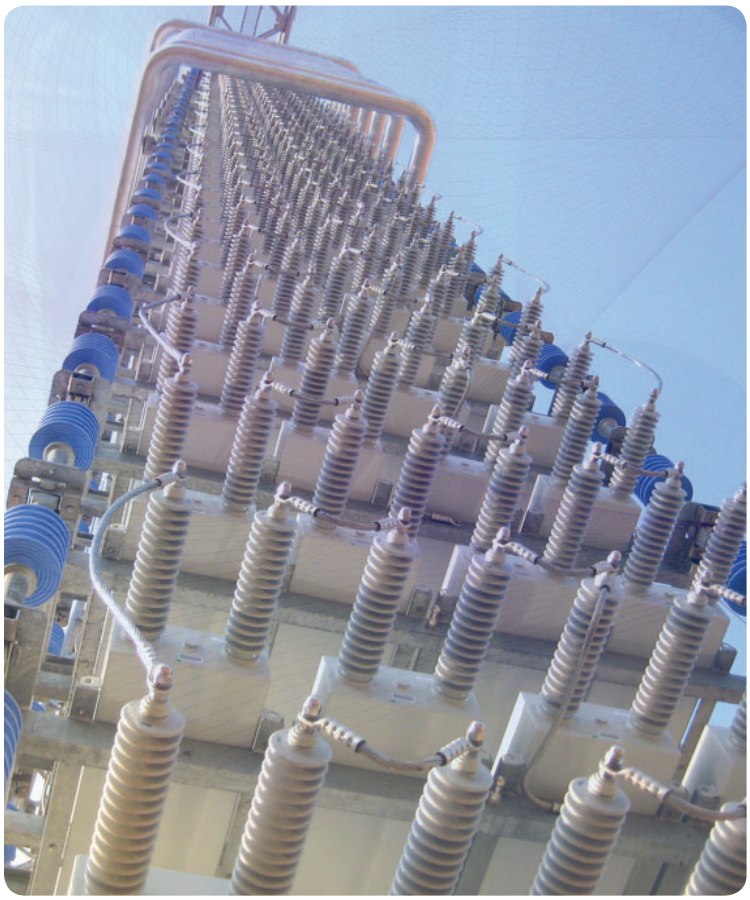
MH Vishay High Voltage Power Capacitors



High Voltage Power Capacitors Data Book

- Scope
- Standards
- Fields of Application
- General Data

One of the World's Largest Manufacturers of
Power Capacitors

High Voltage Power Capacitors

High Voltage Power Capacitors

SCOPE

Single phase capacitor units from 1 kV up to maximum 24 kV, 50 Hz or 60 Hz, 20 kvar up to maximum 1000 kvar for indoor or outdoor use.
- With dead casing, open terminal IP00 (2 bushings)
- With dead casing, type of enclosure IP55 (2 bushings)
- With live casing, open terminal IP00 (1 bushing)

Three phase capacitor units from 1 kV up to maximum 12 kV, 50 Hz or 60 Hz, 20 kvar up to max. 800 kvar with pressure monitoring device.
- With dead casing (3 bushings), open terminal IP00 (indoor use only)
- With dead casing (3 bushings), protected terminals, type of enclosure IP55 (indoor or outdoor)

STANDARDS

- VDE 0560/4 Bestimmungen für Leistungskondensatoren
- IEC 60871 Shunt capacitors for AC power systems having a rated voltage above 1000 V
- IEC 60143 Series capacitors for power systems

Capacitors in accordance with other standards like AS, ANSI IEEE, BS, CSA, IS, etc... are also available upon request.

QUALITY MANAGEMENT SYSTEM

ISO 9001, ISO 14001, IRIS

QUALIFICATIONS

- EDF (HN 54-S-05)
- CSA std. C22.2 no. 190-M1985

SAFETY REGULATIONS

When installing the equipment, relevant IEC or VDE recommendations shall be observed, in particular VDE 0101 and 0111, as well as VDE 0560 part 4 section C.

FIELDS OF APPLICATION

POWER FACTOR CORRECTION

The active power produced by the active current can alone be turned into an effective use for the consumer; while the reactive power produced by the reactive current does not yield usable power, and consequently, is not registered on the active performance meter. The reactive power has, however, a negative effect on generators, transformers, and conductor lines, while causing voltage drops and financial losses due to additional electric heating.
The reactive power required for the creation of the magnetic field around motors, transformers, and conducter lines continiously oscillates between the current generators and the consumers. A more cost effective way to provide this reactive power is to produce it by placing capacitors close to the consumers of reactive power (motors, transformers), thus relieving the line between generator and consumer of the transport of the reactive current portion. This way, several more current consumers can be connected to an existing supply system without having to extend or amplify that system if the capacitors are suitably positioned.

INDIVIDUAL POWER FACTOR CORRECTION

The power factor correction capacitor is connected directly to the terminals of the consumer and will be switched together with it. The advantages of this method are: Relief of the conductor lines and switches, no capacitor switches or discharge resistors are needed, and the installation is simple and cheap. The individual compensation is the best solution for large consumers (e.g. motors), particularly if they are in continuous operation.

INDIVIDUAL POWER FACTOR CORRECTION OF 3-PHASE MOTORS

The motor and the capacitor are connected in parallel. They are both switched in and out by means of one and the same switchgear and also monitored by a common protective device. A discharge device is not required, because discharging takes place through the motor windings.
The switchgear must be rated to be capable of withstanding the inrush current of the capacitor and the connection lines must be capable of withstanding the full load current of the motor. The capacitor, in this case, has to be installed in close proximity to the motor.

INDIVIDUAL POWER FACTOR CORRECTION OF POWER TRANSFORMERS

The direct connection of the capacitor to a power transformer, which is jointly switched in and out, is feasible and permissible both at the H.V. side and the L.V. side.
In cases where harmonics exist in the line, the line should be checked to determine whether the capacitors and the power transformer are connected in series and create a resonance. Care should be taken not to overcompensate the power transformer during low load operation in order to avoid an unacceptable rise in voltage.

INDIVIDUAL POWER FACTOR CORRECTION OF WELDING MACHINES

The output of capacitors for welding transformers and resistance welding machines only needs to be in the range of 30 % to 50 % of the nominal transformer capacity. For welding rectifiers, a capacitor output of about 10 % of the nominal capacity of the transformer/rectifier is sufficient.

GROUP POWER FACTOR CORRECTION

The power factor correction capacitor is connected to the secondary distribution system which feeds a number of individual motors, operating either continuously or at intervals.
The motors and the capacitors are each switched in and out separately and are monitored by separate protective devices. The capacitors can be switched in or out individually or in groups.

CENTRAL POWER FACTOR CORRECTION

In large installations where many individual electrical appliances of various size (motors etc.) operate at different times and for different periods, the power factor correction capacitors are centrally connected to the main bus bar. The capacitors can be switched either manually or, by means of power factor control relays, automatically.

Advantage:

Automatic control and optimal matching of the capacitor output to the specified requirements for reactive power insures that the specified cos phi is maintained in the most cost effective way.

GENERAL DATA

DIELECTRIC

An all film dielectric is used and consists of polypropylene in the form of biaxially oriented film, hazy on both side, and in 2 or 3 layers with a laser cut aluminum foil for the electrodes.

IMPREGNATING AGENT

The capacitors are impregnated with a NON-PCB base fluid.

DIELECTRIC LOSSES AND TOTAL LOSSES

Dielectric losses in new state are approx. 0.1 W/kvar and reduce after 500 h operating to a stable state of approx. 0.02 W/kvar to 0.05 W/kvar (see curve 1 and curve 2).

The dielectric losses, depending on capacitor design, shall be added to the losses caused by:

- Discharge resistors
- Internal connections
- Internal fuses

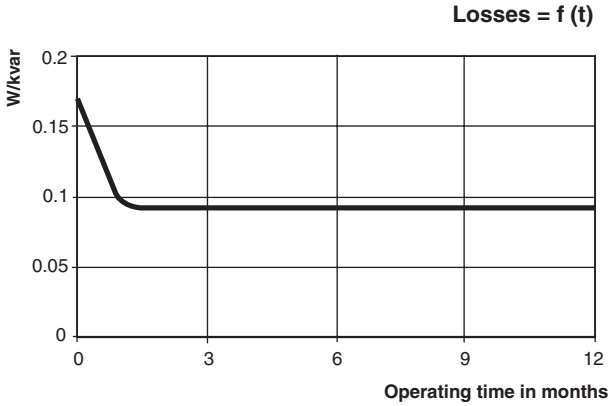
Total losses will reach values from 0.07 W/kvar to approx. 0.15 W/kvar.

TESTING

Capacitors are tested in accordance with IEC-standard 60871.
Other standards upon request.

CURVE 1

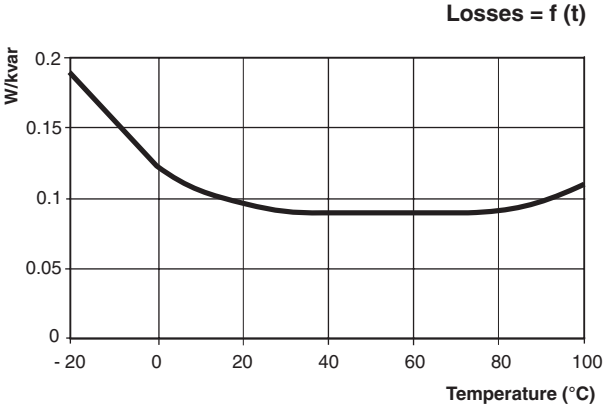
Losses as a function of dielectric temperature



Losses variation of a representative capacitor unit

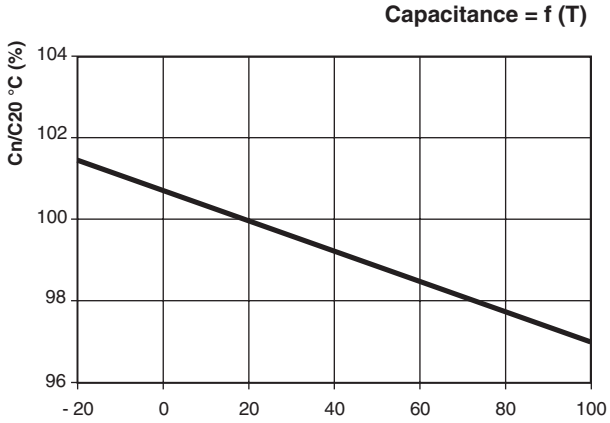
CURVE 2

Losses as a function of dielectric temperature



CURVE 3

Capacitance as a function dielectric temperature



TEMPERATURE RANGE

Capacitors are classified in temperature categories, with each category being specified by a number followed by a letter

SYMBOL	AMBIENT AIR TEMPERATURE (°C)		
	MAXIMUM	HIGHEST MAN OVER ANY PERIOD OF	
		24 h	1 YEAR
A	40	30	0
B	45	35	25
C	50	40	30
D	55	45	35

The number represents the lowest ambient air temperature at which the capacitor may operate. - 50 °C, - 40 °C, - 25 °C, - 15 °C, - 5 °C

The letters represent upper limits of temperature variation ranges, having maximum values specified in above table.

OVERLOADS

a) Maximum permissible voltage (continuous)

Capacitor units shall be suitable for operation at voltage levels according to the following table.

The amplitudes of the over voltages that may be tolerated without significant deterioration of the capacitor depends on the duration, the total number and the capacitor temperature.

TYPE	VOLTAGE FACTOR (V_{RMS})	MAXIMUM DURATION	OBSERVATION
Power frequency	1.0 U_N	Continuous	Highest average value during any period of capacitor energization. For energization periods less than 24 h,exceptions apply in accordance with the value below
	1.1 U_N	12 h in every 24 h	System voltage regulation and fluctuations
	1.15 U_N	30 min in every 24 h	System voltage regulation and fluctuations
	1.2 U_N	5 min	Voltage rise at light load
	1.3 U_N	1 min	

b) Maximum permissible current

Capacitor units shall be suitable for continuous operation at an rms current of 1.30 times the current that occurs at rated sinusoidal voltage and rated frequency, excluding transients.

DISCHARGING

Following may be used as discharge device:
- discharge resistors
- discharge coils
- discharge transformers
- windings of motors or transformers

Each capacitor unit shall be provided with means for discharging to 75 V or less in 10 minutes.

CORROSION PROTECTION

Case material:
- stainless steel

Pre-treatment:
- pickling with acid
- washing with water
- alkalinous degreasing
- washing with water
- washing with distilled water

Primer coating:
DEDELAN wash primer, two-component wash primer based on acrylic resin

Top coating:
2C-PUR HIGH-SOLID TOPCOAT low solvent two component topcoat based on acrylic resin

Total thickness:
CORO 1: 75 µ m to 85 µ m
CORO 2: 115 µ m to 130 µ m

PROTECTION DEVICES FOR POWER CAPACITORS

Detailed information is provided in IEC 60871-3 “Protection of shunt capacitors and shunt capacitor banks.”

a) INTERNAL FUSES

Detailed information is provided in IEC 60871-4 “Internal fuses.”
Internal fuses are designed to isolate faulty elements in order to allow further operation of the capacitor unit and the bank in which the capacitor is connected.
Complete protection is obtained when using internal fuses together with an unbalance protection device.

b) PRESSURE MONITORING DEVICE

The pressure inside the capacitor casing is monitored by means of an over pressure sensor. In the event that the setting (critical value) is exceeded, a change-over contact initiates disconnection of the capacitor. Such an early disconnection from the source of supply after an internal breakdown can stop gas evolution in the capacitor casing, avoiding the bursting of it. Complete protection is obtained when using the pressure monitoring device together with H.R.C. fuses.

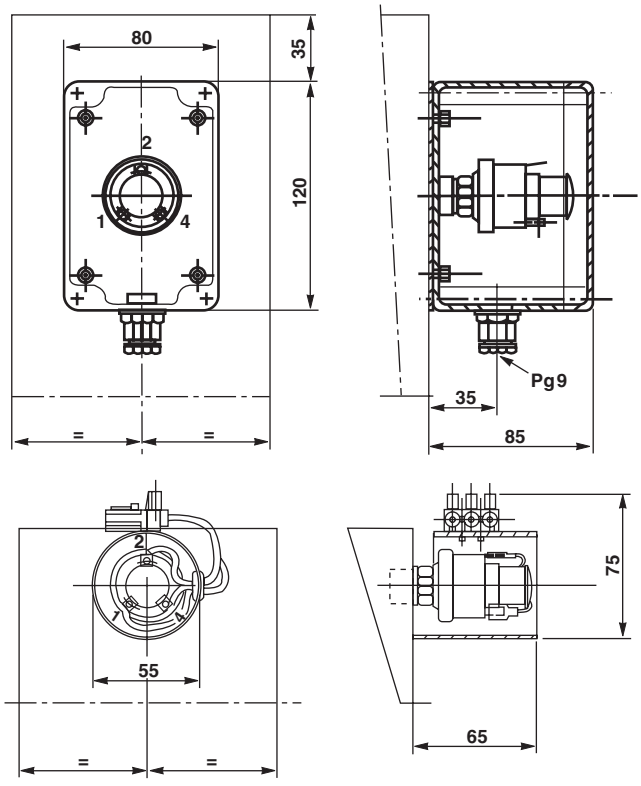
Important!
If the pressure monitoring device has operated, the capacitor must not be placed back into service, but returned together with the device to our factory for examination.

TECHNICAL DATA

Casing: Polycarbonat

Electrical connection:	AMP-plug type lugs 6.35 mm
Contacts:	1 change-over contact 15 A/250 VAC
Insulation test voltage:	1500 V
Setting range:	0.2 bar to 0.9 bar
Standard setting:	0.6 bar to 0.8 bar
Pressure limit:	6.0 bar
Accessory:	Rubber protective cap
Temperature range:	- 40 °C up to + 85 °C
Dimension:	See dimension
Fitting:	R 1/4" and mechanical protection
Mounting position:	Dependant on design of capacitor
Testing:	Functional test and leakage test

EXAMPLES OF MOUNTING



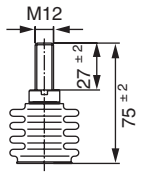
High Voltage Power Capacitors

BUSHINGS

Porcelain bushings for indoor and outdoor

TYPE	IMPULSE WITHSTAND BIL (kV)	MIN. CREEPAGE (mm)	INSTALLATION	HEIGHT (mm)	THREAD	MAX. TORQUE N/m
D-197	0	90	Indoor	75	M12	16
D-199	75	189	Indoor	159	M12	20
D-401	95	317	In/outdoor	240	M16	40
D-404	125	472	In/outdoor	270	M16	40
D-406	150	658	In/outdoor	290	M16	40
D-341	170	810	In/outdoor	415	M16	40

DRAWINGS OF BUSHINGS



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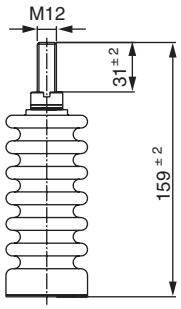

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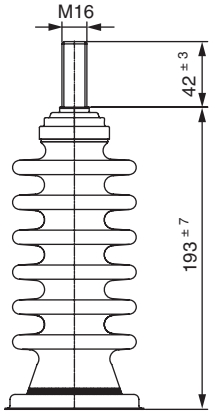

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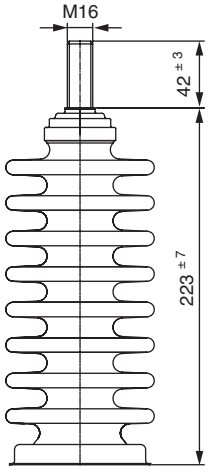

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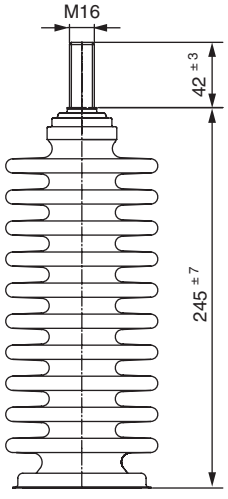

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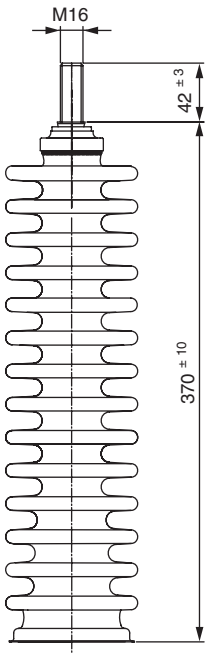

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High Voltage Power Capacitors

REQUEST FOR QUOTATION			
PRODUCT GROUP	**CAPACITOR UNIT**		
Request for quotation			
Reference for inquiry			
Quotation number			
TECHNICAL SPECIFICATION			
		REQUESTED	**OFFERED**
Rated voltage (1)	kV		
Frequency (1)	Hz		
Rated output (1)	kvar		
Connection	Single phase/three phase		
Number of bushings (1)	1/2/3		
Installation (1)	Indoor/outdoor		
Capacitance	µF		
Element fuse	Yes/no		
Discharge resistor	Yes/no		
Standard			
Temperature class	-...../+.....°C		
Insulation level	kV/kV_p		
Enclosure			
Protection	IP...		
Dimension L x W x H	(mm)		
Replacement	Yes/no		
If yes, what to replace			
Dimensions	L x W x H (mm)		
Pressure monitoring	Yes/no		
CONDITIONS			
Quantity			
Delivery	(Ex works/FOB/CIF...)		
Terms of payment			
Requested validity			
Requested delivery			

Note
(1) No quotation possible without this info

REQUEST FOR QUOTATION			
PRODUCT GROUP	**CAPACITOR BANK**		
Request for quotation			
Reference for inquiry			
Quotation number			
TECHNICAL SPECIFICATION			
		REQUESTED	**OFFERED**
Rated voltage (1)	kV		
Frequency (1)	Hz		
Rated output (1)	Mvar		
Installation (1)	Indoor/outdoor		
Connection (1)	Single phase, star, delta		
Capacitance	µF		
Unbalance protection	Yes/no		
Element fuse	Yes/no		
Discharge resistor	Yes/no		
Standard			
Temperature class	-...../+.....°C		
Insulation level	kV/kV_p		
Enclosure			
Protection	IP...		
Replacement	Yes/no		
If Yes, what to replace			
CONDITIONS			
Quantity			
Delivery	(Ex works/FOB/CIF...)		
Terms of payment			
Requested validity			
Requested delivery			

Note

(1) No quotation possible without this info

High Voltage Power Capacitors

FORM OF CONSTRUCTION

In the case of single phase capacitor units with dead casings, both polarities are led out through the casing in an insulated condition by means of porcelain bushings (fig. 1).

In the case of single phase capacitor units with one bushing only, the second polarity is connected to the casing (fig. 2).

Three-phase capacitors are provided with three bushings for connection to the phases and have dead casings with grounding connection point (fig. 3). They are connected either in star or in delta.

In cases where protection against an accidental touch is required, the capacitors can be supplied as IP55 version (fig. 4).

CAPACITOR - DIMENSION AND WEIGHT

• Three-phase capacitor up to 7.2 kV, 50 Hz, IP00

OUTPUT QN kvar	WEIGHT kg	CASING DIMENSIONS L x l x H
50	21	345 mm x 110 mm x 300 mm
75	21	345 mm x 110 mm x 300 mm
100	22	345 mm x 110 mm x 300 mm
133	24	345 mm x 110 mm x 350 mm
150	27	345 mm x 110 mm x 410 mm
167	29	345 mm x 110 mm x 430 mm
200	32	345 mm x 135 mm x 430 mm
250	37	345 mm x 135 mm x 500 mm
300	41	345 mm x 175 mm x 450 mm
350	47	345 mm x 175 mm x 520 mm
400	53	345 mm x 175 mm x 600 mm
450	56	345 mm x 175 mm x 640 mm
500	62	345 mm x 175 mm x 710 mm
550	67	345 mm x 175 mm x 770 mm
600	71	345 mm x 175 mm x 820 mm
650	78	345 mm x 175 mm x 910 mm
700	81	345 mm x 175 mm x 950 mm
750	101	345 mm x 270 mm x 810 mm
800	106	345 mm x 270 mm x 850 mm

• Three-phase capacitor up to 12 kV, 50 Hz, IP00

OUTPUT QN kvar	WEIGHT kg	CASING DIMENSIONS L x l x H
50	25	450 mm x 110 mm x 300 mm
75	25	450 mm x 110 mm x 300 mm
100	27	450 mm x 110 mm x 320 mm
133	30	450 mm x 110 mm x 400 mm
150	35	450 mm x 110 mm x 430 mm
167	37	450 mm x 110 mm x 470 mm
200	43	450 mm x 110 mm x 540 mm
250	49	450 mm x 110 mm x 620 mm
300	58	450 mm x 110 mm x 750 mm

• Three-phase capacitor up to 12 kV, 50 Hz, IP55

OUTPUT QN kvar	WEIGHT kg	CASING DIMENSIONS L x l x H
50	24	345 mm x 135 mm x 300 mm
75	24	345 mm x 135 mm x 300 mm
100	24	345 mm x 135 mm x 300 mm
133	29	345 mm x 135 mm x 330 mm
150	30	345 mm x 135 mm x 360 mm
167	29	345 mm x 135 mm x 380 mm
200	32	345 mm x 135 mm x 430 mm
250	37	345 mm x 175 mm x 400 mm
300	43	345 mm x 175 mm x 480 mm
350	48	345 mm x 175 mm x 540 mm
400	52	345 mm x 175 mm x 590 mm
450	57	345 mm x 175 mm x 650 mm
500	61	345 mm x 175 mm x 700 mm
550	69	345 mm x 175 mm x 810 mm
600	74	345 mm x 175 mm x 870 mm
650	78	345 mm x 175 mm x 920 mm
700	83	345 mm x 175 mm x 980 mm
750	105	345 mm x 270 mm x 840 mm
800	109	345 mm x 270 mm x 880 mm

• Single-phase capacitor up to 7.2 kV, 50 Hz

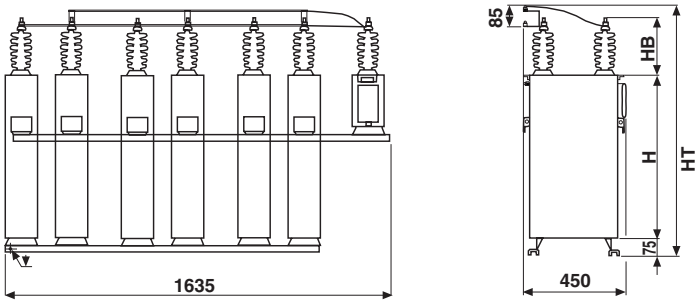
OUTPUT QN kvar	WEIGHT kg	CASING DIMENSIONS L x l x H
200	31	345 mm x 110 mm x 490 mm
300	41	345 mm x 175 mm x 450 mm
400	50	345 mm x 175 mm x 575 mm
500	60	345 mm x 175 mm x 698 mm
600	70	345 mm x 175 mm x 820 mm
700	80	345 mm x 175 mm x 950 mm
800	90	345 mm x 175 mm x 1090 mm
900	99	345 mm x 270 mm x 810 mm
1000	108	345 mm x 270 mm x 950 mm

• Single-phase capacitor up to 12 kV, 50 Hz

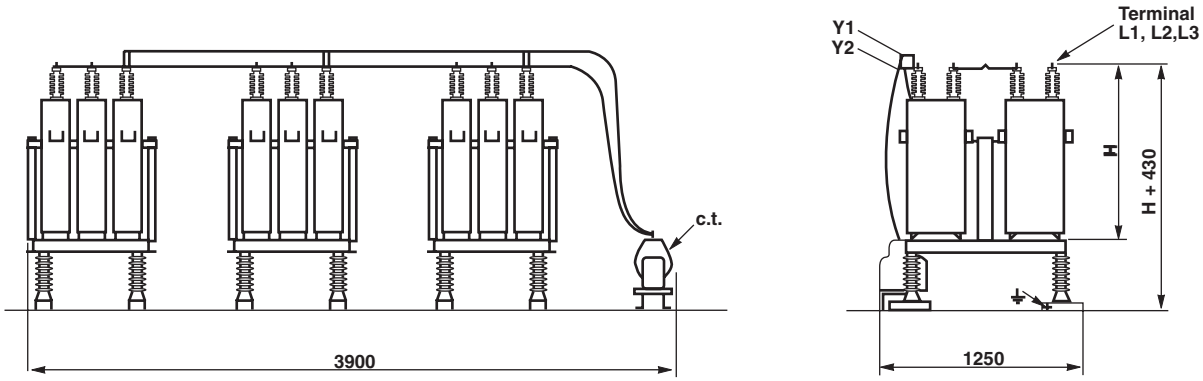
OUTPUT QN kvar	WEIGHT kg	CASING DIMENSIONS L x l x H
200	31	345 mm x 175 mm x 325 mm
300	40	345 mm x 175 mm x 450 mm
400	50	345 mm x 175 mm x 570 mm
500	60	345 mm x 175 mm x 705 mm
600	70	345 mm x 175 mm x 830 mm
700	80	345 mm x 175 mm x 950 mm
800	90	345 mm x 175 mm x 1090 mm
900	99	345 mm x 270 mm x 810 mm
1000	109	345 mm x 270 mm x 895 mm

High Voltage Power Capacitors

TYPICAL ARRANGEMENTS

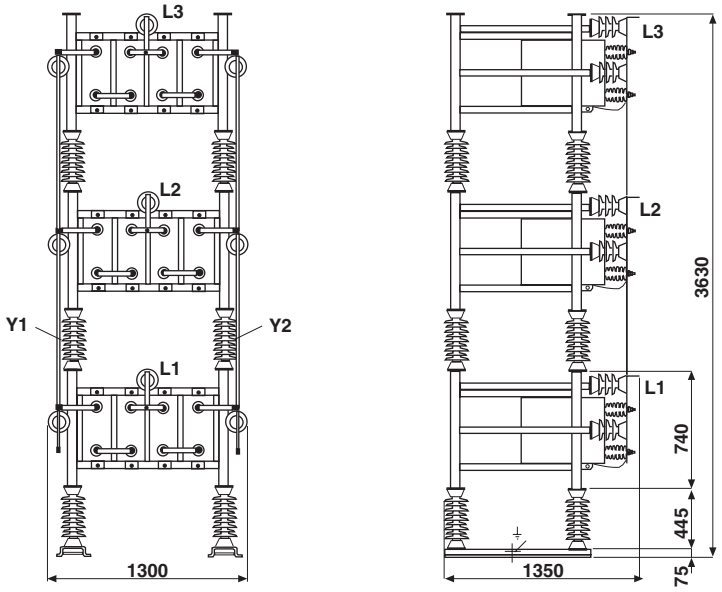


Type: G00S31
Maximum voltage: 24 kV
Installation: Indoor or outdoor
Connection: Double star with unbalance protection device
Protection level: IP00

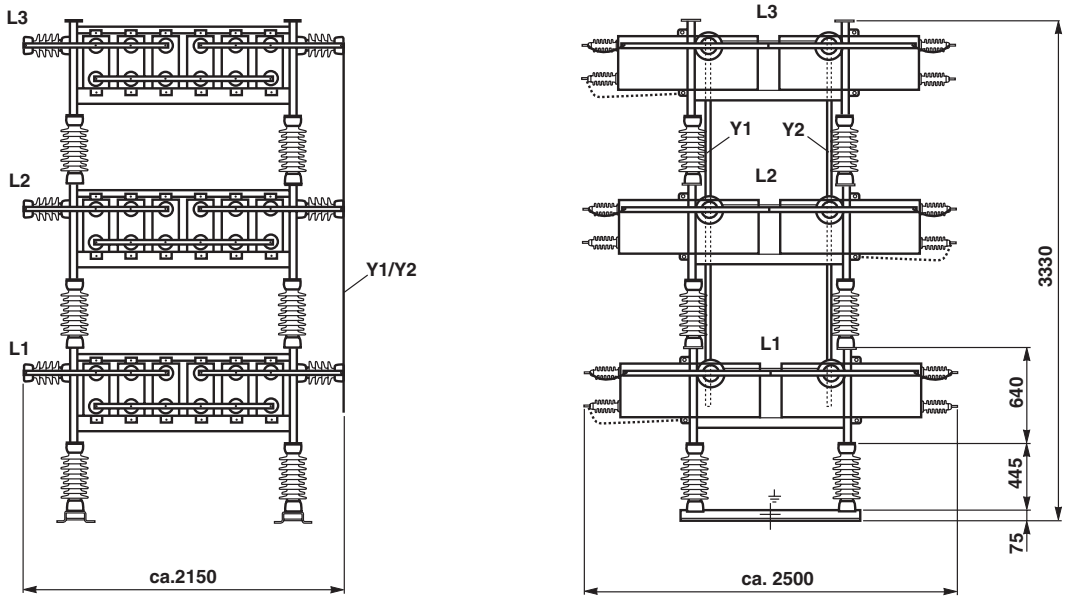


Type: G00S12
Voltage: > 24 kV
Installation: Indoor or outdoor
Connection: Double star with unbalance protection device
Protection level: IP00

TYPICAL ARRANGEMENTS

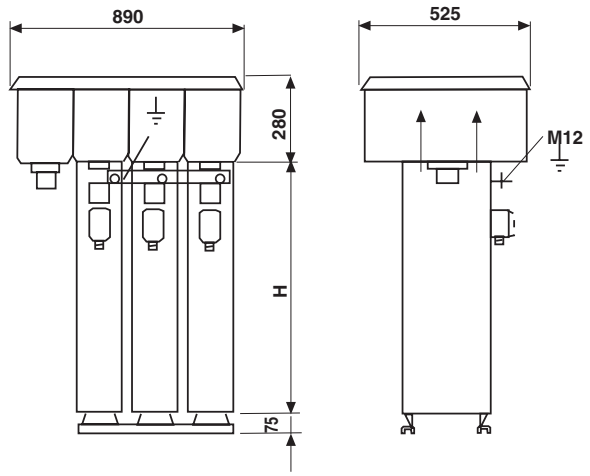


Type: G00L11
Voltage: > 24 kV
Installation: Indoor or outdoor
Connection: Double star
Protection level: IP00

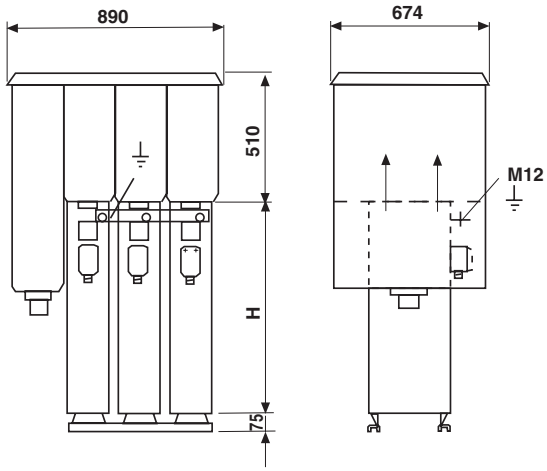


Type: G00L12
Voltage: > 24 kV
Installation: Indoor or outdoor
Connection: Double star
Protection level: IP00

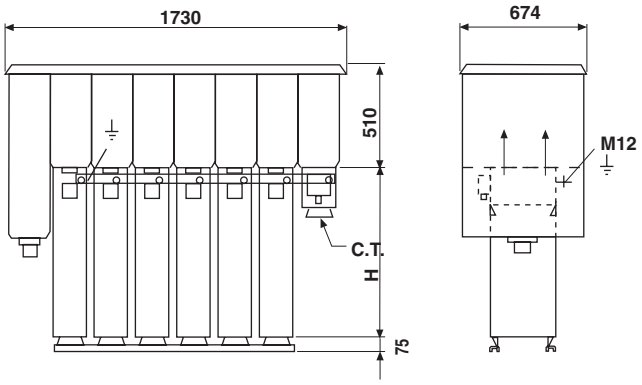
TYPICAL ARRANGEMENTS



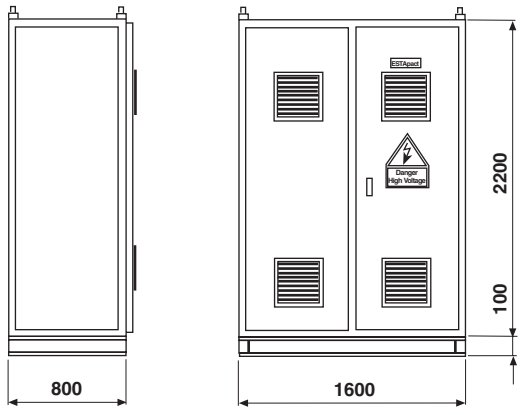
Type: H55S31-3/D/K1PG68
Maximum voltage: 7.2 kV
Installation: indoor or outdoor
Connection: star or delta with pressure monitoring device
Protection level: IP55



Type: H55S31-3/D/G1PG68
Maximum voltage: 12 kV
Installation: indoor or outdoor
Connection: star or delta with pressure monitoring device
Protection level: IP55



Type: H55S31-6/U/G1PG68
Maximum voltage: 12 kV
Installation: indoor or outdoor
Connection: double star with unbalance protection device
Protection level: IP55



Type: S43S31
Maximum voltage: 12 kV
Installation: indoor only
Protection level: IP43

MH Vishay Power Electronic Capacitors

SALES OFFICES

PRODUCTS

Low Voltage Capacitors
High Voltage Capacitors
Power Electronic Capacitors
Induction Heating Capacitors
Surge Suppressor Capacitors
Power Factor Controllers

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