



LVAC Power Capacitors Terminal Block With Spring Connection

ESTAspring



FEATURES

- Maintenance free
- Reduced assembly times up to 60 %
- Vibration proof in wind power plants and during transport
- Optical connection check:
lever closed = successfully contacted
- 2.5 mm² up to 25 mm² with wire-end sleeve
- Defined continuous contact force through spring technology
- Stainless steel spring
- Corrosion proof
- Fast and easy lever-operated wire connection
- Copper alloy for conductor material
- UL and ULc approved



RoHS
COMPLIANT
HALOGEN
FREE
GREEN
(5-2008)

APPLICATIONS

- Wind power plants
- Solar panels and inverters
- Thermal power station
- Power factor correction $\leq 1000 \text{ VAC}_{\text{RMS}}$



QUICK REFERENCE DATA		
Series	PhMKP..., cylindrical with ESTAspring	PhMKPg..., cylindrical with ESTAspring
Description	LVAC power capacitors - oil - INDOOR , IP20	LVAC power capacitors - dry - INDOOR , IP20
Type	Capacitors, fixed, low voltage	Capacitors, fixed, low voltage
Technology	MKP, metallized polypropylene film	MKP, metallized polypropylene film
Voltage max. (V)	1000	1000
Capacitance min.	3-phase D: 3 x 11.5 μF , 3-phase Y: 3 x 83.6 μF , 1-phase: 49.7 μF	3-phase D: 3 x 11.5 μF , 3-phase Y: 3 x 83.6 μF
Capacitance max.	3-phase D: 3 x 335.0 μF , 3-phase Y: 3 x 219.3 μF , 1-phase: 332.2 μF	3-phase D: 3 x 335.0 μF , 3-phase Y: 3 x 219.3 μF
Output min. (kvar)	2	2
Output max. (kvar)	37.1	37.1



CAPACITORS IN CYLINDRICAL CASINGS

DESIGN

The Vishay ESTA PhMKP / PhMKPg series of power factor correction capacitors in cylindrical aluminum casings with ESTAspring terminals is available in 64 mm, 84 mm, and 116 mm diameter designs.

The 116 mm starts where the output of the 84 mm design ends. At the point of change, the customer has two options: the lower height profile of the 116 mm or the slimmer diameter of the 84.4 mm design.

The Vishay ESTA LVAC MKP capacitors are metallized polypropylene film capacitors with self-healing properties. The current-carrying metal layer of an MKP capacitor is vaporized onto one side of the polypropylene film. The front surface of tubular winding elements are joined by means of the metal spray method (schooping). Three winding elements are encapsulated in one aluminum casing and connected to form a true 3-phase capacitor. The overpressure tear-off fuse prevents the capacitor from bursting at the end of service life, or due to inadmissible electrical or thermal overloads.

The capacitor is housed in a tubular aluminum container with a aluminum lid press-rolled onto it. The current is supplied via an ESTAspring IP20 block-type safety terminal. A threaded stud (M12) at the bottom of the container serves for both grounding and mounting.

The Vishay ESTAprop and ESTAdry capacitors will be delivered together with discharge resistors and hardware for mounting.

The entire range of Vishay ESTA LVAC products are offered in both natural oil-filled ESTAprop PhMKP and gas-filled ESTAdry PhMKPg versions.

1-PHASE / 3-PHASE CAPACITOR, ESTAspring IP20 TERMINAL BLOCK 64 mm / 84.4 mm DIAMETER

ESTAspring



3-PHASE CAPACITOR, ESTAspring IP20 TERMINAL BLOCK 116 mm DIAMETER

ESTAspring





CAPACITORS IN CYLINDRICAL CASINGS

TECHNICAL DATA	
STANDARDS	IEC 60831-1 + 2, EN 60831- 1 + 2, UL 810 LATEST EDITIONS, UL / ULc - FILE E97723
Overvoltages (in accordance with the above standards)	$U_{cn} + 10\%$ (up to 8 h daily) $U_{cn} + 15\%$ (up to 30 min daily) $U_{cn} + 20\%$ (up to 5 min, only 200 times in the life of the capacitor) $U_{cn} + 30\%$ (up to 1 min, only 200 times in the life of the capacitor) Please also refer to "Terms and Definitions"
Overcurrent (in accordance with the above standards)	$1.3 \times I_n$ $1.43 \times I_n$ with 10 % overvoltages, 10 % over capacitance and harmonics included, continuous operation Please also refer to "Terms and Definitions"
Tolerance on capacitance	-5 % / +10 % in accordance with the standards ± 5 % as Vishay ESTA standard
Test voltage, terminal / terminal	$2.15 \times U_{cn}$, VAC, 2 s (routine test)
Test voltage, terminal / casing	4800 VAC, 2 s (routine test)
Inrush current	300 times rated current I_n
Losses	≤ 0.25 W/kvar to 0.45 W/kvar (without discharge resistors)
Statistical life expectancy ⁽¹⁾	> 150 000 operating h (ESTAprop) > 130 000 operating h (ESTAdry)
Degree of protection	ESTAspring IP20 terminal, Indoor
Ambient temperature category	-40 / D (max. 55 °C) as highest temperature category, specified by the standard
Permitted casing temperature	Max. 65 °C (measured on top of the can)
Cooling	Naturally air-cooled
Permissible relative humidity	Maximum 95 %
Maximum allowed altitude	2000 m above sea level without any derating of the capacitor to be considered. Otherwise even altitudes > 2000 m possible
Mounting position	Vertical and horizontal ⁽²⁾
Terminal	ESTAspring fast and easy lever-operated spring loaded terminal, 2.5 mm ² up to 25 mm ² cable cross section with wire-end sleeve. Maximum current of the terminal: 3 x 90 A
Mounting and grounding	Threaded M12 stud at the bottom of the container, 10 Nm
Safety features	All-phase overpressure tear-off fuse, self-healing
Casing	Aluminum can
Dielectric	Polypropylene film, self-healing
Filling agent	Natural oil, non-PCB, biodegradable (ESTAprop) or dry / gas-filled (ESTAdry)

Notes

- ⁽¹⁾ Statements about product lifetime are based on calculations and internal testing. They should only be interpreted as estimations. Also due to external factors, the lifetime in the field application may deviate from the calculated lifetime. In general, nothing stated herein shall be construed as a guarantee of quality or durability
- ⁽²⁾ When placing in a horizontal position, an adequate mounting support should be used towards the terminal end of the capacitor for support. This is to protect the M12 mounting bolt against breakage due to vibrations and the torque caused by the weight of the capacitor along with the connecting cables. The use of a collecting tray is a good practice in consideration of the very unlikely event of a leaking oil-filled capacitor



3-PHASE CAPACITORS ESTAspring

IP20, OIL

RATED VOLTAGE 230 V, 50 Hz, DELTA CONNECTION, UL / ULc							
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A	DIMENSIONS Ø x H mm	WEIGHT kg	DRAWING NO.
PhMKP230.3.02,50-S64	5341-48100-xx	2.5	3 x 50.1	6.3	64 x 190	0.8	1
PhMKP230.3.05,00-S64	5341-48101-xx	5	3 x 100.3	12.6	64 x 265	1.0	1
PhMKP230.3.10,00-S84	5341-48800-xx	10	3 x 200.6	25.1	84.4 x 265	1.7	2
PhMKP230.3.12,50-S84	5341-48801-xx	12.5	3 x 250.7	31.4	84.4 x 340	2.0	2
PhMKP230.3.15,00-S84	5341-48802-xx	15	3 x 300.9	37.7	84.4 x 340	2.1	2
PhMKP230.3.10,00-S116	5341-47103-xx	10	3 x 200.6	25.1	116 x 160	2.1	3
PhMKP230.3.12,50-S116	5341-47104-xx	12.5	3 x 250.7	31.4	116 x 190	2.5	3
PhMKP230.3.15,00-S116	5341-47105-xx	15	3 x 300.9	37.7	116 x 190	2.5	3
PhMKP230.3.16,70-S116	5341-47106-xx	16.7	3 x 335.0	41.9	116 x 230	3.1	3

RATED VOLTAGE 400 V, 50 Hz, DELTA CONNECTION, UL / ULc								
CAN BE USED ALSO FOR 415 V, FULL OVER VOLTAGE RANGE								
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar 400 V	OUTPUT kvar 415 V	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A 400 V / 415 V	DIMENSIONS Ø x H mm	WEIGHT kg	DRAWING NO.
PhMKP400.3.02,50-S64	5341-48102-xx	2.5	2.7	3 x 16.6	3.6 / 3.7	64 x 190	0.8	1
PhMKP400.3.05,00-S64	5341-48103-xx	5	5.4	3 x 33.2	7.2 / 7.5	64 x 190	0.8	1
PhMKP400.3.06,67-S64	5341-48104-xx	6.67	7.2	3 x 44.2	9.6 / 10.0	64 x 190	0.8	1
PhMKP400.3.07,50-S64	5341-48105-xx	7.5	8.1	3 x 49.7	10.8 / 11.2	64 x 190	0.8	1
PhMKP400.3.08,33-S64	5341-48106-xx	8.33	9.0	3 x 55.2	12 / 12.5	64 x 190	0.8	1
PhMKP400.3.10,00-S64	5341-48107-xx	10	10.8	3 x 66.3	14.4 / 14.9	64 x 265	1.0	1
PhMKP400.3.12,50-S64	5341-48108-xx	12.5	13.5	3 x 82.9	18 / 18.7	64 x 265	1.0	1
PhMKP400.3.10,00-S84	5341-48803-xx	10	10.8	3 x 66.3	14.4 / 14.9	84.4 x 190	1.3	2
PhMKP400.3.12,50-S84	5341-48804-xx	12.5	13.5	3 x 82.9	18 / 18.7	84.4 x 190	1.3	2
PhMKP400.3.15,00-S84	5341-48805-xx	15	16.1	3 x 99.5	21.6 / 22.4	84.4 x 190	1.3	2
PhMKP400.3.16,70-S84	5341-48806-xx	16.7	18.0	3 x 110.7	24.1 / 25.0	84.4 x 265	1.7	2
PhMKP400.3.20,00-S84	5341-48807-xx	20	21.5	3 x 132.6	28.8 / 30.0	84.4 x 265	1.7	2
PhMKP400.3.25,00-S84	5341-48808-xx	25	26.9	3 x 165.8	36.1 / 37.4	84.4 x 265	1.7	2
PhMKP400.3.16,70-S116	5341-47110-xx	16.7	18.0	3 x 110.7	24.1 / 25.0	116 x 160	2.1	3
PhMKP400.3.20,00-S116	5341-47111-xx	20	21.5	3 x 132.6	28.8 / 29.9	116 x 160	2.1	3
PhMKP400.3.25,00-S116	5341-47112-xx	25	26.9	3 x 165.8	36.1 / 37.4	116 x 190	2.5	3

Notes

- Other voltage ratings, outputs and frequencies upon request. All PhMKP / PhMKPg-type capacitors may also be applied in 60 Hz networks, however the resulting output and current will be 20 % higher in these cases (i.e. additional thermal load and therefore a lower temperature class must be taken into account unless otherwise specified for the capacitor concerned)

⁽¹⁾ Version no. xx may differ as it respects small changes, e.g. on the label



3-PHASE CAPACITORS ESTAspring

IP20, OIL

RATED VOLTAGE 440 V, 50 Hz, DELTA CONNECTION, UL / ULc								
CAN BE USED ALSO FOR 415 V								
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar 440 V	OUTPUT kvar 415 V	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A 440 V / 415 V	DIMENSIONS Ø x H mm	WEIGHT kg	DRAWING NO.
PhMKP440.3.02,50-S64	5341-48122-xx	2.5	2.2	3 x 13.7	3.3 / 3.1	64 x 190	0.7	1
PhMKP440.3.05,00-S64	5341-48109-xx	5	4.4	3 x 27.4	6.6 / 6.1	64 x 190	0.8	1
PhMKP440.3.08,33-S64	5341-48110-xx	8.33	7.4	3 x 45.7	10.9 / 10.3	64 x 190	0.8	1
PhMKP440.3.10,00-S64	5341-48111-xx	10	8.9	3 x 54.8	13.1 / 12.4	64 x 265	1.0	1
PhMKP440.3.11,20-S64	5341-48112-xx	11.2	10	3 x 61.4	14.7 / 13.9	64 x 265	1.0	1
PhMKP440.3.12,50-S64	5341-48113-xx	12.5	11.1	3 x 68.5	16.4 / 15.4	64 x 265	1.0	1
PhMKP440.3.14,00-S64	5341-48114-xx	14	12.5	3 x 76.7	18.4 / 17.4	64 x 265	1.0	1
PhMKP440.3.12,50-S84	5341-48809-xx	12.5	11.1	3 x 68.5	16.4 / 15.5	84.4 x 190	1.3	2
PhMKP440.3.14,10-S84	5341-48810-xx	14.1	12.5	3 x 77.0	18.5 / 17.5	84.4 x 190	1.3	2
PhMKP440.3.15,00-S84	5341-48811-xx	15	13.3	3 x 82.2	19.7 / 18.6	84.4 x 190	1.3	2
PhMKP440.3.16,90-S84	5341-48812-xx	16.9	15	3 x 92.6	22.2 / 20.9	84.4 x 190	1.3	2
PhMKP440.3.18,80-S84	5341-48813-xx	18.8	16.67	3 x 103.0	24.7 / 23.3	84.4 x 265	1.7	2
PhMKP440.3.20,00-S84	5341-48814-xx	20	17.8	3 x 109.6	26.2 / 24.8	84.4 x 265	1.7	2
PhMKP440.3.22,50-S84	5341-48815-xx	22.5	20	3 x 123.3	29.5 / 27.8	84.4 x 265	1.7	2
PhMKP440.3.25,00-S84	5341-48816-xx	25	22.2	3 x 137.0	32.8 / 30.9	84.4 x 265	1.7	2
PhMKP440.3.28,10-S84	5341-48817-xx	28.1	25	3 x 154.0	36.9 / 34.8	84.4 x 265	1.7	2
PhMKP440.3.30,00-S84	5341-48818-xx	30	26.7	3 x 164.4	39.4 / 37.1	84.4 x 340	2.1	2
PhMKP440.3.14,10-S116	5341-47168-xx	14.1	12.5	3 x 77.0	18.5 / 17.5	116 x 160	1.5	3
PhMKP440.3.18,80-S116	5341-47115-xx	18.8	16.67	3 x 103.0	24.7 / 23.3	116 x 160	1.8	3
PhMKP440.3.20,00-S116	5341-47116-xx	20	17.8	3 x 109.6	26.2 / 24.8	116 x 160	1.8	3
PhMKP440.3.22,50-S116	5341-47117-xx	22.5	20	3 x 123.3	29.5 / 27.8	116 x 160	1.9	3
PhMKP440.3.25,00-S116	5341-47118-xx	25	22.2	3 x 137.0	32.8 / 30.9	116 x 190	2.0	3
PhMKP440.3.28,10-S116	5341-47120-xx	28.1	25	3 x 154.0	36.9 / 34.8	116 x 190	2.0	3
PhMKP440.3.30,00-S116	5341-47122-xx	30	26.7	3 x 164.4	39.4 / 37.1	116 x 190	2.2	3

Notes

- Other voltage ratings, outputs and frequencies upon request. All PhMKP / PhMKPg-type capacitors may also be applied in 60 Hz networks, however the resulting output and current will be 20 % higher in these cases (i.e. additional thermal load and therefore a lower temperature class must be taken into account unless otherwise specified for the capacitor concerned)

⁽¹⁾ Version no. xx may differ as it respects small changes, e.g. on the label



3-PHASE CAPACITORS ESTAspring

IP20, OIL

RATED VOLTAGE 525 V, 50 Hz, DELTA CONNECTION, UL / ULc								
CAN BE USED ALSO FOR 480 V								
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar 525 V	OUTPUT kvar 480 V	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A 525 V / 480 V	DIMENSIONS Ø x H mm	WEIGHT kg	DRAWING NO.
PhMKP525.3.03,00-S64	5341-48115-xx	3	2.5	3 x 11.5	3.3 / 3.0	64 x 190	0.8	1
PhMKP525.3.05,00-S64	5341-48116-xx	5	4.2	3 x 19.2	5.5 / 5.0	64 x 190	0.8	1
PhMKP525.3.08,33-S64	5341-48117-xx	8.33	7	3 x 32.1	9.2 / 8.4	64 x 190	0.8	1
PhMKP525.3.10,00-S64	5341-48118-xx	10	8.33	3 x 38.5	11.0 / 10.1	64 x 265	1.0	1
PhMKP525.3.10,00-S84	5341-48819-xx	10	8.33	3 x 38.5	11.0 / 10.1	84.4 x 190	1.3	2
PhMKP525.3.12,50-S84	5341-48820-xx	12.5	10.4	3 x 48.1	13.7 / 12.6	84.4 x 190	1.3	2
PhMKP525.3.13,80-S84	5341-48821-xx	13.8	11.5	3 x 53.1	15.2 / 13.8	84.4 x 190	1.3	2
PhMKP525.3.15,00-S84	5341-48822-xx	15	12.5	3 x 57.7	16.5 / 15.0	84.4 x 190	1.3	2
PhMKP525.3.20,00-S84	5341-48823-xx	20	16.7	3 x 77.0	22.0 / 20.1	84.4 x 265	1.7	2
PhMKP525.3.25,00-S84	5341-48824-xx	25	20.9	3 x 96.2	27.5 / 25.1	84.4 x 265	1.7	2
PhMKP525.3.20,00-S116	5341-47124-xx	20	16.7	3 x 77.0	22.0 / 20.1	116 x 160	1.8	3
PhMKP525.3.25,00-S116	5341-47125-xx	25	20.9	3 x 96.2	27.5 / 25.1	116 x 190	2.5	3
PhMKP525.3.30,00-S116	5341-47169-xx	30	25.1	3 x 115.4	33.0 / 30.2	116 x 230	2.6	3
PhMKP525.3.35,90-S116	5341-47170-xx	35.9	30	3 x 138.2	39.5 / 36.1	116 x 265	2.8	3
PhMKP525.3.37,10-S116	5341-47165-xx	37.1	31	3 x 142.8	40.8 / 37.3	116 x 265	2.8	3

Notes

- Other voltage ratings, outputs and frequencies upon request. All PhMKP / PhMKPg-type capacitors may also be applied in 60 Hz networks, however the resulting output and current will be 20 % higher in these cases (i.e. additional thermal load and therefore a lower temperature class must be taken into account unless otherwise specified for the capacitor concerned)

⁽¹⁾ Version no. xx may differ as it respects small changes, e.g. on the label



3-PHASE CAPACITORS ESTAspring

IP20, OIL

RATED VOLTAGE 660 V, 50 Hz, 64 / 84: DELTA CONNECTION, 116: STAR CONNECTION, UL / ULc UP TO 660 V								
CAN BE USED ALSO FOR 690 V								
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar 660 V	OUTPUT kvar 690 V	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A 660 V / 690 V	DIMENSIONS Ø x H mm	WEIGHT kg	DRAWING NO.
PhMKP660.3.05,00-S64	5341-48119-xx	5	5.5	3 x 12.2	4.4 / 4.6	64 x 190	0.8	1
PhMKP660.3.08,33-S64	5341-48120-xx	8.33	9.1	3 x 20.3	7.3 / 7.6	64 x 265	1.0	1
PhMKP660.3.08,33-S84	5341-48825-xx	8.33	9.1	3 x 20.3	7.3 / 7.6	84.4 x 190	1.3	2
PhMKP660.3.10,00-S84	5341-48826-xx	10	10.9	3 x 24.4	8.7 / 9.1	84.4 x 190	1.3	2
PhMKP660.3.12,50-S84	5341-48827-xx	12.5	13.7	3 x 30.4	10.9 / 11.4	84.4 x 265	1.7	2
PhMKP660.3.15,00-S84	5341-48828-xx	15	16.4	3 x 36.5	13.1 / 13.7	84.4 x 265	1.7	2
PhMKP660.3.16,70-S84	5341-48829-xx	16.7	18.3	3 x 40.7	14.6 / 15.3	84.4 x 265	1.7	2
PhMKP660.3.20,00-S84	5341-48830-xx	20	21.9	3 x 48.7	17.5 / 18.3	84.4 x 340	2.1	2
PhMKP660.3.22,90-S84	5341-48831-xx	22.9	25	3 x 55.8	20 / 20.9	84.4 x 340	2.1	2
PhMKP660.2.12,50-S116	5341-47157-xx	12.5	13.7	3 x 91.4	10.9 / 11.4	116 x 160	2.1	3
PhMKP660.2.15,00-S116	5341-47158-xx	15	16.4	3 x 109.6	13.1 / 13.7	116 x 160	2.1	3
PhMKP660.2.16,70-S116	5341-47159-xx	16.7	18.3	3 x 122.1	14.6 / 15.3	116 x 160	2.1	3
PhMKP660.2.20,00-S116	5341-47161-xx	20	21.9	3 x 146.2	17.5 / 18.3	116 x 190	2.3	3
PhMKP660.2.22,90-S116	5341-47162-xx	22.9	25	3 x 167.3	20 / 20.9	116 x 190	2.5	3

RATED VOLTAGE 690 V, 50 Hz, 64 / 84: DELTA CONNECTION, 116: STAR CONNECTION								
CAN BE USED ALSO FOR 660 V								
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar 690 V	OUTPUT kvar 660 V	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A 690 V / 660 V	DIMENSIONS Ø x H mm	WEIGHT kg	DRAWING NO.
PhMKP690.3.10,00-S64	5341-48121-xx	10	9.1	3 x 22.3	8.4 / 8.0	64 x 265	1.1	1
PhMKP690.3.12,50-S84	5341-48832-xx	12.5	11.4	3 x 27.9	10.5 / 10.0	84.4 x 265	1.9	2
PhMKP690.3.15,00-S84	5341-48833-xx	15	13.7	3 x 33.4	12.5 / 12.0	84.4 x 265	1.9	2
PhMKP690.3.20,00-S84	5341-48834-xx	20	18.3	3 x 44.6	16.7 / 16.0	84.4 x 340	2.4	2
PhMKP690.3.25,00-S84	5341-48835-xx	25	22.9	3 x 55.7	20.9 / 20.0	84.4 x 340	2.4	2
PhMKP690.2.12,50-S116	5341-47171-xx	12.5	11.4	3 x 83.6	10.5 / 10.0	116 x 160	2.0	3
PhMKP690.2.15,00-S116	5341-47172-xx	15	13.7	3 x 100.3	12.5 / 12.0	116 x 160	2.2	3
PhMKP690.2.20,00-S116	5341-47173-xx	20	18.3	3 x 133.7	16.7 / 16.0	116 x 190	2.2	3
PhMKP690.2.25,00-S116	5341-47174-xx	25	22.9	3 x 167.3	20.9 / 20.0	116 x 190	2.5	3

Notes

- Other voltage ratings, outputs and frequencies upon request. All PhMKP / PhMKPg-type capacitors may also be applied in 60 Hz networks, however the resulting output and current will be 20 % higher in these cases (i.e. additional thermal load and therefore a lower temperature class must be taken into account unless otherwise specified for the capacitor concerned)

⁽¹⁾ Version no. xx may differ as it respects small changes, e.g. on the label



3-PHASE CAPACITORS ESTAspring

IP20, DRY

RATED VOLTAGE 230 V, 50 Hz, DELTA CONNECTION, UL / ULc							
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A	DIMENSIONS Ø x H mm	WEIGHT kg	DRAWING NO.
PhMKPg230.3.02,50-S64	5343-48400-xx	2.5	3 x 50.1	6.3	64 x 190	0.6	1
PhMKPg230.3.05,00-S64	5343-48401-xx	5	3 x 100.3	12.6	64 x 265	0.8	1
PhMKPg230.3.10,00-S84	5343-48700-xx	10	3 x 200.6	25.1	84.4 x 265	1.4	2
PhMKPg230.3.12,50-S84	5343-48701-xx	12.5	3 x 250.7	31.4	84.4 x 340	1.5	2
PhMKPg230.3.15,00-S84	5343-48702-xx	15	3 x 300.9	37.7	84.4 x 340	1.7	2
PhMKPg230.3.10,00-S116	5343-47306-xx	10	3 x 200.6	25.1	116 x 160	1.5	3
PhMKPg230.3.12,50-S116	5343-47307-xx	12.5	3 x 250.7	31.4	116 x 190	1.7	3
PhMKPg230.3.15,00-S116	5343-47308-xx	15	3 x 300.9	37.7	116 x 190	1.9	3
PhMKPg230.3.16,70-S116	5343-47309-xx	16.7	3 x 335.0	41.9	116 x 230	2.2	3

RATED VOLTAGE 400 V, 50 Hz, DELTA CONNECTION, UL / ULc								
CAN BE USED ALSO FOR 415 V, FULL OVER VOLTAGE RANGE								
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar 400 V	OUTPUT kvar 415 V	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A 400 V / 415 V	DIMENSIONS Ø x H mm	WEIGHT kg	DRAWING NO.
PhMKPg400.3.02,50-S64	5343-48402-xx	2.5	2.7	3 x 16.6	3.6 / 3.7	64 x 190	0.6	1
PhMKPg400.3.05,00-S64	5343-48403-xx	5	5.4	3 x 33.2	7.2 / 7.5	64 x 190	0.6	1
PhMKPg400.3.06,67-S64	5343-48404-xx	6.67	7.2	3 x 44.2	9.6 / 10.0	64 x 190	0.6	1
PhMKPg400.3.07,50-S64	5343-48405-xx	7.5	8.1	3 x 49.7	10.8 / 11.2	64 x 190	0.6	1
PhMKPg400.3.08,33-S64	5343-48406-xx	8.33	9.0	3 x 55.2	12 / 12.5	64 x 190	0.7	1
PhMKPg400.3.10,00-S64	5343-48407-xx	10	10.8	3 x 66.3	14.4 / 14.9	64 x 265	0.7	1
PhMKPg400.3.12,50-S64	5343-48408-xx	12.5	13.5	3 x 82.9	18 / 18.7	64 x 265	0.8	1
PhMKPg400.3.10,00-S84	5343-48703-xx	10	10.8	3 x 66.3	14.4 / 14.9	84.4 x 190	1.0	2
PhMKPg400.3.12,50-S84	5343-48704-xx	12.5	13.5	3 x 82.9	18 / 18.7	84.4 x 190	1.4	2
PhMKPg400.3.15,00-S84	5343-48705-xx	15	16.1	3 x 99.5	21.6 / 22.4	84.4 x 190	1.4	2
PhMKPg400.3.16,70-S84	5343-48706-xx	16.7	18.0	3 x 110.7	24.1 / 25.0	84.4 x 265	1.4	2
PhMKPg400.3.20,00-S84	5343-48707-xx	20	21.5	3 x 132.6	28.8 / 30.0	84.4 x 265	1.4	2
PhMKPg400.3.25,00-S84	5343-48708-xx	25	26.9	3 x 165.8	36.1 / 37.4	84.4 x 265	1.5	2
PhMKPg400.3.16,70-S116	5343-47312-xx	16.7	18.0	3 x 110.7	24.1 / 25.0	116 x 160	1.5	3
PhMKPg400.3.20,00-S116	5343-47313-xx	20	21.5	3 x 132.6	28.8 / 29.9	116 x 160	1.6	3
PhMKPg400.3.25,00-S116	5343-47315-xx	25	26.9	3 x 165.8	36.1 / 37.4	116 x 190	1.9	3

Notes

- Other voltage ratings, outputs and frequencies upon request. All PhMKP / PhMKPg-type capacitors may also be applied in 60 Hz networks, however the resulting output and current will be 20 % higher in these cases (i.e. additional thermal load and therefore a lower temperature class must be taken into account unless otherwise specified for the capacitor concerned)

⁽¹⁾ Version no. xx may differ as it respects small changes, e.g. on the label



3-PHASE CAPACITORS ESTAspring

IP20, DRY

RATED VOLTAGE 440 V, 50 Hz, DELTA CONNECTION, UL / ULc								
CAN BE USED ALSO FOR 415 V								
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar 440 V	OUTPUT kvar 415 V	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A 440 V / 415 V	DIMENSIONS Ø x H mm	WEIGHT kg	DRAWING NO.
PhMKPg440.3.02,50-S64	5343-48422-xx	2.5	2.2	3 x 13.7	3.3 / 3.1	64 x 190	0.6	1
PhMKPg440.3.05,00-S64	5343-48409-xx	5	4.4	3 x 27.4	6.6 / 6.1	64 x 190	0.6	1
PhMKPg440.3.08,33-S64	5343-48410-xx	8.33	7.4	3 x 45.7	10.9 / 10.3	64 x 190	0.6	1
PhMKPg440.3.10,00-S64	5343-48411-xx	10	8.9	3 x 54.8	13.1 / 12.4	64 x 265	0.8	1
PhMKPg440.3.11,20-S64	5343-48412-xx	11.2	10	3 x 61.4	14.7 / 13.9	64 x 265	0.8	1
PhMKPg440.3.12,50-S64	5343-48413-xx	12.5	11.1	3 x 68.5	16.4 / 15.4	64 x 265	0.8	1
PhMKPg440.3.14,00-S64	5343-48414-xx	14	12.5	3 x 76.7	18.4 / 17.4	64 x 265	1.0	1
PhMKPg440.3.12,50-S84	5343-48709-xx	12.5	11.1	3 x 68.5	16.4 / 15.5	84.4 x 190	1.0	2
PhMKPg440.3.14,10-S84	5343-48710-xx	14.1	12.5	3 x 77.0	18.5 / 17.5	84.4 x 190	1.1	2
PhMKPg440.3.15,00-S84	5343-48711-xx	15	13.3	3 x 82.2	19.7 / 18.6	84.4 x 190	1.1	2
PhMKPg440.3.16,90-S84	5343-48712-xx	16.9	15	3 x 92.6	22.2 / 20.9	84.4 x 190	1.2	2
PhMKPg440.3.18,80-S84	5343-48713-xx	18.8	16.67	3 x 103.0	24.7 / 23.3	84.4 x 265	1.3	2
PhMKPg440.3.20,00-S84	5343-48714-xx	20	17.8	3 x 109.6	26.2 / 24.8	84.4 x 265	1.4	2
PhMKPg440.3.22,50-S84	5343-48715-xx	22.5	20	3 x 123.3	29.5 / 27.8	84.4 x 265	1.4	2
PhMKPg440.3.25,00-S84	5343-48716-xx	25	22.2	3 x 137.0	32.8 / 30.9	84.4 x 265	1.5	2
PhMKPg440.3.28,10-S84	5343-48717-xx	28.1	25	3 x 154.0	36.9 / 34.8	84.4 x 265	1.5	2
PhMKPg440.3.30,00-S84	5343-48718-xx	30	26.7	3 x 164.4	39.4 / 37.1	84.4 x 340	1.8	2
PhMKPg440.3.14,10-S116	5343-47369-xx	14.1	12.5	3 x 77.0	18.5 / 17.5	116 x 160	1.0	3
PhMKPg440.3.18,80-S116	5343-47317-xx	18.8	16.67	3 x 103.0	24.7 / 23.3	116 x 160	1.5	3
PhMKPg440.3.20,00-S116	5343-47318-xx	20	17.8	3 x 109.6	26.2 / 24.8	116 x 160	1.6	3
PhMKPg440.3.22,50-S116	5343-47319-xx	22.5	20	3 x 123.3	29.5 / 27.8	116 x 160	1.6	3
PhMKPg440.3.25,00-S116	5343-47320-xx	25	22.2	3 x 137.0	32.8 / 30.9	116 x 190	1.7	3
PhMKPg440.3.28,10-S116	5343-47305-xx	28.1	25	3 x 154.0	36.9 / 34.8	116 x 190	1.6	3

Notes

- Other voltage ratings, outputs and frequencies upon request. All PhMKP / PhMKPg-type capacitors may also be applied in 60 Hz networks, however the resulting output and current will be 20 % higher in these cases (i.e. additional thermal load and therefore a lower temperature class must be taken into account unless otherwise specified for the capacitor concerned)

⁽¹⁾ Version no. xx may differ as it respects small changes, e.g. on the label



3-PHASE CAPACITORS ESTAspring

IP20, DRY

RATED VOLTAGE 525 V, 50 Hz, DELTA CONNECTION, UL / ULc								
CAN BE USED ALSO FOR 480 V								
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar 525 V	OUTPUT kvar 480 V	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A 525 V / 480 V	DIMENSIONS Ø x H mm	WEIGHT kg	DRAWING NO.
PhMKPg525.3.03,00-S64	5343-48415-xx	3	2.5	3 x 11.5	3.3 / 3.0	64 x 190	0.6	1
PhMKPg525.3.05,00-S64	5343-48416-xx	5	4.2	3 x 19.2	5.5 / 5.0	64 x 190	0.6	1
PhMKPg525.3.08,33-S64	5343-48417-xx	8.33	7	3 x 32.1	9.2 / 8.4	64 x 190	0.6	1
PhMKPg525.3.10,00-S64	5343-48418-xx	10	8.33	3 x 38.5	11.0 / 10.1	64 x 265	0.7	1
PhMKPg525.3.10,00-S84	5343-48719-xx	10	8.33	3 x 38.5	11.0 / 10.1	84.4 x 190	0.8	2
PhMKPg525.3.12,50-S84	5343-48720-xx	12.5	10.4	3 x 48.1	13.7 / 12.6	84.4 x 190	1.0	2
PhMKPg525.3.13.80-S84	5343-48721-xx	13.8	11.5	3 x 53.1	15.2 / 13.8	84.4 x 190	1.0	2
PhMKPg525.3.15,00-S84	5343-48722-xx	15	12.5	3 x 57.7	16.5 / 15.0	84.4 x 190	1.2	2
PhMKPg525.3.20,00-S84	5343-48723-xx	20	16.7	3 x 77.0	22.0 / 20.1	84.4 x 265	1.3	2
PhMKPg525.3.25,00-S84	5343-48724-xx	25	20.9	3 x 96.2	27.5 / 25.1	84.4 x 265	1.5	2
PhMKPg525.3.20,00-S116	5343-47366-xx	20	16.7	3 x 77.0	22.0 / 20.1	116 x 160	1.4	3
PhMKPg525.3.25,00-S116	5343-47327-xx	25	20.9	3 x 96.2	27.5 / 25.1	116 x 190	1.5	3
PhMKPg525.3.30,00-S116	5343-47367-xx	30	25.1	3 x 115.4	33.0 / 30.2	116 x 230	2.0	3
PhMKPg525.3.35,90-S116	5343-47371-xx	35.9	30	3 x 138.2	39.5 / 36.1	116 x 265	2.1	3
PhMKPg525.3.37,10-S116	5343-47372-xx	37.1	31	3 x 142.8	40.8 / 37.3	116 x 265	2.2	3

Notes

- Other voltage ratings, outputs and frequencies upon request. All PhMKP / PhMKPg-type capacitors may also be applied in 60 Hz networks, however the resulting output and current will be 20 % higher in these cases (i.e. additional thermal load and therefore a lower temperature class must be taken into account unless otherwise specified for the capacitor concerned)
- ⁽¹⁾ Version no. xx may differ as it respects small changes, e.g. on the label



3-PHASE CAPACITORS ESTAspring

IP20, DRY

RATED VOLTAGE 660 V, 50 Hz, 64 / 84: DELTA CONNECTION, 116: STAR CONNECTION, UL / ULc UP TO 660 V								
CAN BE USED ALSO FOR 690 V, FULL OVER VOLTAGE RANGE								
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar 660 V	OUTPUT kvar 690 V	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A 660 V / 690 V	DIMENSIONS Ø x H mm	WEIGHT kg	DRAWING NO.
PhMKPg660.3.05,00-S64	5343-48419-xx	5	5.5	3 x 12.2	4.4 / 4.6	64 x 190	0.6	1
PhMKPg660.3.08,33-S64	5343-48420-xx	8.33	9.1	3 x 20.3	7.3 / 7.6	64 x 265	0.8	1
PhMKPg660.3.08,33-S84	5343-48725-xx	8.33	9.1	3 x 20.3	7.3 / 7.6	84.4 x 190	0.9	2
PhMKPg660.3.10,00-S84	5343-48726-xx	10	10.9	3 x 24.4	8.7 / 9.1	84.4 x 190	1.1	2
PhMKPg660.3.12,50-S84	5343-48727-xx	12.5	13.7	3 x 30.4	10.9 / 11.4	84.4 x 265	1.2	2
PhMKPg660.3.15,00-S84	5343-48728-xx	15	16.4	3 x 36.5	13.1 / 13.7	84.4 x 265	1.4	2
PhMKPg660.3.16,70-S84	5343-48729-xx	16.7	18.3	3 x 40.7	14.6 / 15.3	84.4 x 265	1.5	2
PhMKPg660.3.20,00-S84	5343-48730-xx	20	21.9	3 x 48.7	17.5 / 18.3	84.4 x 340	1.7	2
PhMKPg660.3.22,90-S84	5343-48731-xx	22.9	25	3 x 55.8	20 / 20.9	84.4 x 340	1.9	2
PhMKPg660.2.12,50-S116	5343-47355-xx	12.5	13.7	3 x 91.4	10.9 / 11.4	116 x 160	1.6	3
PhMKPg660.2.15,00-S116	5343-47356-xx	15	16.4	3 x 109.6	13.1 / 13.7	116 x 160	1.6	3
PhMKPg660.2.16,70-S116	5343-47357-xx	16.7	18.3	3 x 122.1	14.6 / 15.3	116 x 160	1.7	3
PhMKPg660.2.20,00-S116	5343-47359-xx	20	21.9	3 x 146.2	17.5 / 18.3	116 x 190	1.8	3
PhMKPg660.2.22,90-S116	5343-47373-xx	22.9	25	3 x 167.3	20 / 20.9	116 x 190	1.7	3

RATED VOLTAGE 690 V, 50 Hz, 64 / 84: DELTA CONNECTION, 116: STAR CONNECTION								
CAN BE USED ALSO FOR 660 V								
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar 690 V	OUTPUT kvar 660 V	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A 690 V / 660 V	DIMENSIONS Ø x H mm	WEIGHT kg	DRAWING NO.
PhMKPg690.3.10,00-S64	5343-48421-xx	10	9.1	3 x 22.3	8.4 / 8.0	64 x 265	0.9	1
PhMKPg690.3.12,50-S84	5343-48732-xx	12.5	11.4	3 x 27.9	10.5 / 10.0	84.4 x 265	1.1	2
PhMKPg690.3.15,00-S84	5343-48733-xx	15	13.7	3 x 33.4	12.5 / 12.0	84.4 x 265	1.3	2
PhMKPg690.3.20,00-S84	5343-48734-xx	20	18.3	3 x 44.6	16.7 / 16.0	84.4 x 340	1.6	2
PhMKPg690.3.25,00-S84	5343-48735-xx	25	22.9	3 x 55.7	20.9 / 20.0	84.4 x 340	1.9	2
PhMKPg690.2.12,50-S116	5343-47374-xx	12.5	11.4	3 x 83.6	10.5 / 10.0	116 x 160	1.2	3
PhMKPg690.2.15,00-S116	5343-47375-xx	15	13.7	3 x 100.3	12.5 / 12.0	116 x 160	1.3	3
PhMKPg690.2.20,00-S116	5343-47376-xx	20	18.3	3 x 133.7	16.7 / 16.0	116 x 190	1.5	3
PhMKPg690.2.25,00-S116	5343-47377-xx	25	22.9	3 x 167.3	20.9 / 20.0	116 x 190	1.6	3

Notes

- Other voltage ratings, outputs and frequencies upon request. All PhMKP / PhMKPg-type capacitors may also be applied in 60 Hz networks, however the resulting output and current will be 20 % higher in these cases (i.e. additional thermal load and therefore a lower temperature class must be taken into account unless otherwise specified for the capacitor concerned)

⁽¹⁾ Version no. xx may differ as it respects small changes, e.g. on the label



1-PHASE CAPACITORS ESTAspring

IP20, OIL

RATED VOLTAGE 230 V, 50 Hz, UL / ULc							
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A	DIMENSIONS Ø x H (mm)	WEIGHT kg	DRAWING NO.
PhMKP230.1.02,50-S64	5341-48142-xx	2.5	150.0	10.9	64 x 140	0.6	4
PhMKP230.1.03,33-S64	5341-48123-xx	3.33	200.4	14.5	64 x 190	0.7	4
PhMKP230.1.04,17-S64	5341-48124-xx	4.17	251.0	18.1	64 x 190	0.8	4
PhMKP230.1.05,00-S84	5341-48838-xx	5	300.0	21.7	84.4 x 140	0.9	5

RATED VOLTAGE 400 V, 50 Hz, UL / ULc								
CAN BE USED ALSO FOR 415 V, FULL OVER VOLTAGE RANGE								
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar 400 V	OUTPUT kvar 415 V	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A 400 V / 415 V	DIMENSIONS Ø x H mm	WEIGHT kg	DRAWING NO.
PhMKP400.1.02,50-S64	5341-48125-xx	2.5	2.7	49.7	6.3 / 6.5	64 x 82	0.3	4
PhMKP400.1.03,33-S64	5341-48126-xx	3.33	3.6	66.2	8.3 / 8.6	64 x 109	0.4	4
PhMKP400.1.05,00-S64	5341-48127-xx	5	5.4	99.5	12.5 / 13.0	64 x 140	0.5	4
PhMKP400.1.06,67-S64	5341-48128-xx	6.67	7.2	132.7	16.7 / 17.3	64 x 190	0.7	4
PhMKP400.1.08,33-S64	5341-48129-xx	8.33	9	165.7	20.8 / 21.6	64 x 190	0.8	4
PhMKP400.1.10,00-S64	5341-48130-xx	10	10.8	198.9	25.0 / 25.9	64 x 240	0.9	4
PhMKP400.1.08,33-S84	5341-48839-xx	8.33	9	165.7	20.8 / 21.6	84.4 x 140	0.9	5
PhMKP400.1.10,00-S84	5341-48840-xx	10	10.8	198.9	25.0 / 25.9	84.4 x 140	1.0	5
PhMKP400.1.16,70-S84	5341-48841-xx	16.7	18	332.2	41.7 / 43.3	84.4 x 240	1.3	5

RATED VOLTAGE 525 V, 50 Hz, UL / ULc								
CAN BE USED ALSO FOR 480 V								
TYPE	ARTICLE NO. ⁽¹⁾	OUTPUT kvar 525 V	OUTPUT kvar 480 V	CAP. μF	FUNDAMENTAL CURRENT I _n AT 50 Hz A 525 V / 480 V	DIMENSIONS Ø x H mm	WEIGHT kg	DRAWING NO.
PhMKP525.1.05,00-S64	5341-48131-xx	5	4.2	57.7	9.5 / 8.8	64 x 140	0.5	4
PhMKP525.1.08,33-S64	5341-48132-xx	8.33	7.0	96.2	15.9 / 14.6	64 x 190	0.7	4
PhMKP525.1.10,00-S64	5341-48133-xx	10	8.4	115.5	19.0 / 17.5	64 x 240	0.9	4
PhMKP525.1.16,70-S84	5341-48842-xx	16.7	14.0	192.9	31.6 / 29.2	84.4 x 240	1.3	5
PhMKP525.1.20,00-S84	5341-48843-xx	20	16.7	231.0	38.0 / 34.8	84.4 x 240	1.3	5

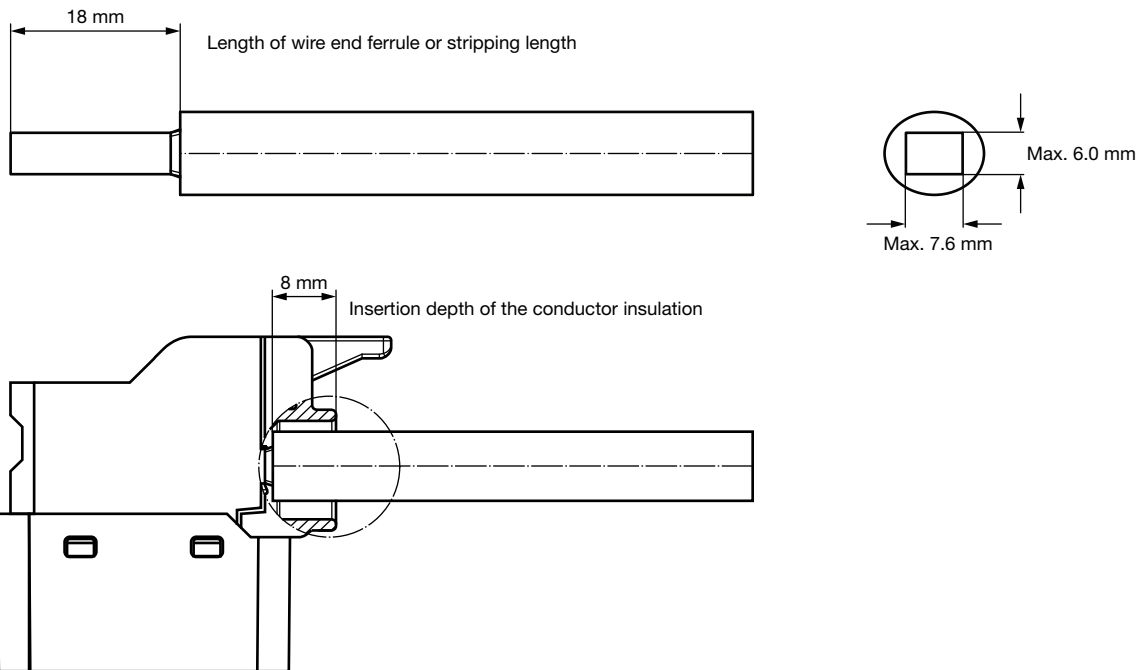
Notes

- Other voltage ratings, outputs and frequencies upon request. All PhMKP / PhMKPg-type capacitors may also be applied in 60 Hz networks, however the resulting output and current will be 20 % higher in these cases (i.e. additional thermal load and therefore a lower temperature class must be taken into account unless otherwise specified for the capacitor concerned)

⁽¹⁾ Version no. xx may differ as it respects small changes, e.g. on the label



CAPACITORS WITH ESTAspring



Transverse ok



Upended wrong

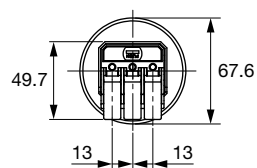
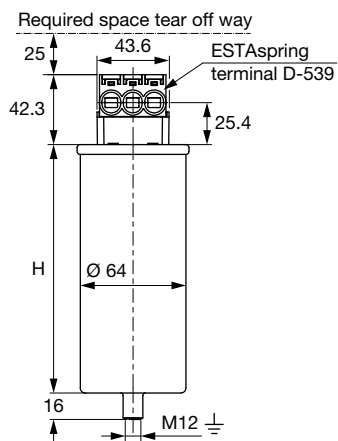
STANDARDS FOR ESTAspring TERMINAL BLOCK

- Conductor pull-out test according to IEC 60998-2-1
- Impulse withstand voltage test according to IEC 60664-1
- Current carrying capacity up to 90 A/phase according to IEC 60512-5-2
- Vibration test according to IEC 60068-2-6
- Corrosion test according to IEC 6988
- Temperature shock test according to IEC 60512-11-4, clause 11d
- Degree of protection IP20, test according to DIN 40050-9/60529

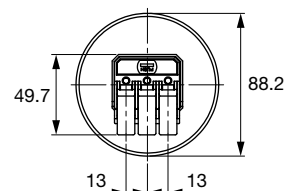
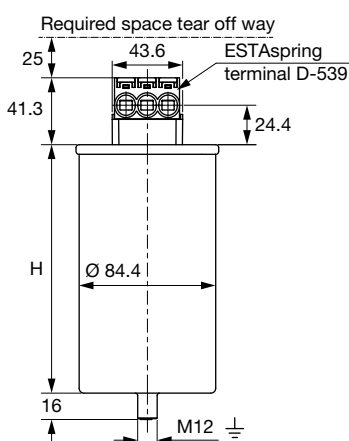
The lever is designed for a minimum of 10 operating cycles. Continuous use can result in excessive wear.



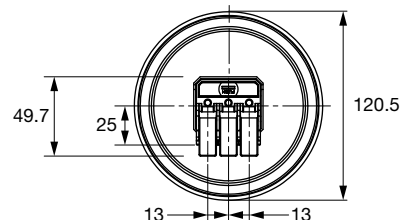
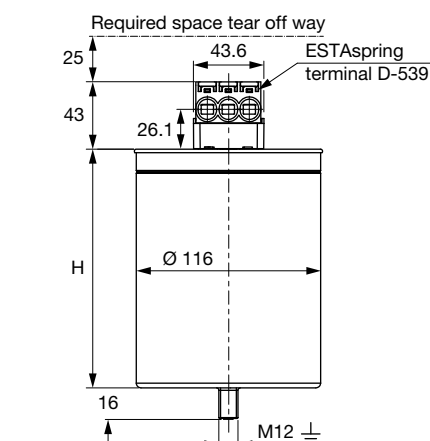
DIMENSIONS in millimeters ESTAspring



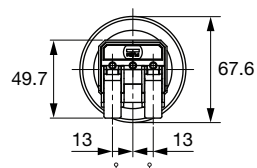
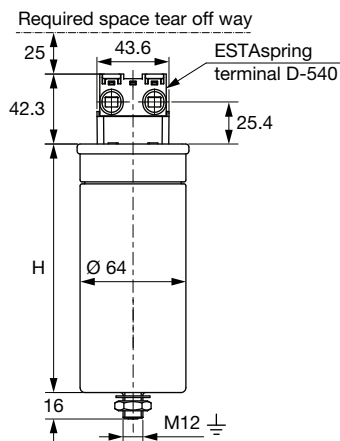
Drawing 1



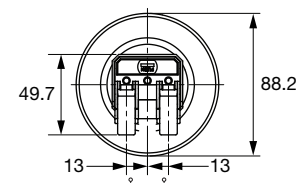
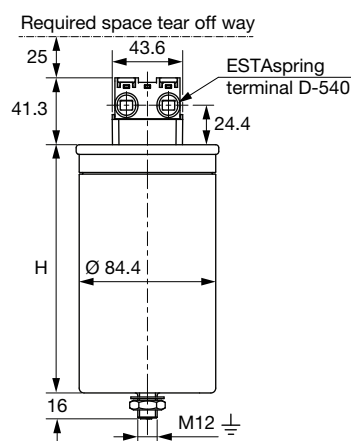
Drawing 2



Drawing 3



Drawing 4



Drawing 5

Note

- Ø 64 / Ø 84, single-phase: middle lever left out

ORDERING INFORMATION

TECHNICAL UNITS

Full cardboard boxes:	Ø 64 mm - 9 pcs per carton
	Ø 84.4 mm - 4 pcs per carton
	Ø 116 mm - 4 pcs per carton



Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.