁾	3 × 28.9	A	75 × 185	1	B25675C5072J525	6
MKK525-D-8.3-04	8.3	9.1 ⁽⁵⁾	10	11 ⁽²⁾	3 × 31.9	A	75 × 200	1.1	B25675C5082J325	6
MKK525-D-10.4-04	10.4	11.4 ⁽⁵⁾	12.5	13.7 ⁽²⁾	3 × 40.0	A	85 × 185	1.2	B25675C5102J425	9
MKK525-D-12.5-04	12.5	13.7 ⁽⁵⁾	15	16.5 ⁽²⁾	3 × 48.1	A	85 × 200	1.3	B25675C5122J525	9
MKK525-D-13.2-04	13.2	14.5 ⁽⁵⁾	15.8	17.4 ⁽²⁾	3 × 50.8	A	85 × 200	1.3	B25675C5132J225	9
MKK525-D-15.0-04	15	16.5 ⁽⁴⁾	18	19.8 ⁽¹⁾	3 × 57.7	A	85 × 218	1.5	B25675C5152J025	4
MKK525-D-16.7-04	16.7	18.4 ⁽³⁾	20	22 ⁽¹⁾	3 × 64.3	B	100 × 207	1.9	B25675C5162J725	6
MKK525-D-20.0-04	20	22 ⁽²⁾	24	26.4 ⁽¹⁾	3 × 77.0	B	100 × 224	2.1	B25675C5202J025	4
MKK525-D-20.8-04	20.8	22.9 ⁽²⁾	25	27.5 ⁽¹⁾	3 × 80.1	B	100 × 224	2.1	B25675C5202J825	4
MKK525-D-25.0-04	25	27.5 ⁽¹⁾	30	33 ⁽¹⁾	3 × 96.2	B	116 × 207	2.6	B25675C5252J025	4
MKK525-D-26.5-04	26.5	29.1 ⁽¹⁾	31.8	35 ⁽¹⁾	3 × 102.0	B	116 × 207	2.6	B25675C5262J525	4
MKK525-D-28.1-04	28.1	30.9 ⁽¹⁾	—	—	3 × 108.2	B	125 × 192	2.8	B25675C5282J125	4
MKK525-D-30.0-04	30	33 ⁽¹⁾	—	—	3 × 115.5	B	125 × 207	3	B25675C5302J025	4
MKK525-D-33.1-04	33.1	36.4 ⁽¹⁾	—	—	3 × 127.4	B	136 × 192	3.3	B25675C5332J125	4
MKK525-D-34.4-04	34.4	37.8 ⁽¹⁾	—	—	3 × 132.4	B	136 × 192	3.3	B25675C5342J425	4
MKK525-D-40.0-04	40	44 ⁽¹⁾	48	52.8 ⁽¹⁾	3 × 154.0	F	136 × 233	3.7	B25675C5402J025	4
MKK525-D-50.0-04	50	55 ⁽¹⁾	60	66 ⁽¹⁾	3 × 192.5	F	136 × 312	5	B25675C5502J025	2
MKK525-D-60.0-04	60	66 ⁽¹⁾	—	—	3 × 230.9	F	136 × 351	5.7	B25675C5602J025	2
PhaseCap Energy Plus · resin · three-phase · 600 V AC, delta connection										
MKK600-D-5.3-04	5.3	5.1 ⁽⁵⁾	6.4	6.2 ⁽²⁾	3 × 15.6	C	75 × 185	1	B25675C6052J300	6
MKK600-D-6.2-04	6.2	6	7.4	7.1 ⁽²⁾	3 × 18.3	C	75 × 185	1	B25675C6062J200	6
MKK600-D-6.9-04	6.9	6.6 ⁽⁵⁾	8.3	8 ⁽²⁾	3 × 20.3	C	75 × 200	1.1	B25675C6062J900	6
MKK600-D-8.3-04	8.3	8 ⁽⁴⁾	10	9.6 ⁽¹⁾	3 × 24.5	C	75 × 218	1.1	B25675C6082J300	9
MKK600-D-10.4-04	10.4	10 ⁽⁴⁾	12.5	12 ⁽¹⁾	3 × 30.6	C	85 × 200	1.3	B25675C6102J400	9
MKK600-D-12.5-04	12.5	12 ⁽⁴⁾	15	14.4 ⁽¹⁾	3 × 36.8	D	100 × 192	1.8	B25675C6122J500	6
MKK600-D-13.9-04	13.9	13.4 ⁽⁴⁾	16.7	16.1 ⁽¹⁾	3 × 41.0	D	100 × 207	1.9	B25675C6132J900	6
MKK600-D-14.6-04	14.6	14 ⁽⁴⁾	17.5	16.8 ⁽¹⁾	3 × 43.0	D	100 × 207	1.9	B25675C6142J600	6
MKK600-D-16.7-04	16.7	16.1 ⁽³⁾	20	19.2 ⁽¹⁾	3 × 49.2	D	100 × 224	2.1	B25675C6162J700	4
MKK600-D-20.0-04	20	19.2 ⁽²⁾	24	23.1 ⁽¹⁾	3 × 58.9	D	116 × 207	2.6	B25675C6202J000	4
MKK600-D-20.8-04	20.8	20 ⁽²⁾	25	24.1 ⁽¹⁾	3 × 61.3	D	116 × 207	2.6	B25675C6202J800	4
MKK600-D-25.0-04	25	24.1 ⁽¹⁾	30	28.9 ⁽¹⁾	3 × 73.7	D	125 × 207	3	B25675C6252J000	4
MKK600-D-28.0-04	28	26.9 ⁽¹⁾	—	—	3 × 82.5	D	136 × 192	3.3	B25675C6282J000	4
MKK600-D-30.0-04	30	28.9 ⁽¹⁾	—	—	3 × 88.4	D	136 × 207	3.6	B25675C6302J000	4
PhaseCap Energy Plus · resin · three-phase · 690 V AC, delta connection										
MKK690-D-5.3-04	5.3	4.4 ⁽⁵⁾	6.4	5.4 ⁽²⁾	3 × 11.8	C	75 × 185	1	B25675C6052J390	6
MKK690-D-6.2-04	6.2	5.2	7.4	6.2	3 × 13.8	C	75 × 200	1.1	B25675C6062J290	6
MKK690-D-6.9-04	6.9	5.8 ⁽⁵⁾	8.3	6.9 ⁽²⁾	3 × 15.4	C	75 × 200	1.1	B25675C6062J990	6
MKK690-D-8.3-04	8.3	6.9 ⁽⁵⁾	10	8.4 ⁽²⁾	3 × 18.5	C	75 × 200	1.1	B25675C6082J390	6
MKK690-D-10.4-04	10.4	8.7 ⁽⁴⁾	12.5	10.5 ⁽¹⁾	3 × 23.2	C	75 × 200	1.1	B25675C6102J490	6
MKK690-D-12.5-04	12.5	10.5 ⁽⁴⁾	15	12.6 ⁽¹⁾	3 × 27.9	C	85 × 200	1.3	B25675C6122J590	9
MKK690-D-13.9-04	13.9	11.6 ⁽⁴⁾	16.7	14 ⁽¹⁾	3 × 31.0	C	85 × 200	1.3	B25675C6132J990	9
MKK690-D-14.6-04	14.6	12.2 ⁽⁴⁾	17.5	14.6 ⁽¹⁾	3 × 32.5	D	100 × 207	1.9	B25675C6142J690	6
MKK690-D-16.7-04	16.7	14 ⁽⁴⁾	20	16.7 ⁽¹⁾	3 × 37.2	D	100 × 192	1.8	B25675C6162J790	6
MKK690-D-20.0-04	20	16.7	24	20.1 ⁽¹⁾	3 × 44.6	D	100 × 207	1.9	B25675C6202J090	6
MKK690-D-20.8-04	20.8	17.4 ⁽³⁾	25	20.9 ⁽¹⁾	3 × 46.3	D	100 × 224	2.1	B25675C6202J890	4
MKK690-D-25.0-04	25	20.9 ⁽²⁾	30	25.1 ⁽¹⁾	3 × 55.7	D	116 × 192	2.4	B25675C6252J090	4

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (μF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
MKK690-D-28.0-04	28	23.4 ⁽¹⁾	—	—	3 × 62.4	D	116 × 207	2.6	B25675C6282J090	4
MKK690-D-30.0-04	30	25.1 ⁽¹⁾	—	—	3 × 66.8	D	125 × 192	2.8	B25675C6302J090	4
PhaseCap Energy Plus · resin · three-phase · 800 V AC, delta connection										
MKK800-D-15.0-04	15	10.8 ^(a)	18	13 ⁽¹⁾	3 × 24.9	E	100 × 224	2.1	B25675C8152J000	6
MKK800-D-20.0-04	20	14.4	24	17.3 ⁽¹⁾	3 × 33.2	E	116 × 224	2.8	B25675C8202J000	4
MKK800-D-25.0-04	25	18 ⁽¹⁾	30	21.7 ⁽¹⁾	3 × 41.4	E	116 × 224	2.8	B25675C8252J000	4
MKK800-D-28.0-04	28	20.2 ⁽¹⁾	—	—	3 × 46.4	E	116 × 248	3.1	B25675C8282J000	4
MKK800-D-30.0-04	30	21.7 ⁽¹⁾	—	—	3 × 49.7	E	116 × 248	3.1	B25675C8302J000	4
PhaseCap Energy Plus · resin · three-phase · 900 V AC, delta connection										
MKK900-D-15.0-04	15	9.6 ^(a)	18	11.5 ⁽¹⁾	3 × 19.6	E	100 × 224	2.1	B25675C9152J000	6
MKK900-D-20.0-04	20	12.8	24	15.4 ⁽¹⁾	3 × 26.2	E	116 × 224	2.8	B25675C9202J000	4
MKK900-D-25.0-04	25	16 ⁽¹⁾	30	19.2 ⁽¹⁾	3 × 32.7	E	116 × 224	2.8	B25675C9252J000	4
MKK900-D-30.0-04	30	19.2 ⁽¹⁾	—	—	3 × 39.3	E	116 × 248	3.1	B25675C9302J000	4
PhaseCap Energy Plus · resin · three-phase · 1000 V AC, delta connection										
MKK1000-D-15.0-04	15	8.7 ^(a)	18	10.4 ⁽¹⁾	3 × 15.9	E	100 × 224	2.1	B25675C0152J000	6
MKK1000-D-20.0-04	20	11.5	24	13.9 ⁽¹⁾	3 × 21.2	E	116 × 224	2.8	B25675C0202J000	4
MKK1000-D-25.0-04	25	14.4 ⁽¹⁾	30	17.3 ⁽¹⁾	3 × 26.5	E	116 × 248	3.1	B25675C0252J000	4
MKK1000-D-30.0-04	30	17.3 ⁽¹⁾	—	—	3 × 31.8	E	116 × 282	3.5	B25675C0302J000	2
PhaseCap Premium · gas (N2) · three-phase · 230 V AC, delta connection										
MKK230-D-5.0-01	5	13	6	16	3 × 100	—	116 × 164	1.3	B25667C3297A375	4
MKK230-D-7.5-01	7.5	19	9	23	3 × 150	—	116 × 164	1.3	B25667C2457A375	4
MKK230-D-10.4-01	10.4	26	12.5	31	3 × 209	—	116 × 164	1.5	B25667C2627A375	4
MKK230-D-12.5-01	12.5	31	15	37	3 × 251	—	116 × 200	1.7	B25667C2757A375	4
PhaseCap Premium · gas (N2) · three-phase · 400 V AC, delta connection										
MKK400-D-5.0-01	5	7	6	9	3 × 32	—	116 × 164	1.1	B25667C5966A375	4
MKK400-D-7.5-01	7.5	11	9	13	3 × 50	—	116 × 164	1.2	B25667C3147A375	4
MKK400-D-10.0-01	10	14	12	17	3 × 64	—	116 × 164	1.2	B25667C4197A375	4
MKK400-D-12.5-01	12.5	18	15	22	3 × 83	—	116 × 164	1.1	B25667C3247A375	4
MKK400-D-15.0-01	15	22	18	26	3 × 100	—	116 × 164	1.3	B25667C3297A375	4
MKK400-D-20.0-01	20	30	24	36	3 × 133	—	116 × 164	1.5	B25667C3397A375	4
MKK400-D-25.0-01	25	36	—	—	3 × 165	—	116 × 200	1.8	B25667C3497A375	4
PhaseCap Premium · gas (N2) · three-phase · 415 V AC, delta connection										
MKK415-D-5.0-01	5	7	6	8	3 × 32	—	116 × 164	1.1	B25667C5966A375	4
MKK415-D-6.2-01	6.2	8	7.5	10	3 × 39	—	116 × 164	1.2	B25667C5127A375	4
MKK415-D-10.4-01	10.4	15	12.5	17	3 × 64	—	116 × 164	1.2	B25667C4197A375	4
MKK415-D-12.5-01	12.5	17	15	21	3 × 77	—	116 × 164	1.3	B25667C4237A375	4
MKK415-D-15.0-01	15	21	18	25	3 × 93	—	116 × 164	1.4	B25667C4287A375	4
MKK415-D-16.7-01	16.7	23	20	28	3 × 103	—	116 × 164	1.5	B25667C4307A375	4
MKK415-D-20.0-01	20.8	29	25	35 ^(a)	3 × 128	—	116 × 200	1.7	B25667C4387A375	4
MKK415-D-25.0-01	25	35	—	—	3 × 154	—	136 × 200	2.1	B25667C4467A375	4
PhaseCap Premium · gas (N2) · three-phase · 440 V AC, delta connection										
MKK440-D-5.0-01	5	7	6	8	3 × 27	—	116 × 164	1.2	B25667C4826A375	4
MKK440-D-7.5-01	7.5	10	9	12	3 × 41	—	116 × 164	1.2	B25667C4127A375	4
MKK440-D-10.4-01	10.4	14	12.5	16	3 × 57	—	116 × 164	1.3	B25667C4177A375	4
MKK440-D-12.5-01	12.5	16	15	20	3 × 69	—	116 × 164	1.4	B25667C4207A375	4
MKK440-D-14.2-01	14.2	19	17	22	3 × 77	—	116 × 164	1.3	B25667C4237A375	4
MKK440-D-15.0-01	15	20	18	24	3 × 83	—	116 × 164	1.4	B25667C4247A375	4

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (μF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
MKK440-D-16.7-01	16.7	22	20	26	3 × 92	—	116 × 200	1.8	B25667C4277A375	4
MKK440-D-18.8-01	18.8	25	22.6	30	3 × 103	—	116 × 164	1.5	B25667C4307A375	4
MKK440-D-20.0-01	20	26	24	31	3 × 111	—	116 × 200	1.7	B25667C4337A375	4
MKK440-D-25.0-01	25	33	30	39	3 × 137	—	136 × 200	2	B25667C4417A375	4
MKK440-D-28.1-01	28.1	37	—	—	3 × 154	—	136 × 200	2.1	B25667C4467A375	4
MKK440-D-30.0-01	30	39 ^(h)	—	—	3 × 164	—	136 × 200	2.4	B25667C4497A375	4
MKK440-D-33.0-01	33	43 ^(h)	—	—	3 × 181	—	136 × 200	2.5	B25667C4547A375	4
PhaseCap Premium · gas (N2) · three-phase · 480 V AC, delta connection										
MKK480-D-6.25-01	6.25	8	7.5	9	3 × 29	—	116 × 164	1.2	B25667C4866A375	4
MKK480-D-8.3-01	8.3	10	10	12	3 × 39	—	116 × 164	1.2	B25667C5127A375	4
MKK480-D-10.4-01	10.4	12	12.5	14	3 × 48	—	116 × 164	1.3	B25667C5147A375	4
MKK480-D-12.5-01	12.5	15	15	18	3 × 58	—	116 × 164	1.5	B25667C5177A375	4
MKK480-D-15.0-01	15	18	18	22	3 × 69	—	116 × 164	1.4	B25667C4207A375	4
MKK480-D-16.7-01	16.7	20	20	24	3 × 77	—	116 × 200	1.8	B25667C5237A375	4
MKK480-D-20.0-01	20	24	24	29	3 × 92	—	116 × 200	1.8	B25667C4277A375	4
MKK480-D-25.0-01	25	30	30	36	3 × 115	—	136 × 200	2.2	B25667C4347A375	4
MKK480-D-30.0-01	30	36 ^(h)	—	—	3 × 138	—	136 × 200	2.4	B25667C4417A365	4
PhaseCap Premium · gas (N2) · three-phase · 525 V AC, delta connection										
MKK525-D-8.3-01	8.3	9	10	11	3 × 32	—	116 × 164	1.1	B25667C5966A375	4
MKK525-D-10.0-01	10	11	12	13	3 × 39	—	116 × 164	1.2	B25667C5127A375	4
MKK525-D-12.5-01	12.5	14	15	17	3 × 48	—	116 × 164	1.3	B25667C5147A375	4
MKK525-D-15.0-01	15	17	18	20	3 × 58	—	116 × 164	1.5	B25667C5177A375	4
MKK525-D-16.7-01	16.7	18	20	21	3 × 64	—	116 × 164	1.6	B25667C5197A375	4
MKK525-D-20.0-01	20	22	24	26	3 × 77	—	116 × 200	1.8	B25667C5237A375	4
MKK525-D-25.0-01	25	28	30	33	3 × 96	—	136 × 200	2.3	B25667C5287A375	4
MKK525-D-30.0-01	30	33 ^(h)	—	—	3 × 115	—	136 × 200	2.4	B25667C5347A375	4
PhaseCap Premium · gas (N2) · three-phase · 570 V AC, delta connection										
MKK570-D-27.5-01	27.5	27	33	32.4	3 × 90	—	136 × 200	2.5	B25667C5277A375	4
PhaseCap Premium · gas (N2) · three-phase · 690 V AC, delta connection										
MKK690-D-5.0-01	5	4.2	6	5	3 × 11	—	116 × 164	1.3	B25667C6336A375	4
MKK690-D-10.0-01	10	8.4	12	10.1	3 × 23	—	116 × 164	1.4	B25667C6676A375	4
MKK690-D-12.5-01	12.5	10.5	15	12.6	3 × 28	—	116 × 164	1.5	B25667C6836A375	4
MKK690-D-15.0-01	15	12.6	18	15.1	3 × 34	—	116 × 164	1.5	B25667C6107A375	4
MKK690-D-20.8-01	20.8	17.5	25	21	3 × 47	—	136 × 200	2	B25667C6137A375	4
MKK690-D-25.0-01	25	21	30	25.1	3 × 56	—	136 × 200	2.2	B25667C6167A375	4
PhaseCap Premium · gas (N2) · three-phase · 765 V AC, delta connection										
MKK765-D-30.0-01	30	23	36	28	3 × 55	—	136 × 200	2.4	B25667C7167A375	4
PhaseCap Premium · gas (N2) · three-phase · 800 V AC, delta connection										
MKK800-D-5.0-01	5	3.6	6	4.3	3 × 8	—	116 × 164	1.2	B25667C7246A375	4
MKK800-D-7.5-01	7.5	5.4	9	6.5	3 × 12.4	—	121 × 164	1.2	B25667C7376A375	4
MKK800-D-10.0-01	10	7.2	12	8.7	3 × 17	—	116 × 164	1.3	B25667C7496A375	4
MKK800-D-12.5-01	12.5	9	15	11	3 × 21	—	116 × 164	1.4	B25667C7626A375	4
MKK800-D-15.0-01	15	11	18	13	3 × 25	—	116 × 164	1.5	B25667C7746A375	4
MKK800-D-20.0-01	20	14.5	24	17.3	3 × 33	—	136 × 200	2	B25667C7996A375	4
MKK800-D-25.0-01	25	18	30	22	3 × 41	—	136 × 200	2.3	B25667C7127A375	4
MKK800-D-28.0-01	28	20	33	24	3 × 46	—	136 × 200	2.4	B25667C7137A375	4

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (μF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
PhaseCap Premium · gas (N2) · single-phase · 230 V AC, single phase										
MKK230-I-5.0-01	5.2	23	6.2	28	313	—	116 × 164	1.1	B25667C2317A175	4
MKK230-I-6.6-01	6.6	29	7.9	34	397	—	116 × 164	1.4	B25667C2397A175	4
MKK230-I-7.5-01	7.5	33	9	40	457	—	116 × 164	1.3	B25667C2457A175	4
MKK230-I-8.3-01	8.3	36	10	43	502	—	116 × 164	1.3	B25667C2507A175	4
MKK230-I-9.1-01	9.1	38	—	—	548	—	116 × 164	1.4	B25667C2557A175	4
PhaseCap Premium · gas (N2) · single-phase · 400 V AC, single phase										
MKK400-I-10.4-01	10.4	26	12.5	31	207	—	116 × 164	1.2	B25667C3207A175	4
MKK400-I-12.5-01	12.5	31	15	37	249	—	116 × 164	1.3	B25667C3247A175	4
PhaseCap Premium · gas (N2) · single-phase · 440 V AC, single phase										
MKK440-I-6.9-01	6.9	16	8.3	19	116	—	116 × 164	1.3	B25667C5117A175	4
MKK440-I-8.3-01	8.3	19	10	23	144	—	116 × 164	1.5	B25667C5147A175	4
PhaseCap Premium · gas (N2) · single-phase · 525 V AC, single phase										
MKK525-I-10.0-01	10	19	12	23	116	—	116 × 164	1.3	B25667C5117A175	4
MKK525-I-12.5-01	12.5	24	15	29	144	—	116 × 164	1.5	B25667C5147A175	4
MKK525-I-15.0-01	15	29	18	35	173	—	116 × 200	1.7	B25667C5177A175	4
MKK525-I-18.6-01	18.6	36	22.3	43	215	—	136 × 200	2	B25667C5217A175	4
DeltaCap · resin · three-phase · 230 V AC, delta connection										
MKD230-D-0.5	0.5	1.3	0.6	1.6	3 × 10	—	50 × 150	0.4	B32303A2002A530	50
MKD230-D-0.7	0.7	1.8	0.8	2.2	3 × 14	—	50 × 150	0.4	B32303A2002A730	50
MKD230-D-1.0	1	2.5	1.2	3	3 × 20	—	50 × 150	0.4	B32303A2012A030	50
MKD230-D-1.5	1.5	3.8	1.8	4.6	3 × 30	—	63.5 × 150	0.6	B32303A2012A530	12
MKD230-D-2.0	2	5	2.4	6	3 × 40	—	63.5 × 150	0.6	B32303A2022A030	12
MKD230-D-2.5	2.5	6.3	3	7.6	3 × 50	—	63.5 × 150	0.8	B32303A2022A530	12
MKD230-D-5.0	5	12.6	6	15.1	3 × 100	—	75 × 200	1.1	B32304A2052#030*	6
MKD230-D-7.5	7.5	18.8	9	22.6	3 × 151	—	75 × 275	1.4	B32304A2072#530*	6
MKD230-D-10.0	10	25.1	12	30.1	3 × 201	—	85 × 275	1.7	B32304A2102#030*	4
MKD230-D-12.5	12.5	31.4	15	37.7	3 × 251	—	85 × 350	2.2	B32304A2122#530*	4
MKD230-D-15.0	15	37.7	18	45.2	3 × 301	—	85 × 350	2.2	B32304A2152#030*	4
DeltaCap · resin · three-phase · 400 V AC, delta connection										
MKD400-D-1.0	1	1.4	1.2	1.7	3 × 6.6	—	50 × 150	0.4	B32303A4012A000	50
MKD400-D-1.5	1.5	2.2	1.8	2.6	3 × 10	—	50 × 150	0.4	B32303A4012A500	50
MKD400-D-2.0	2	2.9	2.4	3.5	3 × 13	—	50 × 150	0.4	B32303A4022A000	50
MKD400-D-2.5	2.5	3.6	3	4.3	3 × 17	—	50 × 150	0.4	B32303A4022A500	50
MKD400-D-5.0	5	7.2	6	8.6	3 × 33	—	63.5 × 150	0.6	B32303A4052A000	12
MKD400-D-6.3	6.3	9.1	7.6	10.9	3 × 42	—	75 × 163	0.8	B32304A4071#500*	6
MKD400-D-7.5	7.5	10.8	9	13	3 × 50	—	75 × 163	0.9	B32304A4072#500*	6
MKD400-D-8.3	8.3	12	10	14.4	3 × 55	—	75 × 200	1.1	B32304A4101#000*	6
MKD400-D-10.0	10	14.4	12	17.3	3 × 66	—	75 × 200	1.1	B32304A4102#000*	6
MKD400-D-12.5	12.5	18	15	21.6	3 × 83	—	75 × 275	1.4	B32304A4122#500*	6
MKD400-D-15.0	15	21.7	18	26	3 × 100	—	75 × 275	1.4	B32304A4152#000*	6
MKD400-D-16.7	16.7	24.1	20	28.9	3 × 111	—	85 × 275	1.8	B32304A4201#000*	4
MKD400-D-20.0	20	28.9	24	34.7	3 × 133	—	85 × 275	1.8	B32304A4202#000*	4
MKD400-D-25.0	25	36.1	30	43.3	3 × 166	—	85 × 350	2.2	B32304A4252#000*	4
MKD400-D-30.0	30	43.3	—	—	3 × 199	—	96 × 275	2.4	B32304A4302#000*	4
DeltaCap · resin · three-phase · 415 V AC, delta connection										
MKD415-D-1.0	1	1.4	1.2	1.7	3 × 6.2	—	50 × 150	0.4	B32303A4012A010	50

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (µF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
MKD415-D-1.5	1.5	2.1	1.8	2.5	3 × 9.2	—	50 × 150	0.4	B32303A4012A510	50
MKD415-D-2.0	2	2.8	2.4	3.4	3 × 12	—	50 × 150	0.4	B32303A4022A010	50
MKD415-D-2.5	2.5	3.5	3	4.2	3 × 15	—	63.5 × 150	0.6	B32303A4022A510	12
MKD415-D-5.0	5	7	6	8.4	3 × 31	—	63.5 × 150	0.8	B32303A4052A010	12
MKD415-D-6.3	6.3	8.8	7.6	10.6	3 × 39	—	75 × 200	1	B32304A4071#510*	6
MKD415-D-7.5	7.5	10.4	9	12.5	3 × 46	—	75 × 200	1.1	B32304A4072#510*	6
MKD415-D-10.0	10	13.9	12	16.7	3 × 62	—	75 × 275	1.4	B32304A4102#010*	6
MKD415-D-12.5	12.5	17.4	15	20.9	3 × 77	—	75 × 275	1.4	B32304A4122#510*	6
MKD415-D-15.0	15	20.9	18	25.1	3 × 93	—	85 × 275	1.7	B32304A4152#010*	4
MKD415-D-20.0	20	27.8	24	33.4	3 × 123	—	85 × 275	2.2	B32304A4202#010*	4
MKD415-D-20.8	20.8	28.9	25	34.7	3 × 128	—	85 × 350	2.4	B32304A4251#010*	4
MKD415-D-25.0	25	34.8	30	41.8	3 × 154	—	85 × 350	2.4	B32304A4252#010*	4
MKD415-D-30.0	30	41.7	36	50	3 × 185	—	96 × 350	2.7	B32304A4302#010*	4
DeltaCap · resin · three-phase · 440 V AC, delta connection										
MKD440-D-0.9	0.9	1.2	1.1	1.4	3 × 5.2	—	50 × 127	0.4	B32303A4011A040	50
MKD440-D-1.0	1	1.3	1.2	1.6	3 × 5.5	—	50 × 127	0.4	B32303A4012A040	50
MKD440-D-1.2	1.2	1.6	1.4	1.9	3 × 6.6	—	50 × 127	0.4	B32303A4011A540	50
MKD440-D-1.5	1.5	2	1.8	2.4	3 × 8.8	—	50 × 127	0.4	B32303A4012A540	50
MKD440-D-2.0	2	2.6	2.4	3.1	3 × 11	—	50 × 150	0.5	B32303A4022A040	50
MKD440-D-2.1	2.1	2.8	2.5	3.4	3 × 12	—	50 × 150	0.5	B32303A4021A540	50
MKD440-D-2.5	2.5	3.3	3	4	3 × 14	—	63.5 × 150	0.7	B32303A4022A540	12
MKD440-D-4.2	4.2	5.5	5	6.6	3 × 23	—	63.5 × 150	0.7	B32303A4051A040	12
MKD440-D-5.0	5	6.6	6	7.9	3 × 27	—	63.5 × 150	0.8	B32303A4052A040	12
MKD440-D-6.3	6.3	8.3	7.6	10	3 × 35	—	75 × 163	0.8	B32304A4071#540*	6
MKD440-D-7.5	7.5	9.8	9	11.8	3 × 41	—	75 × 200	1.1	B32304A4072#540*	6
MKD440-D-8.3	8.3	10.9	10	13.1	3 × 46	—	75 × 200	1.1	B32304A4101#040*	6
MKD440-D-10.0	10	13.1	12	15.7	3 × 55	—	75 × 275	1.4	B32304A4102#040*	6
MKD440-D-10.4	10.4	13.6	12.5	16.3	3 × 57	—	75 × 275	1.4	B32304A4121#540*	6
MKD440-D-12.5	12.5	16.4	15	19.7	3 × 69	—	75 × 275	1.4	B32304A4151#040*	6
MKD440-D-15.0	15	19.7	18	23.6	3 × 82	—	85 × 275	1.7	B32304A4152#040*	4
MKD440-D-16.7	16.7	21.9	20	26.3	3 × 92	—	85 × 275	1.7	B32304A4201#040*	4
MKD440-D-20.0	20	26.2	24	31.5	3 × 110	—	85 × 275	1.9	B32304A4202#040*	4
MKD440-D-20.8	20.8	27.3	25	32.8	3 × 114	—	85 × 350	2.2	B32304A4251#040*	4
MKD440-D-25.0	25	32.8	30	39.4	3 × 137	—	85 × 350	2.2	B32304A4252#040*	4
MKD440-D-28.0	28	36.7	33.6	44	3 × 154	—	85 × 350	2.2	B32304A4282#040*	4
MKD440-D-30.0	30	39	—	—	3 × 164	—	96 × 350	2.7	B32304A4302#040*	4
MKD440-D-33.0	33	43.3	—	—	3 × 181	—	96 × 350	2.7	B32304A4332#040*	4
MKD440-D-33.8	33.8	44.4	—	—	3 × 185	—	96 × 350	2.7	B32304A4332#840*	4
DeltaCap · resin · three-phase · 480 V AC, delta connection										
MKD480-D-1.5	1.5	1.8	1.8	2.2	3 × 6.9	—	50 × 127	0.4	B32303A4012A580	50
MKD480-D-2.0	2	2.4	2.4	2.9	3 × 9.2	—	50 × 150	0.5	B32303A4022A080	50
MKD480-D-2.5	2.5	3	3	3.6	3 × 12	—	63.5 × 150	0.7	B32303A4022A580	12
MKD480-D-5.0	5	6	6	7.2	3 × 23	—	75 × 163	0.8	B32304A4052#080*	6
MKD480-D-6.3	6.3	7.6	7.6	9.1	3 × 29	—	75 × 163	0.8	B32304A4071#580*	6
MKD480-D-7.5	7.5	9	9	10.8	3 × 35	—	75 × 200	1.1	B32304A4072#580*	6
MKD480-D-8.3	8.3	10	10	12	3 × 38	—	75 × 200	1.1	B32304A4101#080*	6
MKD480-D-10.4	10.4	12.5	12.5	15	3 × 48	—	75 × 275	1.4	B32304A4121#580*	6

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (μF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
MKD480-D-12.5	12.5	15	15	18	3 × 58	—	75 × 275	1.4	B32304A4151#080*	6
MKD480-D-15.0	15	18	18	21.6	3 × 69	—	85 × 275	1.7	B32304A4152#080*	6
MKD480-D-16.7	16.7	20.1	20	24.1	3 × 77	—	85 × 275	1.8	B32304A4162#780*	6
MKD480-D-20.0	20	24.1	24	28.9	3 × 92	—	85 × 350	2.2	B32304A4201#080*	4
MKD480-D-20.8	20.8	25	25	30	3 × 96	—	85 × 350	2.2	B32304A4202#080*	4
MKD480-D-25.0	25	30.1	30	36.1	3 × 115	—	85 × 350	2.2	B32304A4252#080*	4
MKD480-D-30.0	30	36	36	43	3 × 138	—	96 × 350	2.7	B32304A4302#080*	4
MKD480-D-33.0	33	39.7	—	—	3 × 152	—	96 × 350	2.7	B32304A4332#080*	4
DeltaCap · resin · three-phase · 525 V AC, delta connection										
MKD525-D-1.0	1	1.1	1.2	1.3	3 × 3.9	—	50 × 150	0.4	B32303A5012A020	50
MKD525-D-1.5	1.5	1.6	1.8	1.9	3 × 5.8	—	50 × 150	0.4	B32303A5012A520	50
MKD525-D-2.0	2	2.2	2.4	2.6	3 × 7.7	—	63.5 × 150	0.6	B32303A5022A020	12
MKD525-D-2.5	2.5	2.7	3	3.2	3 × 9.6	—	63.5 × 150	0.6	B32303A5022A520	12
MKD525-D-5.0	5	5.5	6	6.6	3 × 19	—	75 × 163	0.8	B32304A5061#020*	6
MKD525-D-6.3	6.3	6.9	7.6	8.3	3 × 24	—	75 × 200	1	B32304A5071#520*	6
MKD525-D-8.3	8.3	9.1	10	10.9	3 × 32	—	75 × 275	1.4	B32304A5101#020*	6
MKD525-D-10.4	10.4	11.4	12.5	13.7	3 × 40	—	75 × 275	1.4	B32304A5121#520*	6
MKD525-D-12.5	12.5	13.7	15	16.4	3 × 48	—	75 × 275	1.4	B32304A5151#020*	6
MKD525-D-16.7	16.7	18.4	20	22.1	3 × 64	—	85 × 275	1.8	B32304A5201#020*	4
MKD525-D-20.8	20.8	22.9	25	27.5	3 × 80	—	85 × 350	2.2	B32304A5202#020*	4
MKD525-D-25.0	25	27.5	30	33	3 × 96	—	85 × 350	2.2	B32304A5252#020*	4
MKD525-D-30.0	30	33	36	39	3 × 115	—	96 × 350	2.7	B32304A5302#020*	4
MKD525-D-40.0	40	44	48	52.8	3 × 150	—	136 × 255	4.2	B32304A5402B025	4
DeltaCap · resin · single-phase · 230 V AC, single phase										
MKD230-I-0.8	0.8	3.5	1	4.2	48	—	63.5 × 64.5	0.3	B32300A2002A830	12
MKD230-I-1.7	1.7	7.4	2	8.9	102	—	63.5 × 102	0.4	B32300A2012A730	12
MKD230-I-2.5	2.5	10.9	3	13.1	151	—	63.5 × 127	0.5	B32300A2022A530	12
DeltaCap · resin · single-phase · 250 V AC, single phase										
MKD250-I-0.8	0.8	3.2	1	3.8	41	—	50 × 77	0.2	B32300A2002A850	50
MKD250-I-1.7	1.7	6.8	2	8.2	87	—	63.5 × 92	0.4	B32300A2012A750	12
MKD250-I-2.0	2	7.8	2.4	9.4	100	—	63.5 × 92	0.4	B32300A2022A050	12
MKD250-I-2.5	2.5	10	3	12	127	—	63.5 × 102	0.5	B32300A2022A550	12
MKD250-I-5.0	5	20	6	24	255	—	75 × 166	0.7	B32301A2052#050*	6
MKD250-I-7.5	7.5	30	9	36	382	—	85 × 196	1.1	B32301A2072#550*	4
MKD250-I-10	10	40	12	48	510	—	85 × 216	1.2	B32301A2102#050*	4
DeltaCap · resin · single-phase · 400 V AC, single phase										
MKD400-I-0.8	0.8	2	1	2.4	16	—	50 × 64.5	0.2	B32300A4002A800	50
MKD400-I-1.7	1.7	4.3	2	5.2	34	—	63.5 × 62.5	0.3	B32300A4012A700	12
MKD400-I-2.5	2.5	6.3	3	7.6	50	—	63.5 × 77	0.3	B32300A4022A500	12
MKD400-I-3.3	3.3	8.3	4	10	66	—	63.5 × 102	0.4	B32300A4032A300	12
MKD400-I-4.2	4.2	10.5	5	12.6	84	—	63.5 × 102	0.4	B32300A4051A000	12
MKD400-I-5.0	5	12.5	6	15	100	—	63.5 × 127	0.5	B32300A4052A000	12
DeltaCap · resin · single-phase · 415 V AC, delta connection										
MKD415-I-0.8	0.8	1.9	1	2.3	15	—	50 × 64.5	0.2	B32300A4082A310	50
MKD415-I-1.7	1.7	4	2	4.8	31	—	63.5 × 64.5	0.3	B32300A4012A710	12
MKD415-I-2.5	2.5	6	3	7.2	46	—	63.5 × 102	0.4	B32300A4022A510	12
MKD415-I-3.3	3.3	8	4	9.6	61	—	63.5 × 102	0.4	B32300A4032A310	12

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (μF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
MKD415-I-5.0	5	12	6	14.4	92	—	63.5 × 127	0.6	B32300A4052A010	12
DeltaCap · resin · single-phase · 440 V AC, single phase										
MKD440-I-0.7	0.7	1.6	0.8	1.9	12	—	50 × 64.5	0.2	B32300A4001A840	50
MKD440-I-1.4	1.4	3.2	1.7	3.8	23	—	63.5 × 64.5	0.3	B32300A4011A740	12
MKD440-I-2.1	2.1	4.8	2.5	5.8	35	—	63.5 × 77	0.3	B32300A4021A540	12
MKD440-I-2.8	2.8	6.4	3.4	7.7	46	—	63.5 × 102	0.4	B32300A4031A340	12
MKD440-I-3.3	3.3	7.5	4	9	54	—	63.5 × 102	0.4	B32300A4032A340	12
MKD440-I-4.2	4.2	9.5	5	11.4	69	—	63.5 × 127	0.5	B32300A4051A040	12
MKD440-I-5.0	5	11.4	6	13.7	82	—	63.5 × 127	0.5	B32300A4052A040	12
DeltaCap · resin · single-phase · 480 V AC, single phase										
MKD480-I-0.7	0.7	1.5	0.8	1.8	10	—	50 × 64.5	0.2	B32300A4001A880	50
MKD480-I-1.4	1.4	2.9	1.7	3.5	19	—	63.5 × 64.5	0.3	B32300A4011A780	12
MKD480-I-2.1	2.1	4.4	2.5	5.3	29	—	63.5 × 77	0.3	B32300A4021A580	12
MKD480-I-2.8	2.8	5.8	3.4	7	39	—	63.5 × 102	0.4	B32300A4031A380	12
DeltaCap · resin · single-phase · 525 V AC, single phase										
MKD525-I-1.4	1.4	2.7	1.7	3.2	16	—	63.5 × 64.5	0.3	B32300A5011A730	12
MKD525-I-2.8	2.8	5.3	3.4	6.4	32	—	63.5 × 102	0.4	B32300A5031A320	12
MKD525-I-3.3	3.3	6.3	4	7.6	38	—	63.5 × 102	0.4	B32300A5032A320	12
MKD525-I-4.2	4.2	8	5	9.6	49	—	63.5 × 127	0.5	B32300A5051A020	12
MKD525-I-25.0	25	47.6	30	57.1	289	—	116 × 200	1.9	B32301A5252#025*	4
DeltaCap X Black Premium · resin · three-phase · 440 V AC, delta connection										
MKD440-D-20.0-X	20	26.2	24	31.4	3 × 110	—	136 × 245	4.2	B32305A4202B040	4
MKD440-D-25.0-X	25	32.8	30	39.4	3 × 137	—	136 × 245	4.2	B32305A4252B040	4
MKD440-D-28.1-X	28.1	36.9	33.7	44.3	3 × 154	—	136 × 245	4.2	B32305A4282B140	4
MKD440-D-30.0-X	30	39.4	36	47.3	3 × 165	—	136 × 275	4.6	B32305A4302B040	4
DeltaCap X Black Premium · resin · three-phase · 480 V AC, delta connection										
MKD480-D-25.0-X	25	30.1	30	36.1	3 × 115	—	136 × 245	4.2	B32305A4252B080	4
MKD480-D-28.0-X	28	33.7	33.6	40.4	3 × 129	—	136 × 230	3.9	B32305A4282B080	4
MKD480-D-30.0-X	30	36.1	36	43.3	3 × 138	—	136 × 245	4.2	B32305A4302B080	4
MKD480-D-33.0-X	33	39.7	39.6	47.6	3 × 152	—	136 × 230	3.8	B32305A4332B080	4
DeltaCap X Black Premium · resin · three-phase · 525 V AC, delta connection										
MKD525-D-20.0-X	20	22	24	26.4	3 × 77	—	136 × 200	3.6	B32305A5202B025	4
MKD525-D-25.0-X	25	27.5	30	33	3 × 96	—	136 × 230	3.9	B32305A5252B025	4
MKD525-D-28.0-X	28	30.8	33.6	37	3 × 108	—	136 × 230	4	B32305A5282B025	4
MKD525-D-33.0-X	33	36.3	39.6	43.6	3 × 127	—	136 × 245	4.2	B32305A5332B025	4
MKD525-D-37.0-X	37	40.7	44	48.8	3 × 143	—	136 × 245	4.2	B32305A5372B025	4
DeltaCap X Black Premium · resin · three-phase · 850 V AC, delta connection										
MKD850-D-35.0-X	35	23.8	42	28.5	3 × 51	—	136 × 230	4.3	B32305A8352B050	4
PhiCap · resin · three-phase · 230 V AC, delta connection										
MKP230-D-0.5	0.5	1.3	0.6	1.6	3 × 10	—	53 × 114	0.3	B32343C2002A530	12
MKP230-D-0.7	0.7	1.9	0.9	2.3	3 × 15	—	53 × 114	0.3	B32343C2002A730	12
MKP230-D-1.0	1	2.5	1.2	3	3 × 20	—	63.5 × 129	0.3	B32343C2012A030	12
MKP230-D-1.5	1.5	3.8	1.8	4.6	3 × 30	—	63.5 × 129	0.4	B32343C2012A530	12
MKP230-D-2.0	2	5	2.4	6	3 × 42	—	75 × 138	0.4	B32344E2022A030	6
MKP230-D-2.5	2.5	6.3	3	7.5	3 × 50	—	75 × 138	0.4	B32344E2022A530	6
MKP230-D-5.0	5	12.6	6	15.1	3 × 100	—	75 × 198	0.6	B32344E2052A030	4
MKP230-D-7.5	7.5	18.8	9	22.6	3 × 150	—	85 × 198	0.8	B32344E2072A530	4

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (μF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
MKP230-D-10.0	10	25.1	12	30.2	3 × 200	—	85 × 273	1.2	B32344E2102A030	4
MKP230-D-12.5	12.5	31.4	15	37.7	3 × 250	—	85 × 348	1.5	B32344E2122A530	4
MKP230-D-15.0	15	37.7	—	—	3 × 300	—	85 × 348	1.5	B32344E2152A030	4
PhiCap · resin · three-phase · 400 V AC, delta connection										
MKP400-D-1.0	1	1.4	1.2	1.7	3 × 7	—	53 × 114	0.3	B32343C4012A000	12
MKP400-D-1.5	1.5	2.2	1.8	2.6	3 × 10	—	53 × 114	0.3	B32343C4012A500	12
MKP400-D-2.0	2	2.9	2.4	3.5	3 × 13	—	63.5 × 129	0.4	B32343C4022A000	12
MKP400-D-2.5	2.5	3.6	3	4.3	3 × 17	—	63.5 × 129	0.4	B32343C4022A500	12
MKP400-D-5.0	5	7.2	6	8.6	3 × 33	—	63.5 × 129	0.4	B32343C4052A000	12
MKP400-D-6.3	6.3	9.1	7.5	11	3 × 42	—	75 × 160	0.5	B32344E4071A500	6
MKP400-D-7.5	7.5	10.8	9	13	3 × 50	—	75 × 160	0.5	B32344E4072A500	6
MKP400-D-8.3	8.3	12	10	14.5	3 × 55	—	75 × 160	0.5	B32344E4101A000	6
MKP400-D-10.0	10	14.5	12	17.3	3 × 67	—	75 × 198	0.6	B32344E4102A000	4
MKP400-D-12.5	12.5	18.1	15	21.7	3 × 83	—	85 × 198	0.8	B32344E4122A500	4
MKP400-D-15.0	15	21.7	18	26	3 × 100	—	85 × 198	0.8	B32344E4152A000	4
MKP400-D-16.7	16.7	24.1	20	28.9	3 × 111	—	85 × 198	0.8	B32344E4201A000	4
MKP400-D-20.0	20	28.9	24	34.7	3 × 133	—	85 × 273	1.1	B32344E4202A000	4
MKP400-D-25.0	25	36.1	—	—	3 × 166	—	85 × 273	1.5	B32344E4252A000	4
MKP400-D-30.0	30	43.3	—	—	3 × 199	—	90 × 348	2.5	B32344E4302A000	4
PhiCap · resin · three-phase · 415 V AC, delta connection										
MKP415-D-1.0	1	1.4	1.2	1.6	3 × 6	—	53 × 114	0.3	B32343C4012A010	12
MKP415-D-1.5	1.5	2.1	1.8	2.4	3 × 9	—	53 × 114	0.3	B32343C4012A510	12
MKP415-D-2.0	2	2.8	2.4	3.4	3 × 12	—	53 × 114	0.4	B32343C4022A010	12
MKP415-D-2.5	2.5	3.5	3	4.2	3 × 15	—	63.5 × 129	0.4	B32343C4022A510	12
MKP415-D-5.0	5	7	6	8.4	3 × 31	—	63.5 × 154	0.4	B32343C4052A010	12
MKP415-D-6.3	6.3	8.8	7.5	10.6	3 × 39	—	75 × 160	0.5	B32344E4071A510	6
MKP415-D-7.5	7.5	10.4	9	12.5	3 × 46	—	75 × 198	0.6	B32344E4072A510	4
MKP415-D-10.0	10	13.9	12	16.7	3 × 62	—	75 × 198	0.6	B32344E4102A010	4
MKP415-D-12.5	12.5	17.4	15	20.9	3 × 77	—	85 × 198	0.8	B32344E4122A510	4
MKP415-D-15.0	15	20.9	18	25.1	3 × 92	—	85 × 273	1.2	B32344E4152A010	4
MKP415-D-20.0	20	27.9	24	33.4	3 × 123	—	85 × 273	1.2	B32344E4202A010	4
MKP415-D-25.0	25	34.8	—	—	3 × 154	—	85 × 348	1.5	B32344E4252A010	4
PhiCap · resin · three-phase · 440 V AC, delta connection										
MKP440-D-0.9	0.9	1.2	1	1.3	3 × 5	—	53 × 114	0.3	B32343C4011A040	12
MKP440-D-1.0	1	1.3	1.2	1.6	3 × 6	—	53 × 114	0.3	B32343C4012A040	12
MKP440-D-1.2	1.2	1.6	1.5	2	3 × 7	—	53 × 114	0.3	B32343C4011A540	12
MKP440-D-1.5	1.5	2	1.8	2.3	3 × 8	—	53 × 114	0.3	B32343C4012A540	12
MKP440-D-2.1	2.1	2.7	2.5	3.3	3 × 11	—	53 × 114	0.4	B32343C4021A540	12
MKP440-D-2.5	2.5	3.3	3	3.9	3 × 14	—	63.5 × 129	0.3	B32343C4022A540	12
MKP440-D-4.2	4.2	5.5	5	6.6	3 × 23	—	63.5 × 129	0.4	B32343C4051A040	12
MKP440-D-5.0	5	6.5	6	7.8	3 × 27	—	63.5 × 154	0.5	B32343C4052A040	12
MKP440-D-6.3	6.3	8.3	7.5	9.9	3 × 34	—	75 × 160	0.5	B32344E4071A540	6
MKP440-D-7.5	7.5	9.9	9	11.8	3 × 41	—	75 × 160	0.5	B32344E4072A540	6
MKP440-D-8.3	8.3	10.9	10	13.1	3 × 46	—	75 × 198	0.6	B32344E4101A040	4
MKP440-D-10.0	10	13.1	12	15.8	3 × 55	—	75 × 198	0.6	B32344E4102A040	4
MKP440-D-10.4	10.4	13.7	12.5	16.4	3 × 57	—	75 × 198	0.6	B32344E4121A540	4
MKP440-D-12.5	12.5	16.4	15	19.7	3 × 69	—	85 × 198	0.8	B32344E4151A040	4

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (μF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
MKP440-D-15.0	15	19.7	18	23.6	3 × 82	—	85 × 273	1.2	B32344E4152A040	4
MKP440-D-16.7	16.7	21.9	20	26.3	3 × 92	—	85 × 273	1.2	B32344E4201A040	4
MKP440-D-20.8	20.8	27.3	25	32.8	3 × 114	—	85 × 273	1.2	B32344E4251A040	4
MKP440-D-25.0	25	32.8	30	40	3 × 138	—	85 × 348	1.5	B32344E4252A040	4
MKP440-D-28.0	28	36.8	—	—	3 × 154	—	85 × 348	1.5	B32344E4282A040	4
MKP440-D-30.0	30	39	—	—	3 × 165	—	85 × 348	1.6	B32344E4302A040	4
PhiCap · resin · three-phase · 480 V AC, delta connection										
MKP480-D-1.5	1.5	1.8	1.8	2.2	3 × 7	—	63.5 × 129	0.4	B32343C4012A580	12
MKP480-D-2.0	2	2.4	2.4	2.9	3 × 9	—	63.5 × 129	0.4	B32343C4022A080	12
MKP480-D-2.5	2.5	3	3	3.6	3 × 11	—	63.5 × 129	0.4	B32343C4022A580	12
MKP480-D-4.2	4.2	5.1	5	6.1	3 × 19	—	63.5 × 154	0.5	B32343C4051A080	12
MKP480-D-5.0	5	6	6	7.2	3 × 23	—	75 × 160	0.5	B32344E4052A080	6
MKP480-D-6.3	6.3	7.6	7.6	9.1	3 × 29	—	75 × 160	0.5	B32344E4071A580	6
MKP480-D-7.5	7.5	9	9	10.8	3 × 35	—	75 × 198	0.6	B32344E4072A580	4
MKP480-D-8.3	8.3	10	10	12	3 × 38	—	75 × 198	0.6	B32344E4101A080	4
MKP480-D-10.4	10.4	12.5	12.5	15	3 × 48	—	85 × 198	0.8	B32344E4121A580	4
MKP480-D-12.5	12.5	15.1	15	18.1	3 × 58	—	85 × 198	0.8	B32344E4151A080	4
MKP480-D-15.0	15	18.1	18	21.7	3 × 69	—	85 × 273	1.2	B32344E4152A080	4
MKP480-D-16.7	16.7	20.1	20	24.1	3 × 77	—	85 × 273	1.2	B32344E4162A780	4
MKP480-D-20.8	20.8	25	25	30.1	3 × 96	—	85 × 273	1.2	B32344E4202A080	4
MKP480-D-25.0	25	30.1	30	36.1	3 × 115	—	85 × 348	1.5	B32344E4252A080	4
MKP480-D-30.0	30	36.1	—	—	3 × 138	—	90 × 348	1.5	B32344E4302A080	4
PhiCap · resin · three-phase · 525 V AC, delta connection										
MKP525-D-1.0	1	1.1	1.2	1.3	3 × 4	—	53 × 114	0.3	B32343C5012A020	12
MKP525-D-1.5	1.5	1.6	1.8	2	3 × 6	—	53 × 114	0.3	B32343C5012A520	12
MKP525-D-2.0	2	2.2	2.4	2.6	3 × 8	—	63.5 × 129	0.4	B32343C5022A020	12
MKP525-D-2.5	2.5	2.7	2.7	3	3 × 9	—	63.5 × 129	0.4	B32343C5022A520	12
MKP525-D-5.0	5	5.5	6	6.6	3 × 19	—	75 × 160	0.3	B32344E5061A020	6
MKP525-D-6.3	6.3	6.9	7.6	8.3	3 × 24	—	75 × 160	0.5	B32344E5071A520	6
MKP525-D-8.3	8.3	9.1	10	11	3 × 32	—	75 × 198	0.6	B32344E5101A020	4
MKP525-D-10.4	10.4	11.5	12.5	13.7	3 × 40	—	85 × 198	0.8	B32344E5121A520	4
MKP525-D-12.5	12.5	13.8	15	16.5	3 × 48	—	85 × 273	1.2	B32344E5151A020	4
MKP525-D-16.7	16.7	18.3	20	21.9	3 × 64	—	85 × 273	1.2	B32344E5201A020	4
MKP525-D-20.8	20.8	22.9	25	27.5	3 × 80	—	85 × 348	1.5	B32344E5202A020	4
MKP525-D-25.0	25	27.5	30	33	3 × 96	—	85 × 348	1.5	B32344E5252A020	4
PhiCap · resin · single-phase · 230 V AC, single phase										
MKP230-I-0.8	0.8	3.6	1	4.3	50	—	63.5 × 105	0.3	B32340C2002A830	12
MKP230-I-1.7	1.7	7.2	2	8.7	100	—	63.5 × 142	0.4	B32340C2012A730	12
MKP230-I-2.5	2.5	10.9	3	13.1	150	—	63.5 × 142	0.5	B32340C2022A530	12
PhiCap · resin · single-phase · 400 V AC, single phase										
MKP400-I-0.8	0.8	2	1	2.3	15	—	63.5 × 68	0.3	B32340C3001A880	12
MKP400-I-1.7	1.7	4.2	2	5	33	—	63.5 × 68	0.3	B32340C4012A700	12
MKP400-I-2.5	2.5	6.3	3	7.5	50	—	63.5 × 105	0.4	B32340C4022A500	12
MKP400-I-3.3	3.3	8.4	4	10	66	—	63.5 × 105	0.4	B32340C4032A300	12
MKP400-I-4.2	4.2	10.4	5	12.5	84	—	63.5 × 142	0.4	B32340C4051A000	12
MKP400-I-5.0	5	12.4	6	15	99	—	63.5 × 142	0.5	B32340C4052A000	12

TYPE	KVAR 50 HZ	IR 50 HZ (A)	KVAR 60 HZ	IR 60 HZ (A)	CR (μF)	TERMINAL	D × H (MM)	KG	ORDERING CODE	PACK
PhiCap · resin · single-phase · 415 V AC, single phase										
MKP415-I-0.8	0.8	2	1	2.4	15	—	63.5 × 68	0.35	B32340C4082A810	12
MKP415-I-1.7	1.7	4	2	4.8	31	—	63.5 × 105	0.45	B32340C4012A710	12
MKP415-I-2.5	2.5	6	3	7.2	46	—	63.5 × 105	0.5	B32340C4022A510	12
MKP415-I-3.3	3.3	8	4	9.7	62	—	63.5 × 142	0.5	B32340C4032A310	12
MKP415-I-5.0	5	12	6	14.5	91	—	63.5 × 142	0.6	B32340C4052A010	12
PhiCap · resin · single-phase · 440 V AC, single phase										
MKP440-I-0.7	0.7	1.6	0.8	1.9	11	—	63.5 × 68	0.3	B32340C4001A840	12
MKP440-I-1.4	1.4	3.2	1.7	3.8	23	—	63.5 × 68	0.3	B32340C4011A740	12
MKP440-I-2.1	2.1	4.7	2.5	5.7	34	—	63.5 × 105	0.4	B32340C4021A540	12
MKP440-I-2.8	2.8	6.4	3.3	7.6	46	—	63.5 × 105	0.4	B32340C4031A340	12
MKP440-I-3.3	3.3	7.6	4	9.1	55	—	63.5 × 142	0.5	B32340C4032A340	12
MKP440-I-4.2	4.2	9.5	5	11.4	68	—	63.5 × 142	0.5	B32340C4051A040	12
MKP440-I-5.0	5	11.4	6	13.6	82	—	63.5 × 142	0.6	B32340C4052A040	12
PhiCap · resin · single-phase · 480 V AC, single phase										
MKP480-I-0.7	0.7	1.5	0.8	1.7	10	—	63.5 × 105	0.3	B32340C4001A880	12
MKP480-I-1.4	1.4	2.9	1.7	3.5	19	—	63.5 × 105	0.3	B32340C4011A780	12
MKP480-I-2.1	2.1	4.3	2.5	5.2	29	—	63.5 × 105	0.5	B32340C4021A580	12
MKP480-I-2.8	2.8	5.8	3.3	6.9	38	—	63.5 × 142	0.5	B32340C4031A380	12
PhiCap · resin · single-phase · 525 V AC, single phase										
MKP525-I-1.4	1.4	2.6	1.7	3.1	16	—	63.5 × 105	0.3	B32340C5011A720	12
MKP525-I-2.8	2.8	5.2	3.3	6.2	31	—	63.5 × 142	0.5	B32340C5031A330	12
MKP525-I-3.3	3.3	6.3	4	7.6	38	—	63.5 × 142	0.6	B32340C5032A320	12
MKP525-I-4.2	4.2	8	5	9.5	48	—	63.5 × 142	0.7	B32340C5051A020	12

6 PF CONTROLLERS BR604, BR6000 AND BR7000, MEASURING INTERFACES AND MC7000-3

Controllers are of major importance in the compensation system: they measure the actual power factor and connect or disconnect capacitor stages to reach the desired $\cos \phi$. All BR604, BR6000 and BR7000 types feature menu-driven handling in plain language and are panel-mounted with an illuminated full-graphic display (not BR604). A microprocessor analyses the signal from a current transformer and commands the contactor — or in dynamic PFC the thyristor — ensuring balanced utilisation of the steps, fewer switchings and a longer service life. The number of steps depends on the number of loads: the more small loads, the more steps. TDK offers controllers for slowly changing loads and dynamic types for rapidly changing loads (elevators, welding machines, cranes, presses) that switch TSM thyristor modules; particular types suit hybrid applications.



BR604

4 relay outputs, standard compensation, 100 × 100 × 40 mm, 230 V, 23 pre-set series



BR6000-R6 / R12

6 / 12 relay outputs; 30 ... 525 V measuring; automatic initialisation; test run; 20 series + editor



BR6000-T6

6 transistor outputs for dynamic compensation, switching time 20 ... 1000 ms



BR7000-I / -I/S485

12 (+1) relay outputs; graphic display 128 × 64; display editor, HELP; RS485 on /S485



BR7000-I-TH / /S485

12 relay + 12 transistor outputs for standard, mixed and dynamic compensation



BR7000 / BR7000-T

15 relay or 15 transistor outputs, three-phase measuring, 2 × RS485, oscilloscope mode, internal timers, fan relay

Selection table BR604 and BR6000

	BR604	BR6000-R6	BR6000-R12	BR6000-T6
Ordering code	B44066R6004E230	B44066R6006E230	B44066R6012E230	B44066R6106E230
Supply voltage	230 V AC	110 ... 230 V~ 50/60 Hz	110 ... 230 V~	110 ... 230 V~
Measurement voltage	= supply, 230 V (L-N)	30 ... 525 V~ (L-N) or (L-L)	30 ... 525 V~	30 ... 525 V~
Power · temperature	< 5 VA · -10 ... +50 °C	< 5 VA · -20 ... +60 °C	< 5 VA · -20 ... +60 °C	< 5 VA · -20 ... +60 °C
Display · languages	2 × 16 · E/ES/GER/PT	illuminated 2 × 16 · 10 languages	illuminated 2 × 16	illuminated 2 × 16
Relay / transistor outputs	4 / –	6 / –	12 / –	– / 6
Alarm / message relay	–	1/0	1/1	1/0
Automatic initialisation · test run	– · –	yes · yes	yes · yes	– · –
Control series	23 pre-set	20 pre-set + editor	20 + editor	20 + editor
Harmonics · THD	–	up to 19th · yes	up to 19th · yes	–
Switching time	1 ... 255 s	1 ... 1200 s	1 ... 1200 s	20 ... 1000 ms
Weight · dimensions	0.5 kg · 100 × 100 × 40 mm	1 kg · 144 × 144 × 55 mm	1 kg · 144 × 144 × 55 mm	1 kg · 144 × 144 × 55 mm
Dynamic PFC	no	no	no	yes

Selection table BR7000 series

	BR7000 / BR7000-T (HD)	BR7000-I / -I/S485	BR7000-I-TH / /S485
Ordering codes	R7415E230 · R7615E230 · HD R7515E230	R7012E230 · R7112E230	R7412E230 · R7612E230
Supply · measurement voltage	110 ... 440 V~ · 3 × 30 ... 440 V (L-N), 3 × 50 ... 760 V (L-L)	110 ... 440 V~ · 30 ... 440 V (L-N), 50 ... 760 V (L-L)	same as BR7000-I
Power · temperature	< 3 VA · -20 ... +70 °C	< 5 VA · -20 ... +70 °C	< 5 VA · -20 ... +70 °C

	BR7000 / BR7000-T (HD)	BR7000-I / -I/S485	BR7000-I-TH / /S485
Display	illuminated graphic 128 × 64, large display of 3 grid parameters, display editor	same	same
Outputs	15 relay (BR7000) or 15 transistor (BR7000-T), freely programmable for 1- or 3-phase capacitors	12 ... 13 relay	12 relay + 12 transistor
Alarm / message · fan relay	1/1 · yes	1 alarm, 1 message (/S485) · –	1 alarm, 1 message (/S485) · –
Interface	2 independent isolated RS485	RS485 with /S485	RS485 with /S485
Measuring · controlling	three-phase · single, three-phase, mixed	single-phase · three-phase	single-phase · three-phase
Extras	internal timers, oscilloscope mode, test run, time/date, values with time stamp	automatic initialisation, test run	–
Harmonics	up to 31st, value / % / bar graph	odd up to 33rd, even and odd up to 17th	odd up to 33rd, even and odd up to 17th
Switching time	20 ... 1000 ms (T) · 1 ... 1200 s	1 ... 1200 s	dynamic 20 ... 1000 ms · relay 1 ... 1200 s
Dimensions · PC software	144 × 144 × 50 mm · included	144 × 144 × 55 mm · /S485	144 × 144 × 55 mm · /S485; TSM-LC-S via interface



Cautions for controllers

1. Make sure the discharge time set in the controller matches the capacitor discharge time. 2. LV PFC capacitors to IEC 60831 are designed for up to 5000 switching operations per year – do not exceed it. 3. Controller hunting must be avoided at any case.



Accessories for the BR6000 and BR7000 series

ACCESSORY	PURPOSE	ORDERING CODE
BR7000-SOFT	Windows software for parametrisation, recording, analysis and visualisation of grid parameters online; harmonics spectrum as bar chart; configuration manager	included with BR7000
IF8000 interface module	adds a second RS485 Modbus-RTU interface to BR7000-I (V4 on) and MMI8003; up to 255 devices	B44066R7013E230
DataLogSD	compact data logger on SD card with evaluation software	B44066R1311E230
USB to RS485 converter	connects BR7000 / BR7000-I/S485 / BR7000-I-TH/S485 to a PC	B44066R3333E230
NET8000 web server	remote access to BR7000-I via the network: measured values, harmonics, settings, error memory, parametrisation, e-mail notification	–
RJ45 adapters	1 × RJ45 for BR7000 (B44066R1611E230), 2 × RJ45 (B44066R1711E230), 2 × RJ45 for MMI6000 (B44066R1811E230)	see left
Touch panel VIP-X-TP	intelligent coupling of 3, 4 or 5 compensation systems on parallel transformers via BR7000-I/S485	B44066R1703 / 1704 / 1705E230
UCM-5	bus-compatible S0 impulse module for MMI-energy: counter impulses (Q+, Q–, P+, P–) on RS485 Modbus; up to 32 devices	B44066R1411E230

Multi measuring interfaces MMI6000, MMI7000 and MMI8003

Universal measuring devices that display and record key grid parameters, revealing harmful conditions (e.g. high harmonic content) immediately. MMI6000 is a single-phase external meter combining many devices in one; with a PF controller with interface it monitors the input lead of the PFC system, also as a trigger (MMI6000-T Dyna-I-trigger switches TSM thyristor modules within 1 ms) or Modbus RTU / ASCII transmitter. MMI7000 (V4) is a three-phase device with SD card, 2 × RS485 and 4 programmable relays, supported by BR7000-SOFT. MMI8003 is a genuine three-phase measuring device without display for hut-rail mounting inside a cabinet, all values readable via Modbus in real time.

	MMI6000	MMI7000	MMI8003
Dimensions · weight	panel 100 × 100 × 45 mm · 0.5 kg	panel 144 × 144 × 60 mm · 1.0 kg	hut rail 92 × 90 × 38 mm · 0.5 kg
Interface	1 × RS485 Modbus RTU	2 × RS485 Modbus RTU	1 × RS485 Modbus RTU
Output capacity	R: 250 V AC, 1000 W · T: 60 V DC, 150 mA	250 V AC, 1000 W	n/a
Display · languages	graphical 2 × 16 illuminated · EN/DE	graphical 128 × 64 · EN/DE/RU/ES/TR	n/a
Measuring	single-phase V, I, F, Q, P, S, cos φ, W, temperature	three-phase + THD, harmonics up to 51st, temperature	three-phase + THD, single harmonics; all via Modbus
Operating · measuring voltage	230 V AC · 230 V AC	110 ... 440 V AC ±15 % · 3 × 30 ... 440 (L-N), 3 × 50 ... 760 V (L-L)	24 V DC · 3 × 30 ... 440 (L-N), 3 × 50 ... 690 V (L-L)
Frequency · consumption	50/60 Hz · < 4 VA	50/60 Hz · < 5 VA	10 ... 80 Hz · < 1 VA
Ambient · protection	−10 ... +55 °C · front IP54, rear IP20	−10 ... +50 °C · front IP54, rear IP20	−10 ... +55 °C · IP20
Ordering code	R: B44066M6000E230 · T: B44066M6100E230	B44066M7500E230	B44066M8003E024

Grid analysis tool MC7000-3

Developed for three-phase measuring, display and storage of electric parameters in low-voltage grids; the Windows software (included) evaluates the data so the optimum PFC design or the inspection of an existing one is easily performed, with data available in Excel format. Features: voltage, current, frequency, active / reactive / apparent power and energy, power factor, harmonics up to the 51st, THD-V, THD-I, temperature (all 3-phase); programmable recording interval and duration; maximum values with time stamp; harmonics bar diagram; automatic calculation of the required kvar and recommendation of the detuning factor.

Weight · dimensions

approx. 4 kg · light plastic suitcase 390 × 310 × 147 mm

Operating voltage · consumption	110 ... 230 V AC ±15 % · < 5 VA · 50/60 Hz
Measuring voltage · current	3 × 30 ... 440 V (L-N), 3 × 50 ... 760 V (L-L) · 30, 300, 3000 A with RogoFlex flexible clamps (ordered separately: 1 pc B44066M2301E230, 3 pcs B44066M2303E230)
Display · menu · ambient	illuminated full graphic 128 × 64 · D/E/ES/RU/TR · -10 ... +50 °C; CAT III; IP40
Included	3 safety voltage cables 2 m 1000 V CAT IV with fuse, 1 blue 2 m CAT III, 4 dolphin clips, Windows software CD
Ordering code	B44066M7777E230

7 SWITCHING DEVICES – CAPACITOR CONTACTORS AND TSM THYRISTOR MODULES

Capacitor contactors – specially designed for damping of inrush current

When a capacitor is switched to an AC voltage the result is a damped resonant circuit; switching can cause high inrush currents, particularly in parallel to capacitors already activated and with high short-circuit power on the line. Capacitor contactors with damping resistors use pre-switching auxiliary contacts that close before the main contacts and pre-load the capacitor, avoiding current peaks – which significantly improves the capacitor life and the power quality (no transients or voltage sags). Features: excellent damping, longer life of main contacts, soft switching, reduced ohmic losses, leading contacts with wiper function, tamper-proof protected resistors, easy cable access, 400 ... 690 V, 12.5 ... 100 kvar, AC6b utilisation category; approvals cUL file 224924 and CCC.

Technical data – type B44066*****J230/J110 (IEC 947-4-1, IEC 947-5-1, EN 60947-4-1, EN 60947-5-1, VDE 0660)

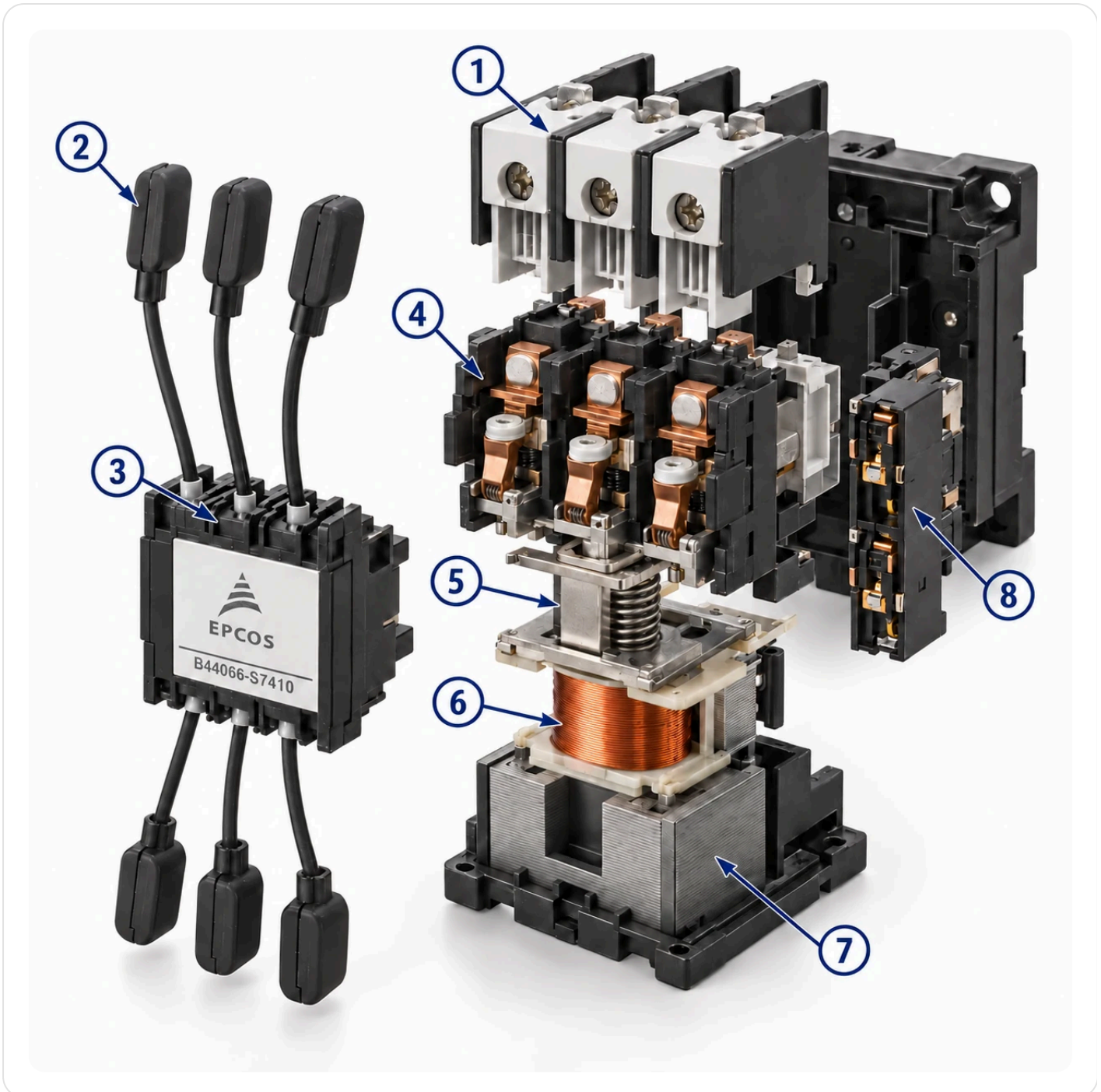
MAIN CONTACTS	S1810	S2410	S3210	S5010	S6210	S7410	S9010	S9910
Rated insulation voltage	690 V	690 V	690 V	690 V	690 V	690 V	1000 V	1000 V
Admissible operations per hour	120	120	120	120	120	80	80	80
Contact life (million operations)	0.25	0.15	0.15	0.15	0.15	0.12	0.12	0.12
Cable solid or standard (mm²)	1.5–6	2.5–25	2.5–25	4–50	4–50	4–50	0.5–95/10–120	0.5–95/10–120
Cable flexible (mm²)	1.5–4	2.5–16	2.5–16	10–35	10–35	10–35	0.5–70/10–95	0.5–70/10–95
Cables per clamp	2	1	1	1	1	1	2	2
Coil operating range (× VS)	0.85–1.1	0.85–1.1	0.85–1.1	0.85–1.1	0.85–1.1	0.85–1.1	0.85–1.1	0.85–1.1
Aux. contact lth at 40 / 60 °C (A)	16 / 12	10 / 6	10 / 6	10 / 6	10 / 6	10 / 6	10 / 6	10 / 6
AC15 220–240 V / 380–440 V (A)	12 / 4	3 / 2	3 / 2	3 / 2	3 / 2	3 / 2	3 / 2	3 / 2
Highest fuse gL (A) · aux. NO/NC	25 · 1/0	20 · 1/0	20 · 1/0	20 · 1/0	20 · 1/0	20 · 1/0	20 · 1/0	20 · 1/0

Main technical parameters – capacitor power at ambient temperature +50 / +60 °C

COIL	380–400 V (KVAR)	415–440 V (KVAR)	660–690 V (KVAR)	RATED CURRENT 50/60 °C (A)	KG	ORDERING CODE
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COIL	380–400 V (KVAR)	415–440 V (KVAR)	660–690 V (KVAR)	RATED CURRENT 50/60 °C (A)	KG	ORDERING CODE
110 V	0–12.5 / 0–12.5	0–13 / 0–13	0–20 / 0–20	18 / 18	0.34	B44066S1810J110
110 V	10–20 / 10–20	10.5–22 / 10.5–22	17–33 / 17–33	28 / 28	0.6	B44066S2410J110
110 V	10–25 / 10–25	10.5–27 / 10.5–27	17–41 / 17–41	36 / 36	0.6	B44066S3210J110
110 V	20–50 / 20–50	23–53 / 23–53	36–82 / 36–82	72 / 72	1.1	B44066S6210J110
110 V	20–75 / 20–60	23–75 / 23–64	36–120 / 36–100	108 / 87	1.1	B44066S7410J110
110 V	33–80 / 33–75	36–82 / 36–77	57–120 / 57–120	115 / 108	2.3	B44066S9010J110
110 V	33–100 / 33–90	36–103 / 36–93	57–148 / 57–148	144 / 130	2.3	B44066S9910J110
230 V	0–12.5 / 0–12.5	0–13 / 0–13	0–20 / 0–20	18 / 18	0.34	B44066S1810J230
230 V	10–20 / 10–20	10.5–22 / 10.5–22	17–33 / 17–33	28 / 28	0.6	B44066S2410J230
230 V	10–25 / 10–25	10.5–27 / 10.5–27	17–41 / 17–41	36 / 36	0.6	B44066S3210J230
230 V	20–33.3 / 20–33.3	23–36 / 23–36	36–55 / 36–55	48 / 48	1.1	B44066S5010J230
230 V	20–50 / 20–50	23–53 / 23–53	36–82 / 36–82	72 / 72	1.1	B44066S6210J230
230 V	20–75 / 20–60	23–75 / 23–64	36–120 / 36–100	108 / 87	1.1	B44066S7410J230
230 V	33–80 / 33–75	36–82 / 36–77	57–120 / 57–120	115 / 108	2.3	B44066S9010J230
230 V	33–100 / 33–90	36–103 / 36–93	57–148 / 57–148	144 / 130	2.3	B44066S9910J230

Inside a capacitor contactor – EPCOS B44066-S7410



The exploded view above is an illustration prepared for this edition, not a manufacturer's service drawing; the numbers belong to the illustration and are not manufacturer part numbers. 1 Insulated terminal and arc-chamber housing · 2 Inrush-limiting resistor assembly · 3 Early-make precontact module · 4 Three-pole main contact assembly · 5 Moving armature and return spring · 6 Electromagnetic operating coil · 7 Fixed magnetic core and mounting base · 8 Auxiliary contact module. Items 2 and 3 are the damping resistors and the leading contacts described above, which close before the main contacts. The exterior is taken from a photograph of a B44066-S7410; its coil suffix J110 / J230 is not visible, so the coil voltage of the pictured unit cannot be read from it. Illustrative exploded view; not to scale. Catalog dimensions and identity limitations are listed separately. Internal geometry and OEM subcomponent part numbers are unverified.

Thyristor modules for dynamic PFC – TSM series

Modern industry causes frequent high load fluctuations and harmonic oscillation; excessive currents, increased losses and flicker influence the supply and sensitive electronics. Dynamic PFC systems are the solution, and the TSM-LC thyristor modules are their main component: fast electronically controlled, self-observing thyristor switches for capacitive loads up to 200 kvar, switching PFC capacitors within a few milliseconds nearly without limitation of the number of switchings. Easy installation like a contactor, all intelligence inside the module, reaction time 5 ms, permanent self-control of voltage, phase sequence and capacitor output, display of operation, faults and activation. TSM-LC-I is single-phase for direct 2-phase switching (L-N or L-L); TSM-LC-S is triggered via the system bus (patch cable) from BR7000-I-TH/S485 – up to 32 devices, with display and monitoring of V, I, Q, temperature and switching state at the controller.

Selection table TSM series

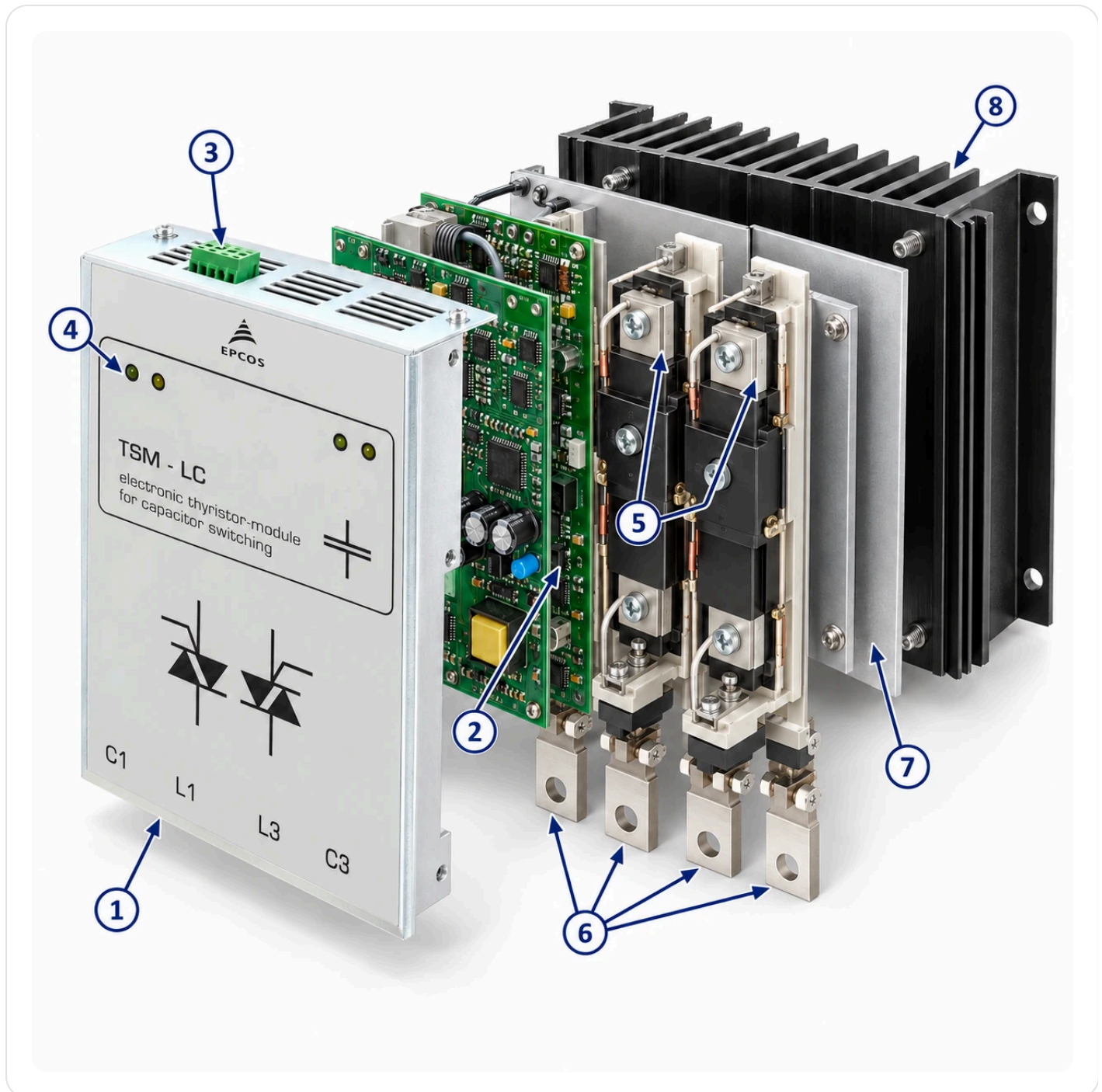
	TSM-LC-I	TSM-LC10	TSM-LC-N1	TSM-LC-N480	TSM-LC-N690	TSM-LC-S	TSM-LC100
Rated voltage	230 ... 525 V	380 ... 400 V	380 ... 440 V	380 ... 480 V	380 ... 690 V	200 ... 440 V	380 ... 400 V
Max. grid voltage conventional / 7 % / 14 %	525 / 525 / 525 V	440 / 440 / 400 V	440 / 440 / max. 440 V	480 / 480 / 480 V	690 / 690 / max. 690 V	440 / 440 / max. 440 V	440 / 440 / 400 V
Max. power at nominal voltage	10 – 22 kvar	12.5 kvar	25 – 50 kvar	50 kvar	40 – 75 kvar	15 – 55 kvar	100 kvar
Power connection	plug connector, max. 2 × 35 mm ²	4-pole terminal clamps (6 / 4 mm ²)	terminal clamps from bottom	terminal clamps	high-current plug	high-current plug	4-pole busbar, lug 70 mm ² , D = 10 mm
Aux. supply	24 V DC	no	no	230 V AC / 10 VA	230 V AC / 10 VA	24 V DC via ESP24	230 V AC (fan)
Losses PV	1.0 × I W, approx. 45 W	2.0 × I W, approx. 35 W	2.0 × I W, approx. 150 W	2.0 × I W, approx. 150 W	2.4 × I W, approx. 150 W	2.0 × I W, approx. 150 W	2.0 × I W, typ. 300 W
Recommended superfast fuses	1 × 63 A	3 × 35 A NH00	3 × 125 A (50 kvar), 63 A (25 kvar)	3 × 125 A / 63 A	3 × 125 A NH00	3 × 125 A NH00	3 × NH1 250 A
Dimensions w × h × d · weight	70 × 200 × 150 · 1.5 kg	163 × 152 × 75 · 1.75 kg	157 × 200 × 180 · 4.8 kg	157 × 200 × 180 · 4.8 kg	157 × 200 × 190 · 4.8 kg	157 × 200 × 180 · 5 kg	157 × 240 × 195 · 5.5 kg
Display · ambient	3 LED · –10 ... +55 °C	2 LED	2 LED	2 LED	2 LED	OLED 2 × 16	2 LED
Discharge resistors EW-22 · BD reactors	not needed · 1	1 · 2	1 · 2 × BD100	1 · 2 × BD100	2 · 2 × BD100	1 · 2 × BD100	1–2 parallel · special

Accessories for TSM modules

ACCESSORY	DESCRIPTION
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ACCESSORY	DESCRIPTION
EW-22	discharge resistor: two single resistors of 22 k Ω , 90 × 50 × 100 mm, 0.3 kg, screw terminals ready for three-phase connection to the capacitor
BD050 / BD100	single-phase current-limitation reactors for TSM modules in conventional dynamic PFC systems without reactor: limit di/dt to the permissible value – 400/480 V, 50 A (55 × 60 × 70 mm, 1.5 kg) / 85 A (70 × 74 × 90 mm, 2.3 kg); mandatory without detuning reactors
ESP-24	feed-in module (power supply) for TSM-LC-S – 24 V DC into the network, 1 module per max. 10 thyristor switches, DIN-rail mounting

Inside a TSM-LC thyristor module

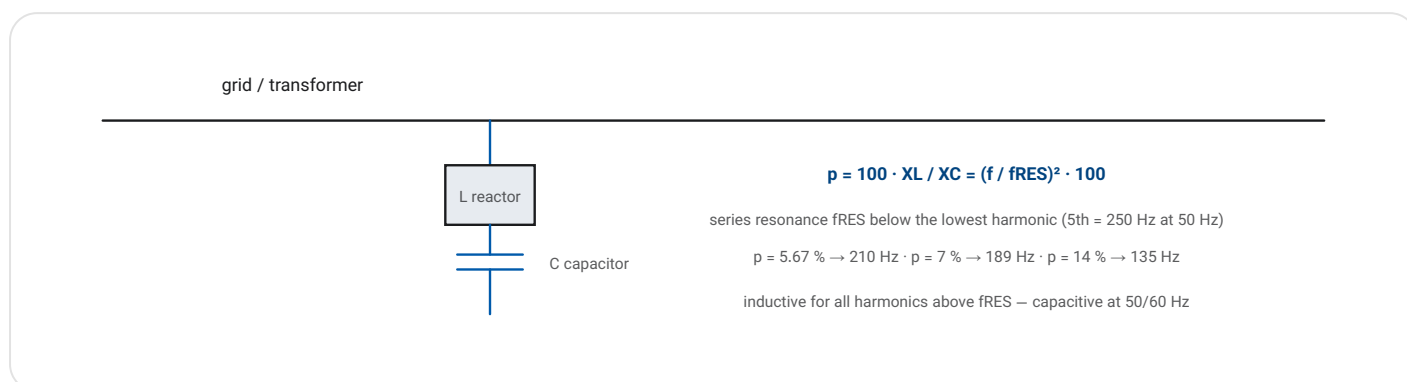


The exploded view above is an illustration prepared for this edition, not a manufacturer's service drawing; the numbers belong to the illustration and are not manufacturer part numbers. 1 Ventilated front cover · 2 Control and gate-drive circuit board · 3 Low-voltage control connector · 4 Status indicator LEDs · 5 Two AC thyristor switching branches · 6 Four separate power terminals / busbars · 7 Thermal interface · 8 Finned heat sink and mounting support. Item 2 is the intelligence that sits inside the module. The exterior is taken from a photograph of a TSM-LC whose power suffix is not visible, and one illustration stands for both the 25 and the 50 kvar module. Illustrative exploded view; not to scale. Catalog dimensions and identity limitations are listed separately. Internal geometry and OEM subcomponent part numbers are unverified.

8 REACTORS – ANTIRESONANCE HARMONIC FILTER, AND DISCHARGE REACTOR

The increasing use of modern power-electronic apparatus produces non-linear currents and loads the network with harmonics. The PFC capacitor forms a resonant circuit with the feeding transformer, typically between 250 and 500 Hz – the region of the 5th and 7th harmonics – which can overload capacitors, transformers and transmission equipment, interfere with metering, control systems and computers, amplify harmonics and distort the voltage. These phenomena are avoided by connecting capacitors in series with filter reactors: the detuned system is scaled so that its self-resonant frequency is below the lowest line harmonic, purely inductive for harmonics above and purely capacitive at the base frequency.

Principle of the detuned branch



Technical data and limit values – filter reactors (three-phase to VDE 0532 / EN 60289)

Harmonics (DIN ENV 61000-2-2, duty cycle 100 %)	$V_3 = 0.5 \% \cdot V_R \cdot V_5 = 6.0 \% \cdot V_7 = 5.0 \% \cdot V_{11} = 3.5 \% \cdot V_{13} = 3.0 \%$
Effective current	$I_{rms} = \sqrt{(I_1^2 + I_3^2 \dots I_{13}^2)}$; fundamental $I_1 = 1.06 \cdot I_R$ (50 or 60 Hz current of the capacitor)
Temperature protection	microswitch (NC)
Frequency · voltage · output	50 or 60 Hz · 400, 440 V · 10 ... 100 kvar
Detuning · cooling · ambient	5.67 %, 7 %, 14 % · natural · +40 °C
Class of protection · enclosure	I · IP00
Features	high harmonic loading capability, very low losses, high linearity to avoid choke tilt, low noise, convenient mounting, long life

All

KVAR	Δ CAPACITANCE (3 · μF)	INDUCTANCE (MH)	IRMS (A)	LOSSES (W)	KG	TERMINAL	ORDERING CODE
Rated voltage 400 V, 50 Hz, $p = 5.67 \% (f_r = 210 \text{ Hz}) \cdot \text{linearity } L \geq 0.95 \cdot \text{LR up to } 2.08 \cdot I_1$							
10	62	3.06	18.5	95	6.4	10 mm2 Kl.	B44066D5010*400
12.5	78	2.45	23	120	8.4	10 mm2 Kl.	B44066D5012*400
20	125	1.53	36.9	100	13	16 mm2 Kl.	B44066D5020*400

KVAR	Δ CAPACITANCE (3 · μF)	INDUCTANCE (MH)	IRMS (A)	LOSSES (W)	KG	TERMINAL	ORDERING CODE
25	156	1.23	46.1	135	17	16 mm2 Kl.	B44066D5025*400
40	250	0.77	73.7	150	23	M6 Al-flat	B44066D5040*400
50	312	0.61	92.1	240	31	M6 Al-flat	B44066D5050*400
75	496	0.41	138.2	260	35	M8 Al-flat	B44066D5075*400
100	625	0.31	183.8	360	47	M8 Al-flat	B44066D5100*400
Rated voltage 400 V, 50 Hz, p = 7 % (fr = 189 Hz) · linearity L ≥ 0.95 · LR up to 1.73 · I1							
10	61	3.84	16.4	70	5.9	10 mm2 Kl.	B44066D7010*400
12.5	77	3.01	20.5	75	8.6	10 mm2 Kl.	B44066D7012*400
20	123	1.92	32.7	120	18	Cu bars Ø 9 mm	B44066D7020*400
25	154	1.53	40.9	180	18	Cu bars Ø 9 mm	B44066D7025*400
40	246	0.96	65.4	230	26	Cu bars Ø 9 mm	B44066D7040*400
50	308	0.77	81.8	270	27	Cu bars Ø 9 mm	B44066D7050*400
75	462	0.51	122.7	330	39	Cu bars Ø 9 mm	B44066D7075*400
100	617	0.38	163.3	390	50	Cu bars Ø 11 mm	B44066D7100*400
Rated voltage 400 V, 50 Hz, p = 14 % (fr = 135 Hz) · linearity L ≥ 0.95 · LR up to 1.37 · I1							
10	57	8.29	15.4	80	9.4	10 mm2 Kl.	B44066D1410*400
12.5	71	6.64	19.2	95	12	10 mm2 Kl.	B44066D1412*400
20	114	4.15	30.8	150	22	Cu bars Ø 9 mm	B44066D1420*400
25	142	3.32	38.5	200	26	Cu bars Ø 9 mm	B44066D1425*400
40	228	2.07	61.6	270	38	Cu bars Ø 9 mm	B44066D1440*400
50	285	1.66	77	290	40	Cu bars Ø 9 mm	B44066D1450*400
75	427	1.11	115.5	380	58	Cu bars Ø 9 mm	B44066D1475*400
100	570	0.83	153.9	470	66	Cu bars Ø 11 mm	B44066D1499*400
Rated voltage 440 V, 50 Hz, p = 5.67 % (fr = 210 Hz) · linearity L ≥ 0.95 · LR up to 2.08 · I1							
10	51	3.71	16.8	100	7	10 mm2 Kl.	B44066D5010*440
12.5	64	2.97	21	120	9	10 mm2 Kl.	B44066D5012*440
25	129	1.48	42	110	16.5	16 mm2 Kl.	B44066D5025*440
50	258	0.74	83.8	200	25	M6 Al-flat	B44066D5050*440
75	387	0.49	125.6	370	36	M8 Al-flat	B44066D5075*440
100	517	0.37	168	320	50	M8 Al-flat	B44066D5100*440
Rated voltage 440 V, 50 Hz, p = 7 % (fr = 189 Hz) · linearity L ≥ 0.95 · LR up to 1.73 · I1							
10	50	4.64	14.9	70	6.5	10 mm2 Kl.	B44066D7010*440
12.5	63	3.71	18.7	65	8.5	10 mm2 Kl.	B44066D7012*440
25	127	1.87	37.2	170	18	Cu bars Ø 9 mm	B44066D7025*440
50	254	0.93	74.3	250	33	Cu bars Ø 9 mm	B44066D7050*440
75	382	0.62	111.4	340	43	Cu bars Ø 9 mm	B44066D7075*440
100	509	0.46	148.7	410	49	Cu bars Ø 9 mm	B44066D7100*440
Rated voltage 440 V, 50 Hz, p = 14 % (fr = 135 Hz) · linearity L ≥ 0.95 · LR up to 1.37 · I1							
10	47	10.04	14	90	10	10 mm2 Kl.	B44066D1410*440
12.5	58	8.03	17.5	100	13	10 mm2 Kl.	B44066D1412*440
25	117	4.02	35	160	27	Cu bars Ø 9 mm	B44066D1425*440
50	235	2.01	70	300	40	Cu bars Ø 9 mm	B44066D1450*440
75	353	1.34	105	440	53	Cu bars Ø 9 mm	B44066D1475*440
100	471	1	140	490	65	Cu bars Ø 9 mm	B44066D1499*440
Rated voltage 440 V, 60 Hz, p = 5.67 % (fr = 252 Hz) · linearity L ≥ 0.95 · LR up to 2.08 · I1							
25	107	1.24	42	140	16	16 mm2 Kl.	B44066D5025*441
50	215	0.62	83.8	210	25	M6 Al-flat	B44066D5050*441

KVAR	Δ CAPACITANCE (3 · μF)	INDUCTANCE (MH)	IRMS (A)	LOSSES (W)	KG	TERMINAL	ORDERING CODE
75	323	0.41	126	340	33	M8 Al-flat	B44066D5075*441
100	431	0.31	167.4	310	47	M8 Al-flat	B44066D5100*441
Rated voltage 440 V, 60 Hz, p = 7 % (fr = 227 Hz) · linearity L ≥ 0.95 · LR up to 1.73 · I1							
25	106	1.55	37.2	130	18	Cu bars Ø 9 mm	B44066D7025*441
50	212	0.77	74.4	250	27	Cu bars Ø 9 mm	B44066D7050*441
75	318	0.52	111.4	320	39	Cu bars Ø 9 mm	B44066D7075*441
100	424	0.39	148.6	380	44	Cu bars Ø 9 mm	B44066D7100*441
Rated voltage 440 V, 60 Hz, p = 14 % (fr = 162 Hz) · linearity L ≥ 0.95 · LR up to 1.37 · I1							
25	98	3.35	34.8	180	22	Cu bars Ø 9 mm	B44066D1425*441
50	196	1.67	69.5	290	34	Cu bars Ø 9 mm	B44066D1450*441
75	294	1.12	104.3	380	45	Cu bars Ø 9 mm	B44066D1475*441
100	392	0.84	139.1	480	54	Cu bars Ø 9 mm	B44066D1499*441

Losses are total maximum losses considering max. specified overvoltage and harmonic currents. TDK offers reactors with slightly different specifications that can be used for the same application, distinguished by different letters at digit 12 of the code – thus this digit is not specified (“*”). Other voltages upon request.

Discharge reactor B44066E9900L001

The losses of discharge reactors are substantially lower than those of resistors; they satisfy the requirement for a permanently connected discharging device and a discharge time of a few seconds, allowing fast re-switching in automatic PFC equipment – while max. 5000 switching operations (IEC 60831) should not be exceeded. Fast discharge, reduced losses, shockproof case for DIN-rail mounting.

Voltage · frequency	230 ... 690 V · 50/60 Hz; 2 windings in V arrangement; R = 7.5 kΩ
Discharge time 230 V	up to 25 kvar < 10 s / 50 kvar < 20 s / 100 kvar < 40 s
Discharge time 400 ... 525 V	up to 25 kvar < 5 s / 50 kvar < 10 s / 100 kvar < 20 s
Discharge time 525 ... 690 V	up to 25 kvar < 3 s / 50 kvar < 6 s / 100 kvar < 12 s
Power loss · free-wheeling current	< 1.6 W · < 3.4 mA; accepted discharge number 1 × / minute and 100 kvar
Insulation · cable · terminals	Ta = +40 °C/B · 0.75 ... 2 × 2.5 mm ² · 0.5 Nm
Installation · ambient · dimensions	indoor · –25 ... +55 °C · 90 × 46 × 66 mm, 0.5 kg

9 PQSINE S ACTIVE HARMONIC FILTER AND PQVAR STATIC VAR GENERATOR

PQSine S series – active harmonic filter and power optimiser

An active harmonic filter system designed to eliminate harmonic oscillations and reduce costs: it monitors the current signal and compensates the unwanted elements of the measured current, ensuring harmonic suppression independently of the number of loads, and corrects the power factor. Harmonic compensation up to the 50th (individually selectable), ultra-fast reactive power compensation (inductive and capacitive), load balancing between phases and unloaded neutral, compact three-level topology, modular and extendable, grid resonance detection, FFT and instantaneous reactive algorithms, Ethernet / EtherCAT interconnection. Applications: data centres, UPS, photovoltaics and wind, semiconductor manufacturing, welding, extruders, office buildings (3rd-harmonic cancellation).

Rated voltage (range)	200 V (173 ... 263) · 400 V (228 ... 456) · 480 V (384 ... 552) · 600 V (420 ... 690) · 690 V (483 ... 793)
Module capacity	25, 35, 50, 60, 75, 100, 150 A (200/400 V) · 50, 75, 90, 100 A (480/600/690 V)
Compensation	2nd to 50th harmonic or specified harmonics 0 – 110 %; reduction > 97 %; target PF –1 ... 1; neutral filtering 3 × rated current (4-wire)
Timing	switching 20 kHz; reaction approx. 50 µs; overall response < 5 ms; losses < 3 %
Display · communication	7" TFT touch screen (4.3" on wall units) · RS485 + RJ45, Modbus RTU, TCP/IP · 500 alarm records
Environment	–10 ... +40 °C (derating above); 5 – 95 % RH; IP20; RAL 7035; altitude 1500 m, –1 % per 100 m to 4000 m
Standards	CE, IEEE 61000, ETL (UL 508, CSA C22.2), IEEE 519, ER G5/4
Ordering codes	B44066F...S... – rack modules PQSM, wall-mounted PQSW (25 – 150 A), floor-mounted cabinets PQSF (100 – 600 A)

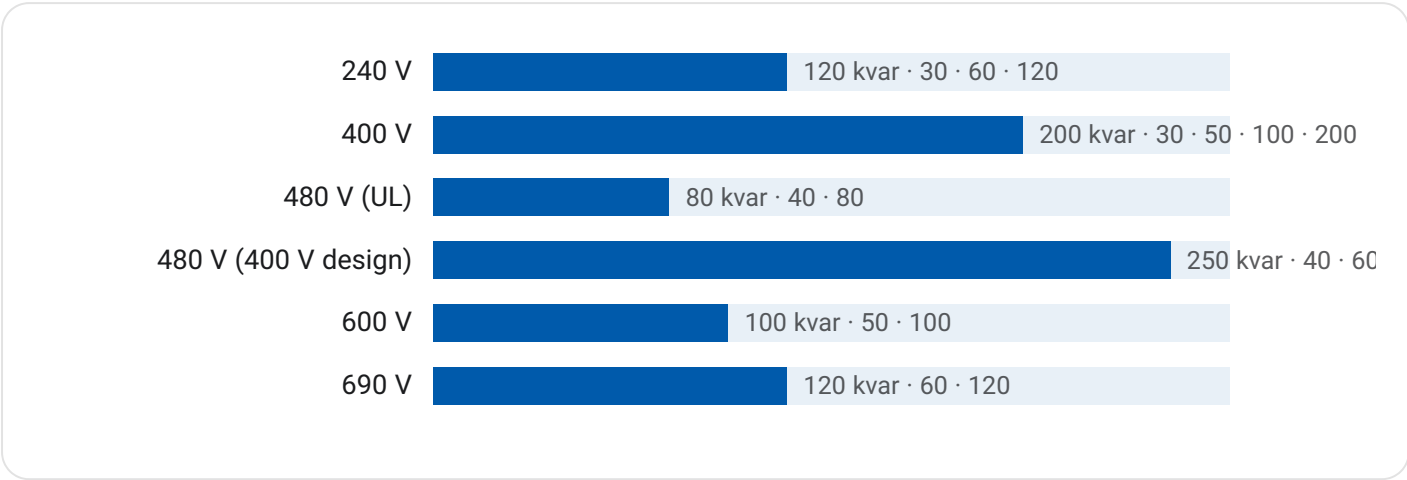
PQvar LV series – static var generator (SVG)

PQvar rewrites the conventional approach to PFC: a three-level inverter generates the reactive part of the measured current to compensate dynamically from –1 to +1 – a controllable reactive current source that reaches a target PF above 0.99 without over- or under-compensation, reacts in less than 50 µs with a state response under 15 ms, needs no capacitor or reactor (no resonance), compensates inductive and capacitive reactive power, balances loads (3P3W and 3P4W), works alongside traditional capacitor banks and

is unaffected by grid-voltage drops – needing 20 – 30 % less capacity than capacitor banks. Modular design for minimum downtime.

Rated voltage (range)	240 V · 400 V · 480 V · 600 V · 690 V
Module capacity (kvar)	30, 60, 120 · 30, 50, 100, 200 · 40, 80 · 50, 100 · 60, 120
Performance	parallel operation unlimited; response < 15 ms; efficiency > 97 %; CT 150/5 ... 10000/5
Communication · protection	RS485, CAN, network; Modbus, PMBus · overvoltage, undervoltage, short-circuit, inverter bridge, over-compensation
Environment	–10 ... +40 °C; 5 – 95 %; IP20; RAL 7035; 1500 m; < 65 dB
Standards	EN 61000-6-2, EN 55011 group 1 class A, EN 50178, IEC 62040-3
Ordering codes	B44066F...V... – modules PQSM, wall PQSW (30 – 250 kvar), floor PQSF (100 – 960 kvar)

PQvar module capacities by voltage (kvar)



 Hybrid PFC – PQvar and classic PFC managed by the Advanced Multi Controller (AMC)

The AMC unit (24 V DC, 7" touch screen) combines an SVG with a classic capacitor bank: target PF –1 ... +1, compensation rate > 99 %, response < 15 ms; three-phase / split / mixed compensation; stack, normal, cycle or individual capacitor switching, auto or manual; up to 18 control outputs (120 V AC / 10 A ... 24 V DC / 5 A); RS485 to the SVG modules plus RS485, network and USB ports; Modbus; protection against under/overvoltage, under/overfrequency, phase failure, harmonic voltage, SVG overload and overtemperature. Ordering codes B44066F9989V230 (thyristor switching) and B44066F9988V230 (contactor switching).

10 FUNDAMENTALS OF POWER FACTOR CORRECTION

The rational use of electrical energy calls for economical generation, transmission and distribution with little losses – restricting all factors that cause losses, one of which is lagging reactive power. Loads in industrial and public grids are primarily ohmic-inductive; PFC systems compensate the lagging reactive power by leading reactive power at defined nodes, avoiding impermissibly high voltage drops and ohmic losses. The leading power is produced by capacitors parallel to the supply, as close as possible to the inductive load; if grid conditions change, the required leading reactive power is matched in steps by adding or taking out capacitors (automatic PFC).



Fast return on investment

lower reactive power, lower power consumption and costs



Effective use of the installation

higher effective power for the same apparent power



Improved voltage quality

reduced voltage drops



Optimum cable design

cross-sections reduced, or extra power transmitted in existing installations



Reduced transmission losses

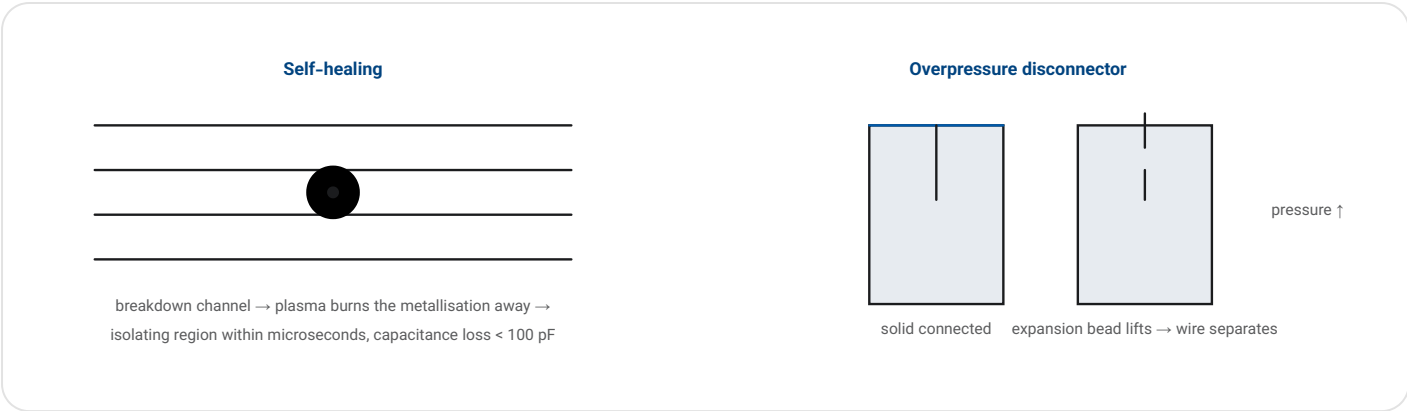
switching devices carry only the effective power



1. Capacitor

PFC capacitors produce the leading reactive power and must withstand high inrush currents ($> 100 \cdot IR$; $\geq 150 \cdot IR$ in banks). MKK/MKP/MKD technology: metallised plastic compact capacitors with self-healing properties and a polypropylene dielectric; zinc/aluminium metallisation gives high performance at low film thickness; a heavy edge and the TDK wavy cut produce a maximum effective contact surface and a solid contact zone without cracks. Series impregnations: PhaseCap Energy gas or resin, PhaseCap / PhaseCap HD nitrogen, PhaseCap Compact, DeltaCap and PhiCap semi-dry biodegradable resin.

Safety mechanisms



Self-healing. In the event of thermal or electrical overload an electric breakdown occurs; the dielectric in the breakdown channel becomes highly compressed plasma that pushes the layers apart and burns the metal surrounding the faulty area completely out, producing perfect isolation within microseconds with negligible capacitance loss (less than 100 pF per event). The capacitor remains fully functional.

Overpressure disconnecter. At the end of the service life or when high pressure forms inside the can, the cover with its expansion bead moves upwards; expansion beyond a certain degree separates the wires at the break point and disconnects the capacitor safely from the line.

Caution – for the disconnecter to work

1. The elastic elements must not be hindered: connecting lines must be flexible cables, at least 20 mm space for expansion above the connections, folding beads not retained by clamps. 2. The maximum permissible fault current of 10 000 A (UL 810) must not be exceeded. 3. Stress parameters must be within IEC 60831.

Dry technology / vacuum impregnation. The winding elements are heated and dried for a defined period and impregnated under vacuum, extracting air and moisture and avoiding oxidation and partial discharges; hermetic sealing in aluminium cases ensures capacitance stability and long life.

Components 2 – 10

COMPONENT	ROLE
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COMPONENT	ROLE
2. Power factor controller	microprocessor-based; even utilisation of the stages, minimised switchings, optimised life. BR604 for four steps; BR6000 for conventional, dynamic and mixed compensation (6 / 12 steps); BR7000 with 15 outputs, BR7000-T dynamic, BR7000-I single-phase controlling, BR7000-I/TH for mixed systems. Rule of thumb: more small inductive loads → more steps; switching time matters.
3. Multi measuring device	external meter combining several features; with a controller it monitors, displays and stores grid parameters and protects the system; stand-alone as meter, trigger for thyristor modules or switch
4. MC7000-3 grid analyser	three-phase measuring, display and storage in a light-weight suitcase – the optimum tool for PFC design or inspection
5. Switching devices	capacitor contactors (pre-switching contacts avoid peak currents; do not exceed the annual switching capability of the capacitor) and thyristor modules for fast-changing loads, reacting within milliseconds without mechanical wear – a dynamic controller such as BR6000-T or BR7000-T is required
6. Reactors	series reactor + capacitor detune the resonant frequency; the most critical frequencies are the 5th and 7th harmonics (250 and 350 Hz at 50 Hz); detuned banks also reduce distortion
7. Active filter PQSine S	dynamic VAR compensation, load balancing and harmonic elimination; installed in parallel to the polluting loads; panels, wall cabinets and modules for 380, 400 and 690 V
8. PQvar	modular SVG for stepless PFC and load balancing, response < 15 ms, reaction < 50 µs
9. Discharge devices	resistors discharge capacitors to 75 V or less within 60 s (specific types 90 s) – required for shock protection and before re-switching (≤ 10 % of rated voltage); discharge reactors when fast discharge within seconds is needed
10. Protection	an HRC fuse or MCCB for short-circuit protection only – rating 1.6 to 1.8 times the nominal capacitor current; never use HRC fuses for switching (risk of arcing)

11 SELECTION TABLES – CABLES, FUSES, QC, MOTORS AND TRANSFORMERS

Standard values for cables, cable cross-sections and fuses

All voltages

POWER (KVAR)	CURRENT (A)	SECTION (MM²)	FUSE (A)
Rated voltage 230 V, 60 Hz			
2.5	6.3	1.5	10
5	12.6	4.0	25
7.5	18.8	6.0	35
10	25.1	10.0	50
12.5	31.4	16.0	50
15	37.7	16.0	63
20	50.2	25.0	80
25	62.8	35.0	100
30	75.3	50.0	125
40	100.4	70.0	160
50	125.5	95.0	200
75	188.3	185.0	315
100	251	2× 120.0	400

POWER (KVAR)	CURRENT (A)	SECTION (MM ²)	FUSE (A)
Rated voltage 400 V, 50 Hz			
2.5	3.6	1.5	10
5	7.2	2.5	16
7.5	10.8	2.5	16
10	14.4	4.0	25
12.5	18	6.0	35
15	21.6	6.0	35
20	28.8	10.0	50
25	36	16.0	63
30	43.2	25.0	80
40	57.6	35.0	100
50	72	50.0	125
75	108.3	70.0	160
100	144.3	120.0	250
125	180.3	185.0	315
150	216.5	2× 95.0	350
175	252.6	2× 95.0	400
200	288	2× 120.0	500
Rated voltage 440 V, 60 Hz			
2.5	3.3	1.5	10
5	6.6	2.5	16
7.5	10	2.5	16
10	13.2	4.0	25
12.5	16.8	4.0	25
15	19.8	6.0	35
20	26.4	10.0	50
25	33	16.0	63
30	39.6	25.0	80
40	52.8	35.0	100
50	66	50.0	125
75	99	70.0	160
100	132	95.0	200
125	165	185.0	315
150	198	2× 95.0	350
175	231	2× 95.0	400
200	264	2× 120.0	500
Rated voltage 480 V, 60 Hz			
2.5	3	1.5	10
5	6	2.5	16
7.5	9	2.5	16
10	12	4.0	25
12.5	18	6.0	35
15	21	6.0	35
20	24	10.0	50
25	30	10.0	50
30	36	16.0	63
40	48	25.0	80

POWER (KVAR)	CURRENT (A)	SECTION (MM ²)	FUSE (A)
50	60	35.0	100
75	90	70.0	160
100	120	95.0	200
125	150	120.0	250
150	180	185.0	315
175	210	2× 95.0	350
200	240	2× 95.0	400
Rated voltage 525 V, 50 Hz			
2.5	2.7	1.5	10
5	5.5	1.5	10
7.5	6.9	2.5	16
10	11	2.5	16
12.5	13.7	4.0	25
15	16.5	4.0	25
20	22	6.0	35
25	27.5	10.0	50
30	33	16.0	63
40	44	25.0	80
50	55	35.0	100
75	82.5	70.0	160
100	110	95.0	200
125	137.5	95.0	200
150	165	185.0	300
175	193	2× 95.0	350
200	220	2× 95.0	350
Rated voltage 690 V, 50 Hz			
2.5	2.1	1.5	10
5	4.2	1.5	10
7.5	6.3	1.5	10
10	8.4	2.5	16
12.5	10.5	2.5	16
15	12.6	4.0	25
20	16.7	4.0	25
25	20.9	6.0	35
30	25.1	10.0	50
40	33.5	16.0	63
50	41.8	25.0	80
75	62.8	50.0	125
100	83.7	70.0	160
125	105	70.0	160
150	126	95.0	200
175	146	120.0	250
200	167	128.5	315

Guidelines for normal conditions at ambient temperatures up to +35 °C; upgrade if temperature or harmonics differ. The internal wiring of a bank is sometimes possible with

a smaller cross-section; cabinet temperature, cable quality, insulation temperature, single or multi-core cable, length and laying system must be considered. The local panel builder / installer is responsible for the selection according to the valid regulations of the country.

 Calculation of the reactive power demand Qc

$Q_c = P \cdot (\tan \phi_1 - \tan \phi_2)$

Active power P (kW)

100

Actual cos φ1

0.7

Target cos φ2

0.96

72.9

capacitor power Qc · kvar

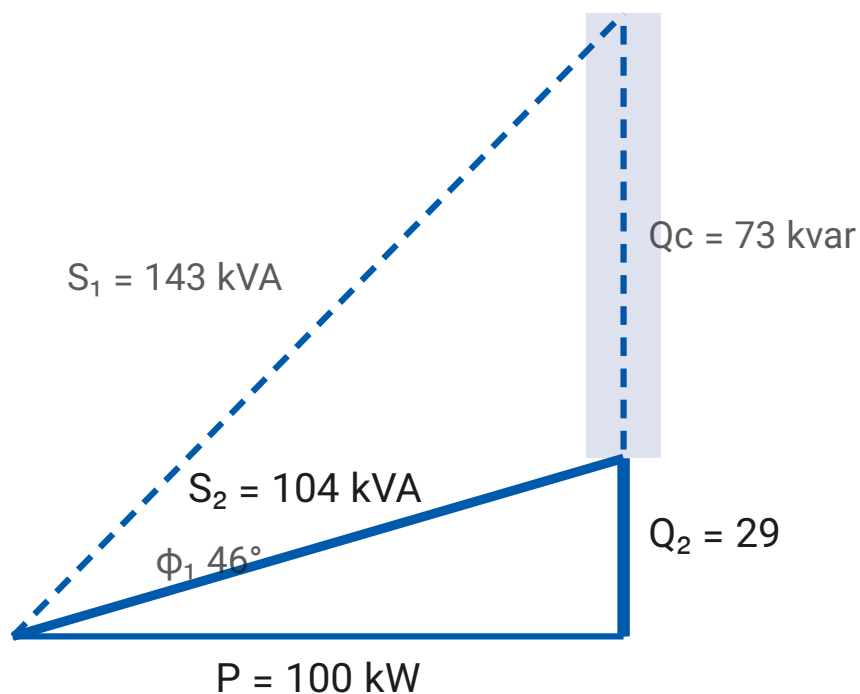
143

S before · kVA

104

S after · kVA

Example from the catalogue: P = 100 kW, actual cos φ 0.61, target 0.96 → factor F = 1.01 → Qc = 101 kvar.



Factor F — Q_c [kvar] = active power [kW] · F (rows: actual $\tan \phi$ / $\cos \phi$; columns: target $\cos \phi$)

TAN ϕ	COS ϕ ACTUAL	→ 0.80	→ 0.82	→ 0.85	→ 0.88	→ 0.90	→ 0.92	→ 0.94	→ 0.96	→ 0.98	→ 1.00
3.18	0.3	2.43	2.48	2.56	2.64	2.7	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	2.6	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	2.1	2.17	2.23	2.3	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	0.4	1.54	1.59	1.67	1.75	1.81	1.87	1.93	2	2.09	2.29
2.16	0.42	1.41	1.46	1.54	1.62	1.68	1.73	1.8	1.87	1.96	2.16
2.04	0.44	1.29	1.34	1.42	1.5	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	1.5	1.57	1.64	1.73	1.93
1.83	0.48	1.08	1.13	1.21	1.29	1.34	1.4	1.47	1.54	1.62	1.83
1.73	0.5	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	1.1	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	1.2	1.27	1.36	1.56
1.48	0.56	0.73	0.78	0.86	0.94	1	1.05	1.12	1.19	1.28	1.48
1.4	0.58	0.65	0.7	0.78	0.86	0.92	0.98	1.04	1.11	1.2	1.4
1.33	0.6	0.58	0.63	0.71	0.79	0.85	0.91	0.97	1.04	1.13	1.33
1.3	0.61	0.55	0.6	0.68	0.76	0.81	0.87	0.94	1.01	1.1	1.3
1.27	0.62	0.52	0.57	0.65	0.73	0.78	0.84	0.91	0.99	1.06	1.27

TAN Φ	COS Φ ACTUAL	→ 0.80	→ 0.82	→ 0.85	→ 0.88	→ 0.90	→ 0.92	→ 0.94	→ 0.96	→ 0.98	→ 1.00
1.23	0.63	0.48	0.53	0.61	0.69	0.75	0.81	0.87	0.94	1.03	1.23
1.2	0.64	0.45	0.5	0.58	0.66	0.72	0.77	0.84	0.91	1	1.2
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	0.6	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	0.9	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	0.3	0.35	0.43	0.51	0.56	0.62	0.69	0.76	0.85	1.05
1.02	0.7	0.27	0.32	0.4	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	0.7	0.79	0.99
0.96	0.72	0.21	0.26	0.34	0.42	0.48	0.54	0.6	0.67	0.76	0.96
0.94	0.73	0.19	0.24	0.32	0.4	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	0.4	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	0.5	0.57	0.65	0.86
0.83	0.77	0.08	0.13	0.21	0.29	0.34	0.4	0.47	0.54	0.63	0.83
0.8	0.78	0.05	0.1	0.18	0.26	0.32	0.38	0.44	0.51	0.6	0.8
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	0.8	—	0.05	0.13	0.21	0.27	0.32	0.39	0.46	0.55	0.75
0.72	0.81	—	—	0.1	0.18	0.24	0.3	0.36	0.43	0.52	0.72
0.7	0.82	—	—	0.08	0.16	0.21	0.27	0.34	0.41	0.49	0.7
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	0.3	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	0.9	—	—	—	—	—	0.06	0.12	0.19	0.28	0.48
0.46	0.91	—	—	—	—	—	0.03	0.1	0.17	0.25	0.46
0.43	0.92	—	—	—	—	—	—	0.07	0.14	0.22	0.43
0.4	0.93	—	—	—	—	—	—	0.04	0.11	0.19	0.4
0.36	0.94	—	—	—	—	—	—	—	0.07	0.16	0.36
0.33	0.95	—	—	—	—	—	—	—	—	0.13	0.33

Individual PFC for motors — approximate values (VDEW)

MOTOR RATING (KW)	1500 RPM (KVAR)	1000 RPM (KVAR)	750 RPM (KVAR)
1 ... 1.9	0.5	0.5	0.6

MOTOR RATING (KW)	1500 RPM (KVAR)	1000 RPM (KVAR)	750 RPM (KVAR)
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	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		

Individual PFC for transformers – standard values

TRANSFORMER (KVA)	OIL IMMERSED (KVAR)	CAST RESIN (KVAR)
10	1	1.5
20	2	1.7
50	4	2
75	5	2.5
100	5	2.5
160	7	4
200	7.5	5
250	8	7.5
315	10	8
400	12.5	8.5
500	15	10
630	17.5	12.5
800	20	15
1000	25	16.7
1250	30	20
1600	35	22
2000	40	25
2500	50	35
3150	60	50



Motors and transformers

The capacitor output should be approx. 90 % of the apparent power of the motor when idle (power factor 0.9 at full load, 0.95 – 0.98 idling). Do not over-rate individually compensated machines with the capacitor on the motor clamps, especially with a big oscillating weight that keeps rotating after switch-off: the capacitor may act as generator and cause serious overvoltages. For transformers: $Q_c = I_0 \% \cdot AN / 100$ (I_0 magnetising current in %, AN rated power in kVA); consult the power supplier about the admissible size, since modern laminations need low capacity and too high an output stresses the transformer while idling.

12 DETUNED AND DYNAMIC PFC – DESIGN INSTRUCTIONS AND COMPONENT SELECTION

When PFC capacitors are connected, the transformer inductance and the capacitors form a resonant circuit that a harmonic current from the load can excite: high current flows through the transformer and the bank, overloading them and raising the voltage across the whole installation. Detuned filtering shifts the resonance to lower values where no harmonic currents exist by introducing a filter reactor in series – a series resonant branch of low impedance that also filters harmonic currents and cleans the grid. Reactors must be selected for the desired tuning frequency (detuning factor p in %) and for the expected harmonic absorption; capacitors for detuned systems need a higher rated voltage because of the overvoltage caused by the series reactor. Detuned filtering is an engineering speciality that takes experienced know-how.



Important design instructions for detuned PFC systems

1

Determine the necessary effective power (kvar) of the capacitor bank to obtain the desired PF.

2

Design the stages so that the sensitivity of the bank is around 15 – 20 % of the total power – a more sensitive bank (5 or 10 %) leads to a high number of switching operations for no real gain.

3

Design the bank with standard kvar values, preferably multiples of 25 kvar.

4

Measure the harmonic currents in the main feeder without capacitors at all load conditions; determine frequency and maximum amplitude of every harmonic. $THD-I = 100 \cdot \sqrt{(I_3^2 + I_5^2 + \dots + I_R^2)} / I_1$; every $THD-IR = 100 \cdot IR / I_1$.

5

Measure harmonic voltages that might come from outside (if possible on the HV side). $THD-V = 100 \cdot \sqrt{(V3^2 + V5^2 + \dots + VN^2)} / V1$.

6

Are there harmonics such that $THD-I > 10\%$ or $THD-V > 3\%$ (without capacitors)?
YES → detuned PFC, go to 7. NO → standard PFC, skip 7 – 9.

7

Is there 3rd-harmonic content $I3 > 0.2 \cdot I5$? YES → $p = 14\%$ and skip 8. NO → $p = 7\%$ or 5.67% , go to 8.

8

$THD-V 3 - 7\% \rightarrow p = 7\%$; $> 7\% \rightarrow p = 5.67\%$; $> 10\% \rightarrow$ ask for a special filter design.

9

Select the components with the TDK tables for the effective power, voltage, frequency and detuning factor.

10

Always use genuine TDK application-specific components: reactors are specified for the effective power of the whole LC set at fundamental frequency, capacitors need a higher rated voltage, and capacitor contactors reduce inrush currents.

All

P (%)	EFFECTIVE OUTPUT (KVAR)	CAPACITOR(S)	REACTOR	CONTACTOR	CABLE (MM ²)	FUSE (A)
400 V – 50 Hz						
5.67	10	1× B25675C4132J880	B44066D5010*400	B44066S1810J230	4	25
5.67	12.5	1× B25675C4142J240	B44066D5012*400	B44066S1810J230	6	35
5.67	20	1× B25675C4282J180	B44066D5020*400	B44066S2410J230	10	50
5.67	25	1× B25675C4282J140	B44066D5025*400	B44066S3210J230	16	63
5.67	40	1× B25675C4202J040 + 1× B25675C4252J040	B44066D5040*400	B44066S6210J230	35	100
5.67	50	2× B25675C4282J140	B44066D5050*400	B44066S6210J230	50	125
5.67	75	3× B25675C4282J140	B44066D5075*400	B44066S7410J230	70	160
5.67	100	4× B25675C4282J140	B44066D5100*400	B44066S9910J230	120	250
7	10	1× B25675C4132J880	B44066D7010*400	B44066S1810J230	4	25
7	12.5	1× B25675C4142J240	B44066D7012*400	B44066S1810J230	6	35
7	20	1× B25675C4282J180	B44066D7020*400	B44066S2410J230	10	50
7	25	1× B25675C4282J140	B44066D7025*400	B44066S3210J230	16	63
7	40	1× B25675C4202J040 + 1× B25675C4252J040	B44066D7040*400	B44066S6210J230	35	100
7	50	2× B25675C4282J140	B44066D7050*400	B44066S6210J230	50	125
7	75	3× B25675C4282J140	B44066D7075*400	B44066S7410J230	70	160
7	100	4× B25675C4282J140	B44066D7100*400	B44066S9910J230	125	250
14	10	1× B25675C4122J580	B44066D1410*400	B44066S1810J230	4	25
14	12.5	1× B25675C4152J080	B44066D1412*400	B44066S1810J230	6	35
14	20	1× B25675C4252J080	B44066D1420*400	B44066S2410J230	10	50
14	25	1× B25675C4312J080	B44066D1425*400	B44066S3210J230	16	63
14	40	2× B25675C4252J080	B44066D1440*400	B44066S6210J230	35	100
14	50	2× B25675C4312J080	B44066D1450*400	B44066S6210J230	50	125
14	75	3× B25675C4312J080	B44066D1475*400	B44066S7410J230	70	160
14	100	4× B25675C4312J080	B44066D1499*400	B44066S9910J230	125	250

P (%)	EFFECTIVE OUTPUT (KVAR)	CAPACITOR(S)	REACTOR	CONTACTOR	CABLE (MM ²)	FUSE (A)
400 V – 60 Hz						
5.67	10	1× B25675C4112J080	B44066D5010*401	B44066S1810J230	4	25
5.67	12.5	1× B25675C4122J040	B44066D5012*401	B44066S1810J230	6	35
5.67	20	1× B25675C4182J840	B44066D5020*401	B44066S2410J230	10	50
5.67	25	1× B25675C4102J040 + 1× B25675C4142J240	B44066D5025*401	B44066S3210J230	16	63
5.67	40	2× B25675C4182J840	B44066D5040*401	B44066S6210J230	35	100
5.67	50	2× B25675C4142J240 + 1× B25675C4182J840	B44066D5050*401	B44066S6210J230	50	125
5.67	75	1× B25675C4202J040 + 2× B25675C4252J040	B44066D5075*401	B44066S7410J230	70	160
5.67	100	1× B25675C4202J040 + 3× B25675C4252J040	B44066D5100*401	B44066S9910J230	120	250
7	10	1× B25675C4092J040	B44066D7010*401	B44066S1810J230	4	25
7	12.5	1× B25675C4122J040	B44066D7012*401	B44066S1810J230	6	35
7	20	1× B25675C4182J840	B44066D7020*401	B44066S2410J230	10	50
7	25	2× B25675C4122J040	B44066D7025*401	B44066S3210J230	16	63
7	40	2× B25675C4182J840	B44066D7040*401	B44066S6210J230	35	100
7	50	2× B25675C4142J240 + 1× B25675C4182J840	B44066D7050*401	B44066S6210J230	50	125
7	75	1× B25675C4202J040 + 2× B25675C4252J040	B44066D7075*401	B44066S7410J230	70	160
7	100	1× B25675C4182J840 + 3× B25675C4252J040	B44066D7100*401	B44066S9910J230	120	250
14	10	1× B25675C4102J480	B44066D1410*401	B44066S1810J230	4	25
14	12.5	1× B25675C4122J580	B44066D1412*401	B44066S1810J230	6	35
14	20	1× B25675C4202J880	B44066D1420*401	B44066S2410J230	10	50
14	25	1× B25675C4252J080	B44066D1425*401	B44066S3210J230	16	63
14	40	2× B25675C4202J880	B44066D1440*401	B44066S6210J230	35	100
14	50	2× B25675C4252J080	B44066D1450*401	B44066S6210J230	50	125
14	75	3× B25675C4252J080	B44066D1475*401	B44066S7410J230	70	160
14	100	4× B25675C4252J080	B44066D1499*401	B44066S9910J230	120	250
440 V – 50 Hz						
5.67	10	1× B25675C4112J080	B44066D5010*440	B44066S1810J230	4	25
5.67	12.5	1× B25675C4132J880	B44066D5012*440	B44066S1810J230	4	35
5.67	20	1× B25675C4222J080	B44066D5020*440	B44066S2410J230	10	50
5.67	25	1× B25675C4282J180	B44066D5025*440	B44066S3210J230	16	63
5.67	40	2× B25675C4222J080	B44066D5040*440	B44066S6210J230	35	100
5.67	50	2× B25675C4282J180	B44066D5050*440	B44066S6210J230	50	125
5.67	75	3× B25675C4282J180	B44066D5075*440	B44066S7410J230	70	160
5.67	100	4× B25675C4282J180	B44066D5100*440	B44066S9910J230	95	200
7	10	1× B25765C4112J080	B44066D7010*440	B44066S1810J230	4	25
7	12.5	1× B25675C4132J880	B44066D7012*440	B44066S1810J230	4	25
7	20	1× B25675C4222J080	B44066D7020*440	B44066S2410J230	10	50
7	25	1× B25675C4282J180	B44066D7025*440	B44066S3210J230	16	63
7	40	2× B25675C4222J080	B44066D7040*440	B44066S6210J230	35	100
7	50	2× B25675C4282J180	B44066D7050*440	B44066S6210J230	50	125
7	75	3× B25675C4282J180	B44066D7075*440	B44066S7410J230	70	160
7	100	4× B25675C4282J180	B44066D7100*440	B44066S9910J230	95	200
14	10	1× B25675C5122J525	B44066D1410*440	B44066S1810J230	4	25
14	12.5	1× B25675C5152J025	B44066D1412*440	B44066S1810J230	4	25
14	20	1× B25675C5252J025	B44066D1420*440	B44066S2410J230	10	50
14	25	1× B25675C5302J025	B44066D1425*440	B44066S3210J230	16	63
14	40	2× B25675C5252J025	B44066D1440*440	B44066S6210J230	35	100

P (%)	EFFECTIVE OUTPUT (KVAR)	CAPACITOR(S)	REACTOR	CONTACTOR	CABLE (MM ²)	FUSE (A)
14	50	2× B25675C5302J025	B44066D1450*440	B44066S6210J230	50	125
14	75	3× B25675C5302J025	B44066D1475*440	B44066S7410J230	70	160
14	100	4× B25675C5302J025	B44066D1499*440	B44066S9910J230	95	200
440 V – 60 Hz						
5.67	10	1× B25675C6142J200	B44066D5010*441	B44066S1810J230	4	25
5.67	12.5	1× B25675C4112J080	B44066D5012*441	B44066S1810J230	4	25
5.67	20	1× B25675C4082J380 + 1× B25675C4102J480	B44066D5020*441	B44066S2410J230	10	50
5.67	25	1× B25675C4112J080 + 1× B25675C4122J580	B44066D5025*441	B44066S3210J230	16	63
5.67	40	1× B25675C4162J780 + 1× B25675C4202J880	B44066D5040*441	B44066S6210J230	35	100
5.67	50	1× B25675C4222J080 + 1× B25675C4252J080	B44066D5050*441	B44066S6210J230	50	125
5.67	75	1× B25675C4202J880 + 2× B25675C4252J080	B44066D5075*441	B44066S7410J230	70	160
5.67	100	1× B25675C4202J080 + 3× B25675C4252J080	B44066D5100*441	B44066S9910J230	95	200
7	10	1× B25675C5102J425	B44066D7010*441	B44066S1810J230	4	25
7	12.5	1× B25675C5132J225	B44066D7012*441	B44066S1810J230	4	25
7	20	1× B25675C4082J380 + 1× B25675C4102J480	B44066D7020*441	B44066S2410J230	10	50
7	25	1× B25675C4222J080	B44066D7025*441	B44066S3210J230	16	63
7	40	1× B25675C4162J780 + 1× B25675C4202J080	B44066D7040*441	B44066S6210J230	35	100
7	50	1× B25675C4202J880 + 1× B25675C4252J080	B44066D7050*441	B44066S6210J230	50	125
7	75	2× B25675C4222J080 + 1× B25675C4252J080	B44066D7075*441	B44066S7410J230	70	160
7	100	3× B25675C4222J080 + 1× B25675C4252J080	B44066D7100*441	B44066S9910J230	95	200
14	10	1× B25675C5102J425	B44066D1410*441	B44066S1810J230	4	25
14	12.5	1× B25675C5122J525	B44066D1412*441	B44066S1810J230	4	25
14	20	1× B25675C5202J825	B44066D1420*441	B44066S2410J230	10	50
14	25	1× B25675C5262J525	B44066D1425*441	B44066S3210J230	16	63
14	40	1× B25675C5202J025 + 1× B25675C5202J825	B44066D1440*441	B44066S6210J230	35	100
14	50	1× B25675C5252J025 + 1× B25675C5262J525	B44066D1450*441	B44066S6210J230	50	125
14	75	2× B25675C5252J025 + 1× B25675C5262J525	B44066D1475*441	B44066S7410J230	70	160
14	100	3× B25675C5252J025 + 1× B25675C5262J525	B44066D1499*441	B44066S9910J230	95	200
480 V – 60 Hz						
5.67	10	1× B25675C6122J500	B44066D5010*481	B44066S1810J230	4	25
5.67	12.5	1× B25675C6142J200	B44066D5012*481	B44066S1810J230	4	25
5.67	20	1× B25675C6252J000	B44066D5020*481	B44066S2410J230	10	50
5.67	25	1× B25675C5082J325 + 1× B25675C5152J025	B44066D5025*481	B44066S3210J230	16	63
5.67	40	1× B25675C5162J725 + 1× B25675C5202J825	B44066D5040*481	B44066S6210J230	35	100
5.67	50	1× B25675C5202J825 + 1× B25675C5252J025	B44066D5050*481	B44066S6210J230	50	125
5.67	75	1× B25675C5202J825 + 2× B25675C5252J025	B44066D5075*481	B44066S7410J230	70	160
5.67	100	1× B25675C5202J025 + 3× B25675C5252J025	B44066D5100*481	B44066S9910J230	95	200
7	10	1× B25675C6122J500	B44066D7010*481	B44066S1810J230	4	25
7	12.5	1× B25675C6142J200	B44066D7012*481	B44066S1810J230	4	25
7	20	1× B25675C6252J000	B44066D7020*481	B44066S2410J230	10	50
7	25	1× B25675C5082J325 + 1× B25675C5152J025	B44066D7025*481	B44066S3210J230	16	63
7	40	1× B25675C5162J725 + 1× B25675C5202J025	B44066D7040*481	B44066S6210J230	35	100
7	50	1× B25675C5202J825 + 1× B25675C5252J025	B44066D7050*481	B44066S6210J230	50	125
7	75	1× B25675C5202J025 + 2× B25675C5252J025	B44066D7075*481	B44066S7410J230	70	160
7	100	1× B25675C5162J725 + 3× B25675C5252J025	B44066D7100*481	B44066S9910J230	95	200
14	10	1× B25675C6142J690	B44066D1410*481	B44066S1810J230	4	25
14	12.5	1× B25675C6132J900	B44066D1412*481	B44066S1810J230	4	25

P (%)	EFFECTIVE OUTPUT (KVAR)	CAPACITOR(S)	REACTOR	CONTACTOR	CABLE (MM ²)	FUSE (A)
14	20	1× B25675C6102J400 + 1× B25675C6122J500	B44066D1420*481	B44066S2410J230	10	50
14	25	2× B25675C6132J900	B44066D1425*481	B44066S3210J230	16	63
14	40	1× B25675C6202J000 + 1× B25675C6252J000	B44066D1440*481	B44066S6210J230	35	100
14	50	1× B25675C6142J200 + 2× B25675C6202J800	B44066D1450*481	B44066S6210J230	50	125
14	75	1× B25675C6082J300 + 3× B25675C6252J000	B44066D1475*481	B44066S7410J230	70	160
14	100	1× B25675C6122J500 + 4× B25675C6252J000	B44066D1499*481	B44066S9910J230	95	200
690 V – 50 Hz						
5.67	12.5	1× B25675C8152J000	B44066D5012*690	B44066S1810J230	4	25
5.67	20	1× B25675C8252J000	B44066D5020*690	B44066S1810J230	10	50
5.67	25	1× B25675C8302J000	B44066D5025*690	B44066S2410J230	16	63
5.67	40	2× B25675C8252J000	B44066D5040*690	B44066S3210J230	35	100
5.67	50	2× B25675C8302J000	B44066D5050*690	B44066S5010J230	50	125
5.67	75	3× B25675C8302J000	B44066D5075*690	B44066S6210J230	70	160
5.67	100	4× B25675C8302J000	B44066D5100*690	B44066S7410J230	95	200
7	12.5	1× B25675C8152J000	B44066D7012*690	B44066S1810J230	4	25
7	20	1× B25675C8252J000	B44066D7020*690	B44066S1810J230	10	50
7	25	1× B25675C8302J000	B44066D7025*690	B44066S2410J230	16	63
7	40	2× B25675C8252J000	B44066D7040*690	B44066S3210J230	35	100
7	50	2× B25675C8302J000	B44066D7050*690	B44066S5010J230	50	125
7	75	3× B25675C8302J000	B44066D7075*690	B44066S6210J230	70	160
7	100	4× B25675C8302J000	B44066D7100*690	B44066S7410J230	95	200
14	12.5	1× B25675C9202J000	B44066D1412*690	B44066S1810J230	4	25
14	20	1× B25675C9302J000	B44066D1420*690	B44066S1810J230	10	50
14	25	1× B25675C0202J000 + 1× B25675C0252J000	B44066D1425*690	B44066S2410J230	16	63
14	40	2× B25675C9302J000	B44066D1440*690	B44066S3210J230	35	100
14	50	3× B25675C0302J000	B44066D1450*690	B44066S5010J230	50	125
14	75	1× B25675C9202J000 + 3× B25675C9302J000	B44066D1475*690	B44066S6210J230	70	160
14	100	6× B25675C0302J000	B44066D1499*690	B44066S7410J230	95	200
690 V – 60 Hz						
5.67	12.5	1× B25675C0202J000	B44066D5012*691	B44066S1810J230	4	25
5.67	20	1× B25675C9252J000 + 1× B25674A8122A500	B44066D5020*691	B44066S1810J230	10	50
5.67	25	2× B25675C0202J000	B44066D5025*691	B44066S2410J230	16	63
5.67	40	2× B25675C8202J000	B44066D5040*691	B44066S3210J230	35	100
5.67	50	1× B25675C8152J000 + 1× B25675C8252J000	B44066D5050*691	B44066S5010J230	50	125
5.67	75	4× B25675C8202J000	B44066D5075*691	B44066S6210J230	70	160
5.67	100	4× B25675C8202J000 + 1× B25675C8252J000	B44066D5100*691	B44066S7410J230	95	200
7	12.5	1× B25675C0202J000	B44066D5012*691	B44066S1810J230	4	25
7	20	1× B25675C9252J000 + 1× B25674A8122A500	B44066D5020*691	B44066S1810J230	10	50
7	25	2× B25675C0202J000	B44066D5025*691	B44066S2410J230	16	63
7	40	2× B25675C8202J000	B44066D5040*691	B44066S3210J230	35	100
7	50	1× B25675C8152J000 + 1× B25675C8252J000	B44066D5050*691	B44066S5010J230	50	125
7	75	4× B25675C8202J000	B44066D5075*691	B44066S6210J230	70	160
7	100	4× B25675C8202J000 + 1× B25675C8252J000	B44066D5100*691	B44066S7410J230	95	200
14	12.5	1× B25675C9152J000	B44066D5012*691	B44066S1810J230	4	25
14	20	1× B25675C9252J000	B44066D5020*691	B44066S1810J230	10	50
14	25	2× B25675C9152J000	B44066D5025*691	B44066S2410J230	16	63
14	40	2× B25675C9252J000	B44066D5040*691	B44066S3210J230	35	100

P (%)	EFFECTIVE OUTPUT (KVAR)	CAPACITOR(S)	REACTOR	CONTACTOR	CABLE (MM ²)	FUSE (A)
14	50	4× B25675C9152J000	B44066D5050*691	B44066S5010J230	50	125
14	75	1× B25675C0152J000 + 4× B25675C0252J000	B44066D5075*691	B44066S6210J230	70	160
14	100	6× B25675C0252J000	B44066D5100*691	B44066S7410J230	95	200

Dynamic PFC – important facts

Conventional systems reach their limits with fast-changing loads: rolling mills, steel presses, wind turbines, container cranes and large buildings require reactive-power adjustment on the millisecond scale and soon exceed the switching capability of electromechanical contactors (100 000 – 200 000 operations in total, i.e. 1 – 2 years) and the 5000 operations per year allowed for capacitors by IEC 60831 – while dynamic applications may need up to 100 000 per year. Burnt contacts, overvoltages and overcurrents during each operation shorten capacitor life and represent a safety risk. In dynamic PFC the contactors are replaced by thyristor modules with no mechanical wear: the TSM switches keep the capacitors at the peak value of the grid voltage and connect them only when the grid reaches this peak, so the capacitors are switched current-free and inrush currents up to $200 \cdot I_N$ are avoided; discharge times of 75 s are not required. Dynamic PFC prevents wear-off, increases lifetime and safety, and reacts almost in real time – fast enough for motor start-ups or spot welding. Key components: TSM modules, fast transistor-output controllers (BR6000-T), standard reactors and capacitors.

All

P (%)	EFFECTIVE OUTPUT (KVAR)	CAPACITOR(S)	REACTOR	THYRISTOR MODULE	DISCHARGE RESISTOR	CABLE (MM ²)	FUSE (A)
400 V – 50 Hz							
5.67	10	1× B25675C5162J725	1× B44066D5010*400	1× B44066T0010E402	1× B44066T0022E400	10	35
5.67	12.5	1× B25675C5202J025	1× B44066D5012*400	1× B44066T0010E402	1× B44066T0022E400	10	35
5.67	20	1× B25675C5332J125	1× B44066D5020*400	1× B44066T3850E402	1× B44066T0022E400	10	50
5.67	25	2× B25675C5202J025	1× B44066D5025*400	1× B44066T3850E402	1× B44066T0022E400	16	63
5.67	40	2× B25675C5332J125	1× B44066D5040*400	1× B44066T3850E402	1× B44066T0022E400	35	100
5.67	50	3× B25675C5282J125	1× B44066D5050*400	1× B44066T3850E402	1× B44066T0022E400	50	125
5.67	75	4× B25675C5302J025	1× B44066D5075*400	1× B44066T0100E402	1× B44066T0022E400	70	160
5.67	100	5× B25675C5332J125	1× B44066D5100*400	1× B44066T0100E402	1× B44066T0022E400	120	250
7	10	1× B25675C5162J725	1× B44066D7010*400	1× B44066T0010E402	1× B44066T0022E400	10	35
7	12.5	1× B25675C5202J025	1× B44066D7012*400	1× B44066T0010E402	1× B44066T0022E400	10	35
7	20	1× B25675C5332J125	1× B44066D7020*400	1× B44066T3850E402	1× B44066T0022E400	10	50
7	25	2× B25675C5202J025	1× B44066D7025*400	1× B44066T3850E402	1× B44066T0022E400	16	63
7	40	2× B25675C5332J125	1× B44066D7040*400	1× B44066T3850E402	1× B44066T0022E400	35	100
7	50	3× B25675C5262J525	1× B44066D7050*400	1× B44066T3850E402	1× B44066T0022E400	50	125
7	75	4× B25675C5302J025	1× B44066D7075*400	1× B44066T0100E402	1× B44066T0022E400	70	160
7	100	5× B25675C5332J125	1× B44066D7100*400	1× B44066T0100E402	1× B44066T0022E400	125	250
14	10	1× B25675C5152J025	1× B44066D1410*400	1× B44066T0010E402	1× B44066T0022E400	10	35

P (%)	EFFECTIVE OUTPUT (KVAR)	CAPACITOR(S)	REACTOR	THYRISTOR MODULE	DISCHARGE RESISTOR	CABLE (MM ²)	FUSE (A)
14	12.5	1× B25675C6252J000	1× B44066D1412*400	1× B44066T0010E402	1× B44066T0022E400	10	35
14	20	1× B25675C5302J025	1× B44066D1420*400	1× B44066T3850E402	1× B44066T0022E400	10	50
14	25	1× B25675C5162J725 + 1× B25675C5202J025	1× B44066D1425*400	1× B44066T3850E402	1× B44066T0022E400	16	63
14	40	2× B25675C5302J025	1× B44066D1440*400	1× B44066T3850E402	1× B44066T0022E400	35	100
14	50	3× B25675C5252J025	1× B44066D1450*400	1× B44066T3850E402	1× B44066T0022E400	50	125
14	75	4× B25675C5282J125	1× B44066D1475*400	1× B44066T0100E402	1× B44066T0022E400	70	160
14	100	5× B25675C5302J025	1× B44066D1499*400	1× B44066T0100E402	1× B44066T0022E400	125	250
400 V – 60 Hz							
5.67	10	1× B25675C5132J225	1× B44066D5010*401	1× B44066T0010E402	1× B44066T0022E400	10	35
5.67	12.5	1× B25675C5162J725	1× B44066D5012*401	1× B44066T0010E402	1× B44066T0022E400	10	35
5.67	20	1× B25675C5262J525	1× B44066D5020*401	1× B44066T3850E402	1× B44066T0022E400	10	50
5.67	25	2× B25675C5162J725	1× B44066D5025*401	1× B44066T3850E402	1× B44066T0022E400	16	63
5.67	40	2× B25675C5262J525	1× B44066D5040*401	1× B44066T3850E402	1× B44066T0022E400	35	100
5.67	50	2× B25675C5202J825 + 1× B25675C5252J025	1× B44066D5050*401	1× B44066T3850E402	1× B44066T0022E400	50	125
5.67	75	4× B25675C5252J025	1× B44066D5075*401	1× B44066T0100E402	1× B44066T0022E400	70	160
5.67	100	5× B25675C5262J525	1× B44066D5100*401	1× B44066T0100E402	2× B44066T0022E400	120	250
7	10	1× B25675C5132J225	1× B44066D7010*401	1× B44066T0010E402	1× B44066T0022E400	10	35
7	12.5	1× B25675C5162J725	1× B44066D7012*401	1× B44066T0010E402	1× B44066T0022E400	10	35
7	20	1× B25675C5262J525	1× B44066D7020*401	1× B44066T3850E402	1× B44066T0022E400	10	50
7	25	2× B25675C5162J725	1× B44066D7025*401	1× B44066T3850E402	1× B44066T0022E400	16	63
7	40	2× B25675C5262J525	1× B44066D7040*401	1× B44066T3850E402	1× B44066T0022E400	35	100
7	50	2× B25675C5202J825 + 1× B25675C5252J025	1× B44066D7050*401	1× B44066T3850E402	1× B44066T0022E400	50	125
7	75	4× B25675C5252J025	1× B44066D7075*401	1× B44066T0100E402	1× B44066T0022E400	70	160
7	100	5× B25675C5262J525	1× B44066D7100*401	1× B44066T0100E402	2× B44066T0022E400	120	250
14	10	1× B25675C5122J525	1× B44066D1410*401	1× B44066T0010E402	1× B44066T0022E400	10	35
14	12.5	1× B25675C5152J025	1× B44066D1412*401	1× B44066T0010E402	1× B44066T0022E400	10	35
14	20	1× B25675C5252J025	1× B44066D1420*401	1× B44066T3850E402	1× B44066T0022E400	10	50
14	25	2× B25675C5152J025	1× B44066D1425*401	1× B44066T3850E402	1× B44066T0022E400	16	63
14	40	2× B25675C5252J025	1× B44066D1440*401	1× B44066T3850E402	1× B44066T0022E400	35	100
14	50	3× B25675C5202J825	1× B44066D1450*401	1× B44066T3850E402	1× B44066T0022E400	50	125
14	75	2× B25675C5202J825 + 2× B25675C5252J025	1× B44066D1475*401	1× B44066T0100E402	1× B44066T0022E400	70	160
14	100	5× B25675C5252J025	1× B44066D1499*401	1× B44066T0100E402	1× B44066T0022E400	120	250
440 V – 50 Hz							
5.67	10	1× B25675C5132J225	1× B44066D5010*440	1× B44066T0010E402	1× B44066T0022E400	10	35
5.67	12.5	1× B25675C5162J725	1× B44066D5012*440	1× B44066T0010E402	1× B44066T0022E400	10	35
5.67	20	1× B25675C5262J525	1× B44066D5020*440	1× B44066T3850E402	1× B44066T0022E400	10	50
5.67	25	1× B25675C5332J125	1× B44066D5025*440	1× B44066T3850E402	1× B44066T0022E400	16	63
5.67	40	2× B25675C5262J525	1× B44066D5040*440	1× B44066T3850E402	1× B44066T0022E400	35	100
5.67	50	2× B25675C5332J125	1× B44066D5050*440	1× B44066T3850E402	1× B44066T0022E400	50	125
5.67	75	3× B25675C5332J125	1× B44066D5075*440	1× B44066T0100E402	1× B44066T0022E400	70	160
5.67	100	4× B25675C5332J125	1× B44066D5100*440	1× B44066T0100E402	1× B44066T0022E400	120	250
7	10	1× B25675C5132J225	1× B44066D7010*440	1× B44066T0010E402	1× B44066T0022E400	10	35
7	12.5	1× B25675C5162J725	1× B44066D7012*440	1× B44066T0010E402	1× B44066T0022E400	10	35
7	20	1× B25675C5262J525	1× B44066D7020*440	1× B44066T3850E402	1× B44066T0022E400	10	50
7	25	1× B25675C5332J125	1× B44066D7025*440	1× B44066T3850E402	1× B44066T0022E400	16	63
7	40	2× B25675C5262J525	1× B44066D7040*440	1× B44066T3850E402	1× B44066T0022E400	35	100

P (%)	EFFECTIVE OUTPUT (KVAR)	CAPACITOR(S)	REACTOR	THYRISTOR MODULE	DISCHARGE RESISTOR	CABLE (MM ²)	FUSE (A)
7	50	2× B25675C5332J125	1× B44066D7050*440	1× B44066T3850E402	1× B44066T0022E400	50	125
7	75	3× B25675C5332J125	1× B44066D7075*440	1× B44066T0100E402	1× B44066T0022E400	70	160
7	100	4× B25675C5332J125	1× B44066D7100*440	1× B44066T0100E402	1× B44066T0022E400	120	250
440 V – 60 Hz							
5.67	10	1× B25675C6132J900	1× B44066D5010*441	1× B44066T0010E402	1× B44066T0022E400	10	35
5.67	12.5	1× B25675C5132J225	1× B44066D5012*441	1× B44066T0010E402	1× B44066T0022E400	10	35
5.67	20	1× B25675C5102J425 + 1× B25675C5122J525	1× B44066D5020*441	1× B44066T3850E402	1× B44066T0022E400	10	50
5.67	25	1× B25675C5122J525 + 1× B25675C5152J025	1× B44066D5025*441	1× B44066T3850E402	1× B44066T0022E400	16	63
5.67	40	1× B25675C5202J825 + 1× B25675C5252J025	1× B44066D5040*441	1× B44066T3850E402	1× B44066T0022E400	35	100
5.67	50	1× B25675C5162J725 + 2× B25675C5202J025	1× B44066D5050*441	1× B44066T3850E402	1× B44066T0022E400	50	125
5.67	75	4× B25675C5202J825	1× B44066D5075*441	1× B44066T0100E402	1× B44066T0022E400	70	160
5.67	100	1× B25675C5122J525 + 4× B25675C5252J025	1× B44066D5100*441	1× B44066T0100E402	1× B44066T0022E400	120	250
7	10	1× B25675C6132J900	1× B44066D7010*441	1× B44066T0010E402	1× B44066T0022E400	10	35
7	12.5	1× B25675C5132J225	1× B44066D7012*441	1× B44066T0010E402	1× B44066T0022E400	10	35
7	20	1× B25675C5102J425 + 1× B25675C5122J525	1× B44066D7020*441	1× B44066T3850E402	1× B44066T0022E400	10	50
7	25	1× B25675C5262J525	1× B44066D7025*441	1× B44066T3850E402	1× B44066T0022E400	16	63
7	40	1× B25675C5202J025 + 1× B25675C5252J025	1× B44066D7040*441	1× B44066T3850E402	1× B44066T0022E400	35	100
7	50	2× B25675C5262J525	1× B44066D7050*441	1× B44066T3850E402	1× B44066T0022E400	50	125
7	75	4× B25675C5202J825	1× B44066D7075*441	1× B44066T0100E402	1× B44066T0022E400	70	160
7	100	4× B25675C5262J525	1× B44066D7100*441	1× B44066T0100E402	1× B44066T0022E400	120	250
690 V – 50 Hz							
5.67	12.5	1× B25675C8152J000	1× B44066D5012*690	1× B44066T3050E690	2× B44066T0022E400	2.5	16
5.67	20	1× B25675C8252J000	1× B44066D5020*690	1× B44066T3050E690	2× B44066T0022E400	4	25
5.67	25	1× B25675C8302J000	1× B44066D5025*690	1× B44066T3050E690	2× B44066T0022E400	6	35
5.67	40	2× B25675C8252J000	1× B44066D5040*690	1× B44066T3050E690	2× B44066T0022E400	16	63
5.67	50	2× B25675C8302J000	1× B44066D5050*690	1× B44066T3050E690	2× B44066T0022E400	25	80
5.67	75	3× B25675C8302J000	1× B44066D5075*690	1× B44066T3050E690	2× B44066T0022E400	50	125
5.67	100	4× B25675C8302J000	2× B44066D5050*690	2× B44066T3050E690	4× B44066T0022E400	25	80
7	12.5	1× B25675C8152J000	1× B44066D7012*690	1× B44066T3050E690	2× B44066T0022E400	2.5	16
7	20	1× B25675C8252J000	1× B44066D7020*690	1× B44066T3050E690	2× B44066T0022E400	4	25
7	25	1× B25675C8302J000	1× B44066D7025*690	1× B44066T3050E690	2× B44066T0022E400	6	35
7	40	2× B25675C8252J000	1× B44066D7040*690	1× B44066T3050E690	2× B44066T0022E400	16	63
7	50	2× B25675C8302J000	1× B44066D7050*690	1× B44066T3050E690	2× B44066T0022E400	25	80
7	75	3× B25675C8302J000	1× B44066D7075*690	1× B44066T3050E690	2× B44066T0022E400	50	125
7	100	4× B25675C8302J000	2× B44066D7050*690	2× B44066T3050E690	4× B44066T0022E400	25	80
14	12.5	1× B25675C9202J000	1× B44066D1412*690	1× B44066T3050E690	2× B44066T0022E400	2.5	16
14	20	1× B25675C9302J000	1× B44066D1420*690	1× B44066T3050E690	2× B44066T0022E400	4	25
14	25	1× B25675C0202J000 + 1× B25675C0252J000	1× B44066D1425*690	1× B44066T3050E690	2× B44066T0022E400	6	35
14	40	2× B25675C9302J000	1× B44066D1440*690	1× B44066T3050E690	2× B44066T0022E400	16	63
14	50	3× B25675C0302J000	1× B44066D1450*690	1× B44066T3050E690	2× B44066T0022E400	25	80
14	75	1× B25675C9202J000 + 3× B25675C9302J000	1× B44066D1475*690	1× B44066T3050E690	2× B44066T0022E400	50	125
14	100	6× B25675C0302J000	2× B44066D1450*690	2× B44066T3050E690	4× B44066T0022E400	25	80
690 V – 60 Hz							
5.67	12.5	1× B25675C0202J000	1× B44066D5012*691	1× B44066T3050E690	2× B44066T0022E400	2.5	16
5.67	20	1× B25675C9252J000 + 1× B25674A8122A500	1× B44066D5020*691	1× B44066T3050E690	2× B44066T0022E400	4	25
5.67	25	2× B25675C0202J000	1× B44066D5025*691	1× B44066T3050E690	2× B44066T0022E400	6	35

P (%)	EFFECTIVE OUTPUT (KVAR)	CAPACITOR(S)	REACTOR	THYRISTOR MODULE	DISCHARGE RESISTOR	CABLE (MM ²)	FUSE (A)
5.67	40	2× B25675C8202J000	1× B44066D5040*691	1× B44066T3050E690	2× B44066T0022E400	16	63
5.67	50	1× B25675C8152J000 + 1× B25675C8252J000	1× B44066D5050*691	1× B44066T3050E690	2× B44066T0022E400	25	80
5.67	75	4× B25675C8202J000	1× B44066D5075*691	1× B44066T3050E690	2× B44066T0022E400	50	125
5.67	100	4× B25675C8202J000 + 1× B25675C8252J000	2× B44066D5050*691	2× B44066T3050E690	4× B44066T0022E400	25	80
7	12.5	1× B25675C0202J000	1× B44066D7012*691	1× B44066T3050E690	2× B44066T0022E400	2.5	16
7	20	1× B25675C9252J000 + 1× B25674A8122A500	1× B44066D7020*691	1× B44066T3050E690	2× B44066T0022E400	4	25
7	25	2× B25675C0202J000	1× B44066D7025*691	1× B44066T3050E690	2× B44066T0022E400	6	35
7	40	2× B25675C8202J000	1× B44066D7040*691	1× B44066T3050E690	2× B44066T0022E400	16	63
7	50	1× B25675C8152J000 + 1× B25675C8252J000	1× B44066D7050*691	1× B44066T3050E690	2× B44066T0022E400	25	80
7	75	4× B25675C8202J000	1× B44066D7075*691	1× B44066T3050E690	2× B44066T0022E400	50	125
7	100	4× B25675C8202J000 + 1× B25675C8252J000	2× B44066D7050*691	2× B44066T3050E690	4× B44066T0022E400	25	80
14	12.5	1× B25675C9152J000	1× B44066D1412*691	1× B44066T3050E690	2× B44066T0022E400	2.5	16
14	20	1× B25675C9252J000	1× B44066D1420*691	1× B44066T3050E690	2× B44066T0022E400	4	25
14	25	2× B25675C9152J000	1× B44066D1425*691	1× B44066T3050E690	2× B44066T0022E400	6	35
14	40	2× B25675C9252J000	1× B44066D1440*691	1× B44066T3050E690	2× B44066T0022E400	16	63
14	50	4× B25675C9152J000	1× B44066D1450*691	1× B44066T3050E690	2× B44066T0022E400	25	80
14	75	1× B25675C0152J000 + 4× B25675C0252J000	1× B44066D1475*691	1× B44066T3050E690	2× B44066T0022E400	50	125
14	100	6× B25675C0252J000	2× B44066D1450*691	2× B44066T3050E690	4× B44066T0022E400	25	80



The recommendations in the selection tables are a support tool; TDK does not take responsibility for the design, as the prevailing circumstances in the application have to be taken into account.

13 PFC BASIC FORMULAS AND WORKED EXAMPLES

NO.	FORMULA	MEANING
1	$P = \sqrt{3} \cdot V \cdot I \cdot \cos \phi$ [W]	active power – the input power converted to output power
2	$Q = \sqrt{3} \cdot V \cdot I \cdot \sin \phi$ [var]	reactive power – consumed by the expansion and collapse of magnetic and electrostatic fields
3	$S = \sqrt{3} \cdot V \cdot I$ [VA]	apparent power delivered to the circuit
4	$PF = P / S$	power factor
5	$Q_c = P \cdot (\tan \phi_1 - \tan \phi_2)$ [var]	reactive power needed; ϕ_1 actual, ϕ_2 target
6 / 7	$Q_c = V_c \cdot I_c = V_c^2 / X_c$	reactive power of the capacitor
8	$X_c = 1 / (\omega \cdot C) = 1 / (2\pi \cdot f \cdot C)$	capacitor impedance
9	$Q_c = V_c^2 \cdot 2\pi \cdot f \cdot C$	formulas 7 and 8 together
10 – 12	star: $Q_{tot} = 3 \cdot Q_c$; $V_c = V_L / \sqrt{3}$; $C_{star} = Q_{tot} / (V_L^2 \cdot 2\pi f)$	three-phase star connection
13 – 15	delta: $V_c = V_L$; $C_{delta} = Q_{tot} / (3 \cdot V_L^2 \cdot 2\pi f) = C_{star} / 3$	three-phase delta connection

NO.	FORMULA	MEANING
16	$Q_{new} = (V_{new} / V_c)^2 \cdot (f_{new} / f_R) \cdot Q_c$	capacitor output at another voltage / frequency (C constant)

Example 1 – 100 kW at cos ϕ 0.70

Reactive power required by the load: 100 kvar; apparent power before PFC 142 kVA.
Installing a 67-kvar capacitor reduces the apparent power to 105 kVA – a 26 % reduction in current – and improves the power factor to 0.95 (100 / 105).

Example 2 – induction motor 220 kW, 440 V, 50 Hz, cos ϕ 0.7 → 0.9

$\tan \phi_1 = 1.02$, $\tan \phi_2 = 0.48 \rightarrow Q_c = 220 \cdot 1000 \cdot (1.02 - 0.48) = 118.8$ kvar.

Example 3 – capacitance in star and delta

Star: $V_c = 440 / \sqrt{3} = 254$ V; $C_{star} = Q_{tot} / (440^2 \cdot 2\pi \cdot 50) = 1954$ μ F per phase (C_{tot} 5862 μ F). Delta: $V_c = 440$ V; $C_{delta} = 651$ μ F per phase (C_{tot} 1954 μ F).

Example 4 – apparent power and cable current

$S_1 = 220 / 0.7 = 314$ kVA; $S_2 = 220 / 0.9 = 244$ kVA; $S_1 - S_2 = 70$ kVA, so $70 \cdot 0.9 = 63$ kW more can be supplied via the existing network. Line current $I_1 = 220\,000 / (\sqrt{3} \cdot 440 \cdot 0.7) = 412$ A uncompensated; $I_2 = 320$ A compensated – the cable can carry 92 A more, or its cross-section can be reduced.

14 CAUTIONS

Temperature class of capacitors (IEC 60831-1) – surrounding air

CLASS	MAXIMUM	MAX. MEAN 24 H	MAX. MEAN 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

IP	FIRST DIGIT	SECOND DIGIT
IP00	no protection against finger touch and solid bodies	no protection against water
IP20	finger touch and solid bodies ≥ 12.5 mm	no protection against water
IP41	tool touch and solid bodies ≥ 1 mm	drip-water protection
IP54	tool touch, bodies ≥ 1 mm, dust deposit	splash-water protection

Maximum admissible overvoltage (50 / 60 Hz)

MAX. VOLTAGE (VRMS)	MAX. DURATION	REMARKS
1.00 · VR	continuous duty	highest mean during the entire operating time; exceptions admissible for < 24 h
1.10 · VR	8 h daily	line voltage fluctuations
1.15 · VR	30 min daily	line voltage fluctuations
1.20 · VR	5 min daily	line voltage fluctuations
1.30 · VR	1 min daily	line voltage fluctuations
with harmonics	—	such that the current does not exceed the maximum admissible figure ($I_{\max} = 1.3 \cdot I_R$)

Temperature and life. Each class is a number (lowest ambient) and a letter (upper limit), e.g. –40/D. Useful life depends very much on temperature: ensure cooling, keep capacitors away from heat of reactors and busbars, prefer forced cooling for compact designs and never arrange capacitors directly above reactors. Overvoltages above $1.15 \cdot VR$ reduce life and must not occur more than 200 times in the lifetime; above $1.3 \cdot VR$ they must not occur at all (lightning protection). Mean life is governed by overload duration, ambient and case temperature, rms current and voltage height and duration; life figures are stated for nominal operating conditions.

Current and fuses. I_R is the current at rated voltage and frequency excluding transients; continuously exceeding it increases self-heating and reduces life; $I_{\max} = 1.3 \cdot I_R$ to IEC 60831 is maintained or overachieved by all capacitors in the catalogue. Protect against short-circuits with slow-blow HRC fuses rated 1.6 to 1.8 times the rated current, or thermal-magnetic relays; magnetic short-circuit relays set to 9 – 12 times the rated current to survive inrush.



HRC fuses must not be used for switching: the arcing can cause death, capacitor failures and, worst case, bursting and fire.

Switching and discharging. A switched capacitor accepts a transient current up to 200 times its rated current; use fast, low-bounce contactors with the capacitive switching

capacity stated by the producer, preferably capacitor contactors with precharging resistors; max. 5000 switching operations per year (IEC 60831). Capacitors must be discharged to 10 % of rated voltage before re-switching and to 75 V or less within 3 min; no switch, fuse or disconnecting device between capacitor and discharging device. Discharge and short-circuit capacitors before handling!

Harmonics. Produced by non-linear loads (rectifiers, inverters, welding, UPS); the 5th and 7th are especially troublesome in LV three-phase systems. Use detuned PFC in networks with harmonics: part of the harmonic current is taken up by the detuned system, the remainder flows into the superordinate system. Most standards limit THD-V on the LV side to 5 %, yet even 3 – 4 % can generate extreme overcurrents in resonance; resonance must be avoided by proper panel design – it may lead to capacitor failures, explosion and fire.

Mechanical, connection, installation

- Dented or mechanically damaged capacitors must not be used.
Vibration resistance to IEC 68-2-6: 2 h, 10 – 55 Hz, max. 0.7 g, 0.75 mm displacement; check stability when built in and do not locate capacitors where vibration amplitude peaks.
- Use flexible cables or copper bands so the overpressure disconnecter can work; design connection cables for at least 1.5 times the rated current so no heat is conducted into the capacitor; keep reactors far enough away; avoid bending lugs or force on the terminals; observe the fixing torque; never exceed the specified terminal current.
- Ground via the threaded bottom stud (remove varnish under washer and nut when grounding through the chassis). Do not use or store in corrosive atmospheres (chloride, sulphide, acid, alkali, salt); clean terminals regularly in dusty environments.
- Installation to IEC 61921, VDE 0100, VDE 0101, VDE 0560 parts 4 and 46, EN 60831 and IEC 60831: cool, well-ventilated locations away from heat, capacitors spaced at least 20 mm apart, otherwise forced cooling scaled so the admissible ambient temperature is not exceeded – exceeding it may set the safety device out of operation.

Reactors

All electrically active parts carry dangerous voltage; covers must not be removed during operation, and all equipment must be disconnected before assembly or maintenance. Use only the protective devices on the type plate and connect temperature switches and sensors as instructed; surfaces may reach up to 260 °C under rated conditions and overload, so pack adjacent components loosely; mount so that cooling ducts are vertical and the air flow is not impeded; do not exceed the insulation-system voltage on the type plate. Non-compliance may lead to death, serious injury, fire or major damage.

Thyristor modules, contactors, controllers

- TSM: live parts must not be touched; warning signs required; wait 10 minutes after the main switch is off; non-detuned 400 V systems need 440 V capacitors, detuned 400 V systems 525 V capacitors; special high-voltage discharge resistors EW-22 (standard resistors and discharge reactors cannot be used – a reactor would short-circuit the high DC voltage); current-limiting reactors (BD series) without filter reactors; superfast electronic fuses, not standard HRC.
- Capacitor contactors: if auxiliary contacts switch discharge resistors, their current must not exceed the auxiliary rating; only flame-resistant, self-extinguishing materials near the resistance spirals.
- Controllers: avoid controller hunting (permanent switching of steps without significant load change) by proper programming of CT primary and secondary, first kvar step, control series and switching time – hunting wears out contactors and capacitors and can end in bursting and fire.
- Observe the ZVEI “General safety recommendations for power capacitors” in addition to the cautions in this catalogue and the data sheets.



SABA KHAZEN MANUFACTURING & INDUSTRIAL CO.

Saba Khazen Industrial Company, established in 1994, is the first and only manufacturer of gas capacitors MKK and resin capacitors MKP under Siemens Germany license in Iran. With the slogan of superior quality and customer satisfaction, the company provides regular after-sales services. It is also the official representative of EPCOS and BELUK Germany, offering a wide range of power factor correction equipment and harmonic elimination solutions to industries.

Contact Us

📍 Tehran, Arjantin Square, Elvand Street, 35th Street, No. 26

📄 Postal Code: 1516933910

📞 Phone: +98 21 88870304

📠 Fax: +98 21 88878342

🕒 Working Hours: 8 AM to 4:30 PM

💬 WhatsApp +98 902 778 0625

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