HYDRA



PQC

Power Quality Components

Low Voltage Capacitors for Power Factor Correction

Three Phase Capacitors
Single Phase Capacitors

L General Information **Page**

i. Introduction 3

ii. Theoretical base 4-5

iii. Operation of power capacitors in

power supply systems with haromnics 6

iv. Switching of power capacitors 6

v. Protection of power capacitors 6

vi. Installation and operation 7

2. Three Phase Capacitors - Technical Parameter

i. Technical Specification 8

ii. Low Voltage Capacitors in cylindrical housing

1. Application 9

2. Construction 9

3. Terminals 9

4. Selfhealing properties 9

5. Safety 9

6. Discharging 9

3. Three Phase Capacitors - Product Table

i. HYDRA PRB DPM oil filled 10-11

ii. HYDRA PRB DPMg gas filled 12-13

iii. Drawings 14

4. Single Phase Capacitors

i. Technical Specification 15

ii. Product Table 16

Introduction

The rational use of electrical energy requires an economical generation, transmission and distribution with low losses. Therefore, all factors which cause such losses have to be minimised or to be eliminated in the power supply. One of these factors is the reduction of the inductive current by power factor compensation.
The loads in industrial and public power supply systems mainly have an ohm-inductive characteristic. Installations for power factor compensation supply capacitive power at defined network junction points to reduce the transmission of inductive loads from the network. Furthermore, inadmissible high voltage drops as well as additional I^2R losses will be avoided. The supply of capacitive power for compensation of inductive loads will be effected by capacitors to be connected in parallel to the power supply system very close to the load. Therefore, a static power factor cornpensation does reduce the reactive load to be transferred over the power supply system. In the case of changing conditions in the power supply system, additional capacitive power can be supplied by several capacitors to be switched on and off in different steps in order to match the reactive power demand. The planning of installations for power factor compensation depends on the following conditions:

- Value of the reactive power demand
- Reactive power demand over a certain period
- Target power factor cos φ to be reached after compensation
- Existence of audio frequency control signals
- Existing of harmonics in the power supply system
- Temperature and climatic conditions at the place of installation

Mode of compensation	Applications	Advantages	Disadvantages
Single compensation	Used for relatively large constant loads (e.g. motors) which are mostly in continuous operation	The capacitor is directly connected to the terminals of the load, no switches are required, cable losses and voltage drops are minimized	Several capacitors required as each load will be individually compensated
Group compensation	Compensation of a bigger number of individual loads to be switched on and off jointly	Compared to the single compensation less capacitors required, minimizing of the losses in the feeding cable	The cables to the individual loads still have to carry the reactive load
Centralized compensation	Compensation of complete installations at a central point	Control either by hand or automatically, automatic control allows to match the capacitor rating closely with the required reative power	Feeding and distribution cables between compensation and points of consumption still have to carry the reactive load

Theoretical base

The power P drawn from the electrical mains is equal to the product of the voltage U, the current I and the phase displacement angle φ

$P = U \times I \times \cos \varphi$

Pure active power results when current and voltage are in phase in case of AC-supply (Fig 1) .This applies to ohmic loads like incandescent lamps and electric heating elements. This power is called active power.

Motors and transformers, for example, need magnetic fields for their operation and since the energy, consumed in generating the magnetic fields, cannot be converted to active power, it is called reactive power Q.

The inductive impedance of the coils implies a displacement between the zero crossing of the current and the zero crossing of the voltage (Fig. 2) by the phase angle φ. Since the zero crossing of the voltage, the current is lagging.

Because of the need to provide this reactive current to generate the magnetic fields, the electrical equipment (cables, transformers and generators) have also to be designed to carry this additional current, i.e. for the geometrical sum of the active and reactive currents (Fig. 3).

It is desirable to keep this reactive component as small as possible but, since such reactive power is needed by the connected equipment, an effort must be made to supply it from a source other than the mains. Capacitors have a leading reactive current (Fig. 4).

The power factor cos φ is the relationship between effective power P and apparent power S:

$\cos \varphi = P/S$

The reactive power that has to be compensated (see also Fig. 3) is obtained from the equation:

$Q = \sqrt{S^2 - P^2}$

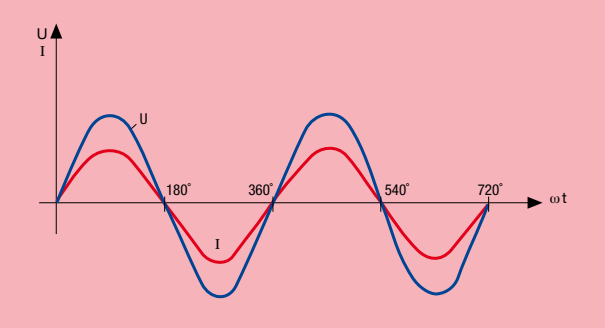


Fig. 1: Ohmic load

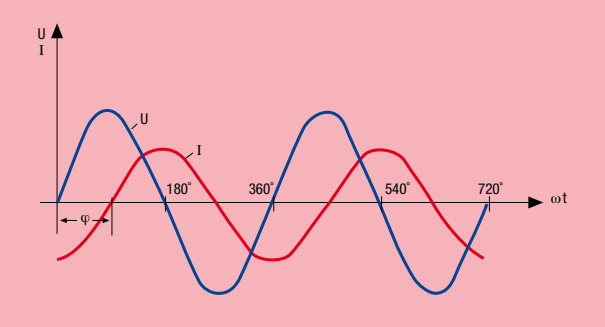


Fig. 2: Inductive load

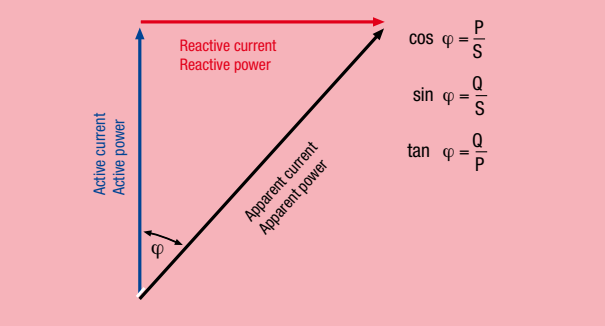


Fig. 3: Sum of active and reactive component

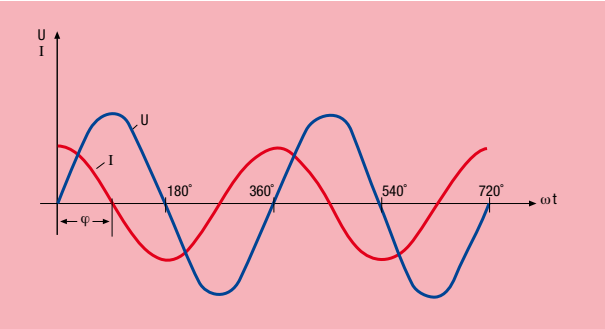


Fig. 4: Capacitive load

Theoretical base

A capacitor having the same power Q_c would provide complete compensation and increase the power factor cos φ to 1. But such complete compensation is not desirable in practice, because a change in load could result in over-compensation. Usually the power supply utilities specify the power factor to which compensation should be provided. The necessary output of the capacitor is then obtained from:

$Q_c = P (\tan \varphi_1 - \tan \varphi_2)$

A load with an active power of P = 167 kW should have its power factor improved from cos $\varphi_1 = 0.64$ to cos $\varphi_2 = 0.9$. From this one obtains:
cos $\varphi_1 = 0.64$ tan $\varphi_1 = 1.20$
cos $\varphi_2 = 0.9$ tan $\varphi_2 = 0.48$
The required output of the capacitor is:
$Q_c = 167$ kW x (1.20 - 0.48) = 120 kvar
P_W = average active power
P_B = average reactive power
$Q_c = K \times P_W$

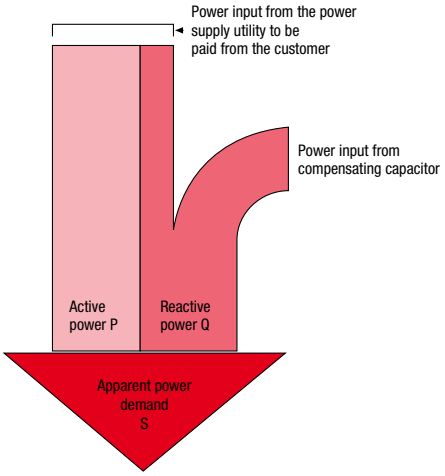


Fig. 5: Power balance

Available Data		Desired cos φ_2												
P_B/P_W	cos φ	0,7	0,75	0,8	0,82	0,84	0,86	0,88	0,9	0,92	0,94	0,96	0,98	1,0
4,90	0,20	3,88	4,02	4,15	4,20	4,26	4,31	4,36	4,42	4,48	4,54	4,61	4,70	4,90
3,88	0,25	2,86	2,99	3,13	3,18	3,23	3,28	3,33	3,39	3,45	3,51	3,58	3,67	3,88
3,18	0,30	2,16	2,30	2,42	2,48	2,53	2,59	2,65	2,70	2,76	2,82	2,89	2,98	3,18
2,68	0,35	1,66	1,80	1,93	1,98	2,03	2,08	2,14	2,19	2,25	2,31	2,38	2,47	2,68
2,29	0,40	1,27	1,41	1,54	1,60	1,65	1,70	1,76	1,81	1,87	1,93	2,00	2,09	2,29
1,98	0,45	0,97	1,11	1,24	1,29	1,34	1,40	1,45	1,50	1,56	1,62	1,69	1,78	1,99
1,73	0,50	0,71	0,85	0,98	1,04	1,09	1,14	1,20	1,25	1,31	1,37	1,44	1,53	1,73
1,64	0,52	0,62	0,76	0,89	0,95	1,00	1,05	1,11	1,16	1,22	1,28	1,35	1,44	1,64
1,56	0,54	0,54	0,68	0,81	0,86	0,92	0,97	1,02	1,08	1,14	1,20	1,27	1,36	1,56
1,48	0,56	0,46	0,60	1,73	0,78	0,84	0,89	0,94	1,00	1,05	1,12	1,19	1,28	1,48
1,41	0,58	0,39	0,52	0,66	0,71	0,76	0,81	0,87	0,92	0,98	1,04	1,11	1,20	1,41
1,33	0,60	0,31	0,45	0,58	0,64	0,69	0,74	0,80	0,85	0,91	0,97	1,04	1,13	1,33
1,27	0,62	0,25	0,39	0,52	0,57	0,62	0,67	0,73	0,78	0,84	0,90	0,97	1,06	1,27
1,20	0,64	0,18	0,32	0,45	0,51	0,56	0,61	0,67	0,72	0,78	0,84	0,92	1,00	1,20
1,14	0,66	0,12	0,26	0,39	0,45	0,49	0,55	0,60	0,66	0,71	0,78	0,85	0,94	1,14
1,08	0,68	0,06	0,20	0,33	0,38	0,43	0,49	0,54	0,60	0,65	0,72	0,79	0,88	1,08
1,02	0,70		0,14	0,27	0,33	0,38	0,43	0,49	0,54	0,60	0,66	0,73	0,82	1,02
0,96	0,72		0,08	0,22	0,27	0,32	0,37	0,43	0,48	0,54	0,60	0,67	0,76	0,97
0,91	0,74		0,03	0,16	0,21	0,26	0,32	0,37	0,43	0,48	0,55	0,62	0,71	0,91
0,86	0,76			0,11	0,15	0,21	0,26	0,32	0,37	0,43	0,50	0,56	0,65	0,86
0,80	0,78			0,05	0,11	0,16	0,21	0,27	0,32	0,38	0,44	0,51	0,60	0,80
0,75	0,80				0,05	0,10	0,16	0,21	0,27	0,33	0,39	0,46	0,55	0,75
0,70	0,82					0,05	0,10	0,16	0,22	0,27	0,33	0,40	0,49	0,70
0,65	0,84						0,05	0,11	0,16	0,22	0,28	0,35	0,44	0,65
0,59	0,86							0,06	0,11	0,17	0,23	0,30	0,39	0,59
0,54	0,88								0,06	0,11	0,17	0,25	0,33	0,54
0,48	0,90									0,06	0,12	0,19	0,28	0,48
0,43	0,92										0,06	0,13	0,22	0,43
0,36	0,94	Factor k										0,07	0,16	0,36

Compensation

Operation of power capacitors in power supply systems with harmonics

Harmonics result from the operation of electrical loads, which have non-linear voltage-current characteristics.

They are caused by DC or AC converters for electrical drives as well as by welding machines and stand-by power supplies. Harmonics are sinusoidal voltages and currents with frequencies that are multiples of a 50 Hz or 60 Hz power supply frequency. In low voltage three-phase power supply systems the 5. and 7. harmonics must be given particular consideration.

In power supply systems with harmonics, only power capacitors with reactors should be used for the power factor compensation. Power capacitors with reactors are a series connection of a capacitance and an inductance that has the smallest resistance at its series resonant point (approximately zero when neglecting the active resistance).

The series resonance circuit will be tuned to a series resonance frequency below the major existing harmonics.

For all frequencies including the frequencies of the harmonics, the series resonance circuit has an inductive characteristic above the series resonance frequency. This prevents a resonance with the inductance of the power supply system.

Depending on the chosen series resonance frequency, a part of the harmonic current will be absorbed by the power capacitors. The rest of the harmonic currents will flow into the power supply system.

The use of power capacitors with reactors reduces the voltage distortion by harmonics and minimises the disturbing effects on the proper operation of other electrical loads.

Switching of power Capacitors

When switching a capacitor to an AC power supply system there will be a more or less damped resonant circuit with the inductance of the system. Besides the rated current I_N of the capacitor a balancing current I_E will also flow which will decay exponentially. The balancing current can be a multiple of the rated current of the capacitor.

Fast switching, chatter-proof contactors should be used as switching devices. The breaking capacity of the capacitive current to be named by the manufacturer must be considered while selecting the switching devices.

It is recommended to select the connection power cables for about 1,5 x I_N by taking into account of the cyclic duration factor as well as of the conversion factor for laying method and grouping at ambient temperatures above +30°C.

Protection of power capacitors

The short-circuit protection of power capacitors will be achieved either by fuses or magnetic short-circuit tripping devices. For protection by fuse, the use of slow-acting HRC-fuses are preferable. Their rated current should be between 1,6 up to 1,8 times that of the rated current of the power capacitor. When using magnetic short-circuit tripping devices instead of HCR-fuses the setting should be at 9 up to 12 times of the power capacitor rated current in order to prevent a response in the case of high inrush currents.

Compensation

Installation and operation

For installation and operation of power capacitors, installation and operating instructions such as VDE 0100, VDE 0105, VDE 0560 part 46 as well as EN 60831 and IEC 831 must be taken into account. Power capacitors must be installed in a cool and well ventilated room, and should not be installed within the range of heat radiating objects. Normally, the natural heat release of the power capacitors is sufficient for cooling provided that provision is made for free entry and exit of the cooling air and a minimum distance of 50 mm between the power capacitors is observed. In the case of an installation within an insufficiently cooled area, a forced ventilation is necessary. The forced ventilation must take place, however, within the range of allowable cooling air temperatures.

Approximate values for capacitor rating for power compensation of single motors

Motor rating (kW)	Capacitor rating (kvar)
4 - 4,9	2
5 - 7,9	3
8 - 10,9	4
11 - 13,9	5
14 - 11,9	6
18 - 21,9	7,5
22 - 29,9	10
30 and above	appr. 35% of motor rating

Recommendation for fusing and cross-sections of cables

Rated Power	230 V			400 V			525 V		
	Rated current	Fuse	Wire cross-section	Rated current	Fuse	Wire cross-section	Rated current	Fuse	Wire cross-section
kvar	A	A	mm² Cu	A	A	mm² Cu	A	A	mm² Cu
2	5,0	10	1,5	2,8	10	1,5			
2,5	6,2	16	2,5	3,6	10	1,5	2,7	10	1,5
3	7,5	16	2,5	4,3	10	1,5	3,3	10	1,5
4	10,0	20	2,5	5,7	10	1,5	4,4	10	1,5
5	12,5	25	4	7,2	16	2,5	5,5	10	1,5
6	15,0	35	6	8,6	16	2,5	6,6	16	2,5
7,5	18,8	35	6	10,8	20	2,5	8,3	16	2,5
10	25,1	50	10	14,4	25	4	11,0	20	2,5
12,5	31,4	63	16	18,0	35	6	13,7	25	4
15	37,6	80	25	21,6	50	10	16,5	35	6
16,7				24,1	50	10	18,4	35	6
20	50,2	100	35	28,8	50	10	22,0	50	10
25	62,8	125	50	36,0	63	16	27,4	50	10
30	75,4	125	50	43,2	80	25	33,0	63	16
35	87,9	160	70	50,5	100	35	38,5	80	25
40	100,5	160	70	57,6	100	35	44,0	80	25

Technical Specification

Rated voltage
230 – 690V

Rated frequency
50/60 Hz

Capacitance tolerance
-5%, +10%

Over voltages
U_{cn} + 10% up to 8h daily
U_{cn} + 15% up to 30 min. daily
U_{cn} + 20% up to 5 minutes, 200 times in life of the capacitor
U_{cn} + 30% up to 1 minute, 200 times in life of the capacitor

Over current
1,5 x In (including harmonics)

Inrush current
Max. 200 x In

Test voltage terminal/terminal
2,15 x Un AC (2 seconds)

Test voltage terminal/case
3,6 kV AC (10 seconds)

Dielectric
Polypropylene film, self-healing

Impregnation (filling)
DPMg: inert insulation gas (N2)
DPM: vegetable oil

Losses
Dielectric: 0,2W/kvar
Total capacitor (50 Hz): < 0,5W/kvar

Life expectancy
>115.000 h
5000 switchings per year

Climatic category
-25/D
Max. ambient temp.: 55°C
Max. ambient temp. over 24h: 45°C
Max. ambient temp. over 1 year: 35°C
Lowest temperature: -25°C
Max. case temperature: 65°C

Humidity
Average relative <95%

Altitude
2000m

Cooling
Natural or forced

Mounting position
DPMg: Any mounting position possible
DPM: vertical position

Installation
Indoor

Case
Cylindrical, aluminium

Fixing
Threaded bolt M12
Max torque (Al can stud) : 10 Nm

Terminals
Degree of protection: IP20
Terminals cross section: 25mm²
Max. torque: 3 Nm

Discharge resistor time:
<3 minutes to 75V

Safety device
Overpressure disconnector

Standards
IEC 60381-1/2
EN 60381-1/2
UL 810 second half 2010 expected

Low-voltage capacitors in cylindrical casing

Application
HYDRA PRB DPM(g) three-phase capacitors are designed for power factor correction (PFC) in low voltage networks. They may be used for:
- individual fixed PFC of motors, transformers, etc.
- automatic PFC equipment
- tuned and detuned capacitor banks

Construction
The HYDRA PRB DPM(g) capacitors have three separate windings from metalized polypropylene film placed in a cylindrical aluminium can. The partial capacitances may be connected either in star or delta configuration. The use of three separate stacked windings guarantees low losses, optimal surge current performance and good heat drain from the windings. A high-vacuum drying of the windings gives long service life with constant capacitance.

HYDRA capacitors are filled with a PCB-free natural oil (PRB DPM) or with nitrogen gas (PRB DPMg).

Terminals
The terminal is designed as a double 3-pole terminal block (IP 20). It is possible to clamp multiple-wires with a cross section up to 25mm²

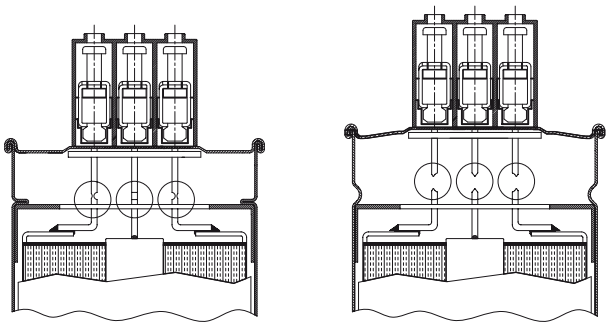
Self-healing
Due to switching operations, inadmissible voltage peaks of up to 3 times that of the rated voltage can occur in low voltage networks. If these stresses affect a dielectric breakdown, the self-healing mechanism will function. After self-healing, the capacitor continues its complete operation. The decrease in capacitance is negligible.

Safety
HYDRA PRB DPM(g) capacitors are equipped with an overpressure expansion fuse. The fuse operates when the internal pressure rise affected by repeated self-healings on faulty spots or any other internal failure has reached a determined value. In this case the lid of the aluminium can bulge out and the capacitor expands in the axial direction. Due to this expansion the planned fracture in the internal connecting wires break and the power capacitor is disconnected safely from power supply system.

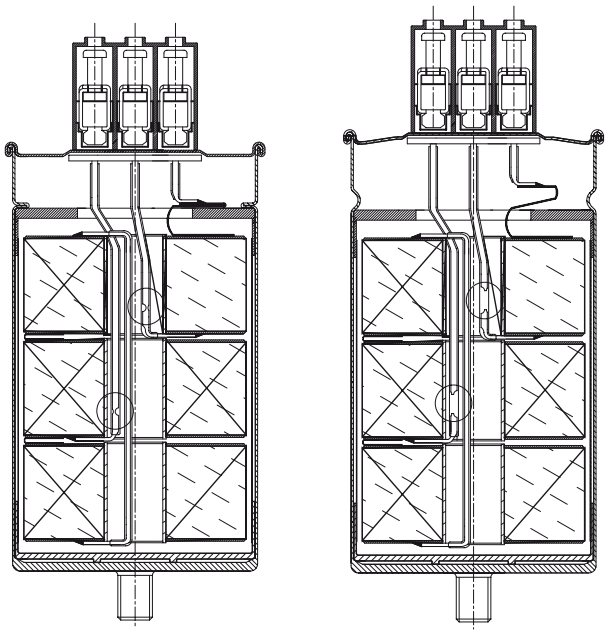
Discharging
Power capacitors must be discharged in 3 minutes to 75V or less. No switch, fuse or any other isolating device should be between the power capacitor and the discharge device. Power capacitors which are directly connected to other electrical equipment providing a discharge path can be considered as properly discharged, provided that the circuit characteristics ensure the discharge of the power capacitor within the time specified above. HYDRA PRB DPM(g) capacitors will be delivered with discharge resistors.

Overpressure disconnector (tear-off fuse)

Diameter 85 mm



Diameter 116 mm



Product Table HYDRA PRB DPM

Oil filled

Rated power (kvar)		Rated capacitance	Rated current (A)		Weight	Dimension	Fig.	Order code
50 Hz	60Hz	(µF+10/-5%)	50Hz	60Hz	(kg)	DxH (mm)		
Rated voltage 230V								
5	6	3 x 104	13	15,6	1,1	85 x 170		PRB DPM 5/230 D
6,25	7,5	3 x 125	15,7	18,8	1,2	85 x 200		PRB DPM 6,25/230 D
8,33	10	3 x 167	21	25,2	1,3	85 x 230		PRB DPM 8,33/230 D
8,33	10	3 x 167	21	25,2	2,1	116 x 175		PRB DPM 8,33/230 D
10,5	12,5	3 x 209	26	31,2	2,3	116 x 205		PRB DPM 10/230 D
12,5	15	3 x 251	31,4	37,7	2,3	116 x 205		PRB DPM 12,5/230 D
15	18	3 x 302	37,7	--	2,6	116 x 235		PRB DPM 15/230 D
Rated voltage 400V								
5	6	3 x 34	7,4	8,9	1,1	85 x 170		PRB DPM 5/400 D
6,25	7,5	3 x 41,5	9	10,8	1,1	85 x 170		PRB DPM 6,25/400 D
7	8,4	3 x 46	10,1	12,1	1,1	85 x 170		PRB DPM 7/400 D
8,33	10	3 x 55	12	14,4	1,1	85 x 170		PRB DPM 8,33/400 D
10,4	12,5	3 x 69	15	18,0	1,2	85 x 200		PRB DPM 10/400 D
12,5	15	3 x 83	18	21,6	1,3	85 x 230		PRB DPM 12,5/400 D
12,5	15	3 x 83	18	21,6	2,1	116 x 175		PRB DPM 12,5/400 D
15	18	3 x 99,5	21,7	26,0	1,3	85 x 230		PRB DPM 15/400 D
15	18	3 x 99,5	21,7	26,0	2,1	116 x 175		PRB DPM 15/400 D
16,7	20	3 x 111	24,1	28,9	2,3	116 x 205		PRB DPM 16,7/400 D
20	24	3 x 137	29,8	35,8	2,6	116 x 235		PRB DPM 20/400 D
25	30	3 x 166	36,1	43,3	2,6	116 x 235		PRB DPM 25/400 D
30	--	3 x 199	43	--	3	116 x 280		PRB DPM 30/400 D
Rated voltage 440V								
5	6	3 x 27,5	6,6	7,9	1,1	85 x 170		PRB DPM 5/440 D
6,25	7,5	3 x 34	8,2	9,8	1,1	85 x 170		PRB DPM 6,25/440 D
7,5	9	3 x 41,5	9,8	11,8	1,1	85 x 170		PRB DPM 7,5/440 D
8,33	10	3 x 46	10,9	13,1	1,1	85 x 170		PRB DPM 8,33/440 D
10	12	3 x 55	13,1	15,7	1,1	85 x 170		PRB DPM 10/440 D
12,5	15	3 x 69	16,4	19,7	1,2	85 x 200		PRB DPM 12,5/440 D
15	18	3 x 83	18	21,6	1,3	85 x 230		PRB DPM 15/440 D
15	18	3 x 83	18	21,6	2,1	116 x 175		PRB DPM 15/440 D
16,7	20	3 x 91,5	21,9	26,3	1,3	85 x 230		PRB DPM 16,7/440 D
16,7	20	3 x 91,5	21,9	26,3	2,1	116 x 175		PRB DPM 16,7/440 D
20	24	3 x 111	26,5	31,8	2,3	116 x 205		PRB DPM 20/440 D
25	30	3 x 137	32,8	39,4	2,6	116 x 235		PRB DPM 25/440 D
28	--	3 x 155	37	--	2,6	116 x 235		PRB DPM 28/440 D
30	--	3 x 166	39,8	--	2,6	116 x 235		PRB DPM 30/440 D
Rated voltage 480V								
5	6	3 x 23	6	7,2	1,1	85 x 170		PRB DPM 5/480 D
6,25	7,5	3 x 29	7,5	9,0	1,1	85 x 170		PRB DPM 6,25/480 D
7,5	9	3 x 35	9	10,8	1,1	85 x 170		PRB DPM 7,5/480 D
8,33	10	3 x 38	10	12,0	1,1	85 x 170		PRB DPM 8,33/480 D
10	12	3 x 46	12	14,4	1,2	85 x 200		PRB DPM 10/480 D
12,5	15	3 x 58	15	18,0	1,2	85 x 200		PRB DPM 12,5/480 D
15	18	3 x 69	18	21,6	1,3	85 x 230		PRB DPM 15/480 D
15	18	3 x 69	18	21,6	2,1	116 x 175		PRB DPM 15/480 D
20	24	3 x 91	24	28,8	2,3	116 x 205		PRB DPM 20/480 D
25	30	3 x 115	30	36,0	2,6	116 x 235		PRB DPM 25/480 D
28	33,6	3 x 129	34	40,8	3	116 x 280		PRB DPM 28/480 D
30	--	3 x 138	36	--	3	116 x 280		PRB DPM 30/480 D

Product Table HYDRA PRB DPM

Oil filled

Rated power (kvar)		Rated capacitance	Rated current (A)		Weight	Dimension	Fig.	Order code
50 Hz	60Hz	(µF+10/-5%)	50Hz	60Hz	(kg)	DxH (mm)		
Rated voltage 525V								
5	6	3 x 19	5,5	6,6	1,1	85 x 170		PRB DPM 5/525 D
6,25	7,5	3 x 24	6,9	8,3	1,1	85 x 170		PRB DPM 6,25/525 D
7,5	9	3 x 29	8,2	9,8	1,1	85 x 170		PRB DPM 7,5/525 D
8,33	10	3 x 32	9,2	11,0	1,1	85 x 170		PRB DPM 8,33/525 D
10	12	3 x 38	11	13,2	1,2	85 x 200		PRB DPM 10/525 D
12,5	15	3 x 48	13,7	16,4	1,3	85 x 230		PRB DPM 12,5/525 D
12,5	15	3 x 48	13,7	16,4	1,3	116 x 175		PRB DPM 12,5/525 D
15	18	3 x 58	16,5	19,8	1,3	85 x 230		PRB DPM 15/525 D
15	18	3 x 58	16,5	19,8	2,1	116 x 175		PRB DPM 15/525 D
18	21,6	3 x 69,7	20	24,0	2,3	116 x 205		PRB DPM 18/525 D
20	24	3 x 77	22	26,4	2,3	116 x 205		PRB DPM 20/525 D
25	30	3 x 97	27,5	33,0	2,6	116 x 235		PRB DPM 25/525 D
30	36	3 x 115	33	39,6	3	116 x 280		PRB DPM 30/525 D
Rated voltage 690V								
5	6	3 x 34	4,2	5,0	1,1	85 x 170		PRB DPM 5/690 Y
6,25	7,5	3 x 41,5	5,2	6,2	1,1	85 x 170		PRB DPM 6,25/690 Y
7	8,4	3 x 46	5,75	6,9	1,1	85 x 170		PRB DPM 7/690 Y
7,5	9	3 x 49	6,3	7,6	1,1	85 x 170		PRB DPM 7,5/690 Y
8,33	10	3 x 55	7	8,4	1,1	85 x 170		PRB DPM 8,33/690 Y
10,3	12,5	3 x 69	8,6	10,3	1,2	85 x 200		PRB DPM 10/690 Y
12,5	15	3 x 83	10,4	12,5	1,3	85 x 230		PRB DPM 12,5/690 Y
12,5	15	3 x 83	10,4	12,5	2,1	116 x 175		PRB DPM 12,5/690 Y
15	18	3 x 99,5	12,4	14,9	1,3	85 x 230		PRB DPM 15/690 Y
15	18	3 x 99,5	12,4	14,9	2,1	116 x 175		PRB DPM 15/690 Y
16,7	20	3 x 111	13,9	16,7	2,3	116 x 205		PRB DPM 16,7/690 Y
20	24	3 x 137	17,1	20,5	2,6	116 x 235		PRB DPM 20/690 Y
25	30	3 x 166	20,7	24,8	2,6	116 x 235		PRB DPM 25/690 Y
30	36	3 x 199	25	30,0	3	116 x 280		PRB DPM 30/690 Y

Product Table HYDRA PRB DPMG

Gas filled

Rated power (kvar)		Rated capacitance	Rated current (A)		Weight	Dimension	Fig.	Order code
50 Hz	60Hz	(µF+10/-5%)	50Hz	60Hz	(kg)	DxH (mm)		
Rated voltage 230V								
5	6	3 x 104	13	15,6	1	85 x 170		PRB DPMg 5/230 D
6,25	7,5	3 x 125	15,7	18,8	1,1	85 x 200		PRB DPMg 6,25/230 D
8,33	10	3 x 167	21	25,2	1,2	85 x 230		PRB DPMg 8,33/230 D
8,33	10	3 x 167	21	25,2	1,5	116 x 175		PRB DPMg 8,33/230 D
10,5	12,5	3 x 209	26	31,2	1,7	116 x 205		PRB DPMg 10/230 D
12,5	15	3 x 251	31,4	37,7	1,7	116 x 205		PRB DPMg 12,5/230 D
15	18	3 x 302	37,7	--	2	116 x 235		PRB DPMg 15/230 D
Rated voltage 400V								
5	6	3 x 34	7,4	8,9	1	85 x 170		PRB DPMg 5/400 D
6,25	7,5	3 x 41,5	9	10,8	1	85 x 170		PRB DPMg 6,25/400 D
7	8,4	3 x 46	10,1	12,1	1	85 x 170		PRB DPMg 7/400 D
8,33	10	3 x 55	12	14,4	1	85 x 170		PRB DPMg 8,33/400 D
10,4	12,5	3 x 69	15	18,0	1,1	85 x 200		PRB DPMg 10/400 D
12,5	15	3 x 83	18	21,6	1,2	85 x 230		PRB DPMg 12,5/400 D
12,5	15	3 x 83	18	21,6	1,5	116 x 175		PRB DPMg 12,5/400 D
15	18	3 x 99,5	21,7	26,0	1,2	85 x 230		PRB DPMg 15/400 D
15	18	3 x 99,5	21,7	26,0	1,5	116 x 175		PRB DPMg 15/400 D
16,7	20	3 x 111	24,1	28,9	1,7	116 x 205		PRB DPMg 16,7/400 D
20	24	3 x 137	29,8	35,8	2	116 x 235		PRB DPMg 20/400 D
25	30	3 x 166	36,1	43,3	2	116 x 235		PRB DPMg 25/400 D
30	--	3 x 199	43	--	2,4	116 x 280		PRB DPMg 30/400 D
Rated voltage 440V								
5	6	3 x 27,5	6,6	7,9	1	85 x 170		PRB DPMg 5/440 D
6,25	7,5	3 x 34	8,2	9,8	1	85 x 170		PRB DPMg 6,25/440 D
7,5	9	3 x 41,5	9,8	11,8	1	85 x 170		PRB DPMg 7,5/440 D
8,33	10	3 x 46	10,9	13,1	1	85 x 170		PRB DPMg 8,33/440 D
10	12	3 x 55	13,1	15,7	1	85 x 170		PRB DPMg 10/440 D
12,5	15	3 x 69	16,4	19,7	1,1	85 x 200		PRB DPMg 12,5/440 D
15	18	3 x 83	18	21,6	1,2	85 x 230		PRB DPMg 15/440 D
15	18	3 x 83	18	21,6	1,5	116 x 175		PRB DPMg 15/440 D
16,7	20	3 x 91,5	21,9	26,3	1,2	85 x 230		PRB DPMg 16,7/440 D
16,7	20	3 x 91,5	21,9	26,3	1,5	116 x 175		PRB DPMg 16,7/440 D
20	24	3 x 111	26,5	31,8	1,7	116 x 205		PRB DPMg 20/440 D
25	30	3 x 137	32,8	39,4	2	116 x 235		PRB DPMg 25/440 D
28	--	3 x 155	37	--	2	116 x 235		PRB DPMg 28/440 D
30	--	3 x 166	39,8	--	2	116 x 235		PRB DPMg 30/440 D
Rated voltage 480V								
5	6	3 x 23	6	7,2	1	85 x 170		PRB DPMg 5/480 D
6,25	7,5	3 x 29	7,5	9,0	1	85 x 170		PRB DPMg 6,25/480 D
7,5	9	3 x 35	9	10,8	1	85 x 170		PRB DPMg 7,5/480 D
8,33	10	3 x 38	10	12,0	1	85 x 170		PRB DPMg 8,33/480 D
10	12	3 x 46	12	14,4	1,1	85 x 200		PRB DPMg 10/480 D
12,5	15	3 x 58	15	18,0	1,1	85 x 200		PRB DPMg 12,5/480 D
15	18	3 x 69	18	21,6	1,2	85 x 230		PRB DPMg 15/480 D
15	18	3 x 69	18	21,6	1,5	116 x 175		PRB DPMg 15/480 D
20	24	3 x 91	24	28,8	1,7	116 x 205		PRB DPMg 20/480 D
25	30	3 x 115	30	36,0	2	116 x 235		PRB DPMg 25/480 D
28	33,6	3 x 129	34	40,8	2,4	116 x 280		PRB DPMg 28/480 D
30	--	3 x 138	36	--	2,4	116 x 280		PRB DPMg 30/480 D

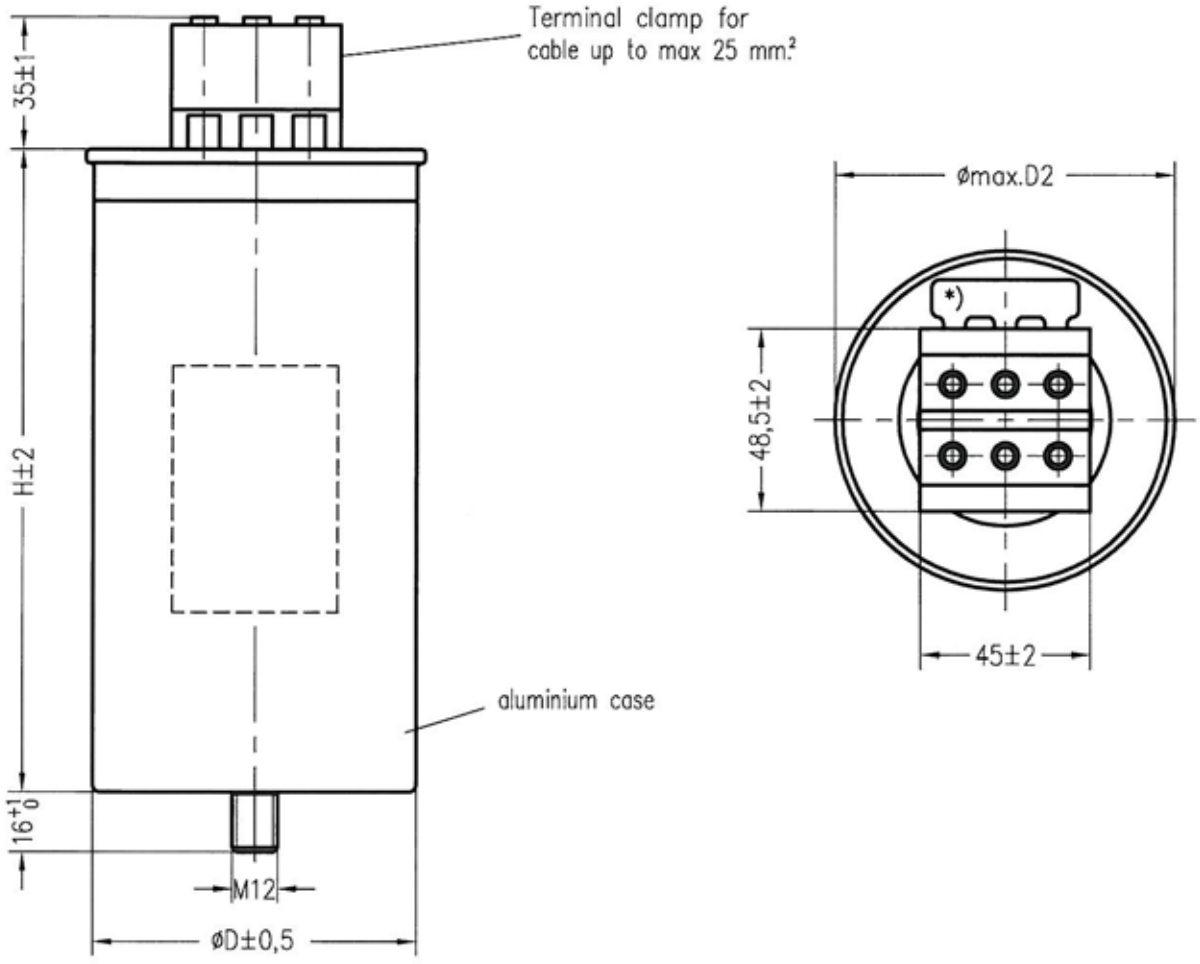
Product Table HYDRA PRB DPMG

Gas filled

Rated power (kvar)		Rated capacitance	Rated current (A)		Weight	Dimension	Fig.	Order code
50 Hz	60Hz	(µF+10/-5%)	50Hz	60Hz	(kg)	DxH (mm)		
Rated voltage 525V								
5	6	3 x 19	5,5	6,6	1	85 x 170		PRB DPMg 5/525 D
6,25	7,5	3 x 24	6,9	8,3	1	85 x 170		PRB DPMg 6,25/525 D
7,5	9	3 x 29	8,2	9,8	1	85 x 170		PRB DPMg 7,5/525 D
8,33	10	3 x 32	9,2	11,0	1	85 x 170		PRB DPMg 8,33/525 D
10	12	3 x 38	11	13,2	1,1	85 x 200		PRB DPMg 10/525 D
12,5	15	3 x 48	13,7	16,4	1,2	85 x 230		PRB DPMg 12,5/525 D
12,5	15	3 x 48	13,7	16,4	1,2	116 x 175		PRB DPMg 12,5/525 D
15	18	3 x 58	16,5	19,8	1,2	85 x 230		PRB DPMg 15/525 D
15	18	3 x 58	16,5	19,8	1,5	116 x 175		PRB DPMg 15/525 D
18	21,6	3 x 69,7	20	24,0	2,3	116 x 205		PRB DPMg 18/525 D
20	24	3 x 77	22	26,4	1,7	116 x 205		PRB DPMg 20/525 D
25	30	3 x 97	27,5	33,0	2	116 x 235		PRB DPMg 25/525 D
30	36	3 x 115	33	39,6	2,4	116 x 280		PRB DPMg 30/525 D
Rated voltage 690V								
5	6	3 x 34	4,2	5,0	1	85 x 170		PRB DPMg 5/690 Y
6,25	7,5	3 x 41,5	5,2	6,2	1	85 x 170		PRB DPMg 6,25/690 Y
7	8,4	3 x 46	5,75	6,9	1	85 x 170		PRB DPMg 7/690 Y
7,5	9	3 x 49	6,3	7,6	1	85 x 170		PRB DPMg 7,5/690 Y
8,33	10	3 x 55	7	8,4	1	85 x 170		PRB DPMg 8,33/690 Y
10,3	12,5	3 x 69	8,6	10,3	1,1	85 x 200		PRB DPMg 10/690 Y
12,5	15	3 x 83	10,4	12,5	1,2	85 x 230		PRB DPMg 12,5/690 Y
12,5	15	3 x 83	10,4	12,5	1,5	116 x 175		PRB DPMg 12,5/690 Y
15	18	3 x 99,5	12,4	14,9	1,2	85 x 230		PRB DPMg 15/690 Y
15	18	3 x 99,5	12,4	14,9	1,5	116 x 175		PRB DPMg 15/690 Y
16,7	20	3 x 111	13,9	16,7	1,7	116 x 205		PRB DPMg 16,7/690 Y
20	24	3 x 137	17,1	20,5	2	116 x 235		PRB DPMg 20/690 Y
25	30	3 x 166	20,7	24,8	2	116 x 235		PRB DPMg 25/690 Y
30	36	3 x 199	25	30,0	2,4	116 x 280		PRB DPMg 30/690 Y

Drawings

PRB DPM Three-phase capacitor



Technical Specification

Rated voltage
440 – 525V

Rated frequency
50/60 Hz

Capacitance tolerance
-5%, +10%

Over voltages
U_{cn} + 10% up to 8h daily
U_{cn} + 15% up to 30 min. daily
U_{cn} + 20% up to 5 minutes, 200 times in life of the capacitor
U_{cn} + 30% up to 1 minute, 200 times in life of the capacitor

Over current
1,3 x In permanent

Inrush current
Max. 100 x In

Test voltage terminal/terminal
2,15 x Un AC (2 seconds)

Test voltage terminal/case
4,3 kV AC (2 seconds)

Dielectric
Polypropylene film, self-healing

Impregnation (filling)
Vegetable oil

Losses
Dielectric: 0,2W/kvar
Total capacitor (50 Hz): < 0,4W/kvar

Life expectancy
>100.000 h
5000 switchings per year

Climatic category
-25/D
Max. ambient temp.: 55°C
Max. ambient temp. over 24h: 45°C
Max. ambient temp. over 1 year: 35°C
Lowest temperature: -25°C

Humidity
Average relative <95%

Altitude
2000m

Cooling
Natural or forced

Mounting position
Vertical position

Installation
Indoor

Case
Cylindrical, aluminium

Fixing
Threaded bolt M12
Max torque (Al can stud): 10 Nm

Terminals
Dual tab connector 6,3x0,8mm

Safety device
Overpressure disconnector

Standards
IEC 60381-1/2
EN 60381-1/2

Product Table HYDRA PAB DPM

Type designation
D = Dielectric, P = Polypropylene, M = metallized

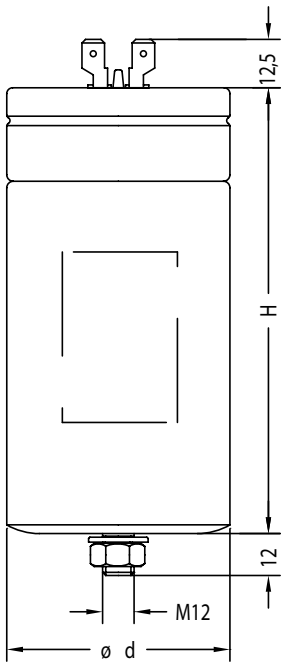
Rated power (kvar)		Rated capacitance	Rated current		Weight appr.	Dimen-sions	Fig.	Order Code
50 Hz	60 Hz	(µF)+10%,-5%	50 Hz	60Hz	(kg)	D x H mm		
Rated voltage 440 V								
2,02	–	33	4,6	–	0,27	45 x 143	5	PAB DPM 2,26/465
3,04	–	50	6,9	–	0,41	55 x 143	5	PAB DPM 3,40/465
3,35	–	55	7,6	–	0,41	55 x 143	5	PAB DPM 3,35/446
4,03	–	66	9,2	–	0,48	60 x 143	5	PAB DPM 4,03/446
5,05	–	83	11,5	–	0,57	65 x 143	5	PAB DPM 5,05/446
Rated voltage 465 V								
2,26	–	33	4,9	–	0,27	45 x 143	5	PAB DPM 2,26/465
3,09	–	45,5	6,6	–	0,34	50 x 143	5	PAB DPM 3,09/465
3,4	–	50	7,3	–	0,41	55 x 143	5	PAB DPM 3,40/465
Rated voltage 525 V								
2,77	–	32	5,3	–	0,41	55 x 143	5	PAB DPM 2,77/526
3,33	–	38,5	6,3	–	0,48	60 x 143	5	PAB DPM 3,33/526
4,17	–	48	7,9	–	0,57	60 x 143	5	PAB DPM 4,17/526

Other Voltages and Frequencies available upon request.



Fig. 5

PAB DPM Single-phase capacitor



Double flat adapter 6,3 mm

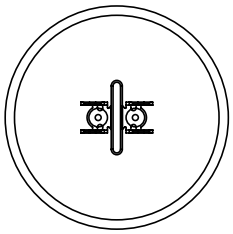


Fig. 8
Protection degree IP00



HYDRA a.s.
Průmyslová 1110
CZ-50601 Jičín

Sales office:
Breitenbachstraße 23
D-13509 Berlin
Tel.: + 49 - 30 / 40 80 41 84
Fax: + 49 - 30 / 40 80 41 89
E-Mail: office@hydra-components.cz

Commercial Agency