



# PARTO KHAZEN Co.

www.pkc-capacitor.com

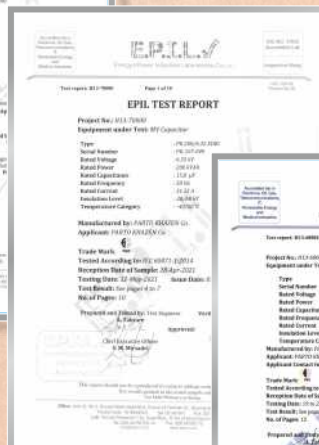
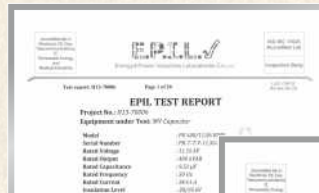


- High Voltage Shunt Capacitors
- High Voltage Capacitor Racks
- High Voltage Capacitor Banks
- Metal-enclosed Capacitor Banks





# Certificate





## High Voltage Shunt Capacitors and Capacitor Banks for A.C. Power Systems

### Application

High voltage shunt capacitors and capacitor banks for a.c. power systems are employed for power factor corrections in high voltage installations. They are used in single compensations for three-phase motors and power transformers, as group compensation and as central compensation in large electrical installations. They are also used in tuned and detuned filter circuits to protect specific pieces of equipment, or to eliminate harmonics at the source.

### Shunt Capacitors and Capacitor Banks

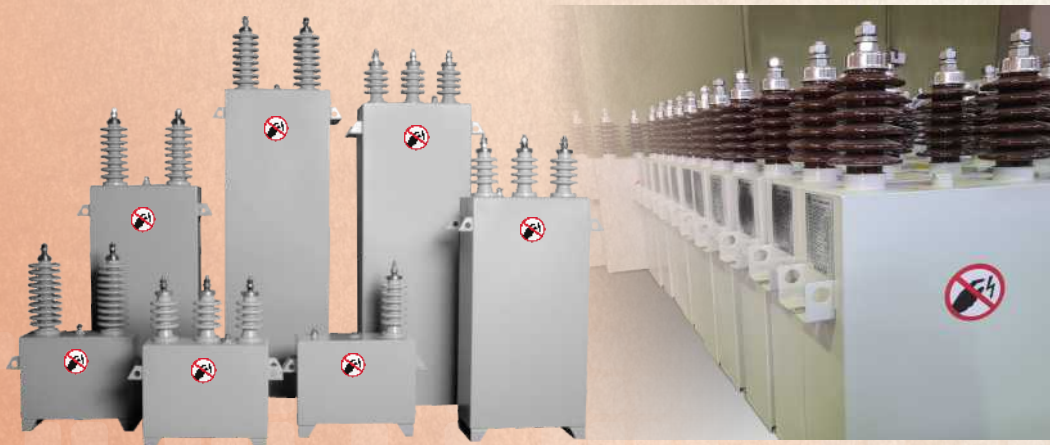
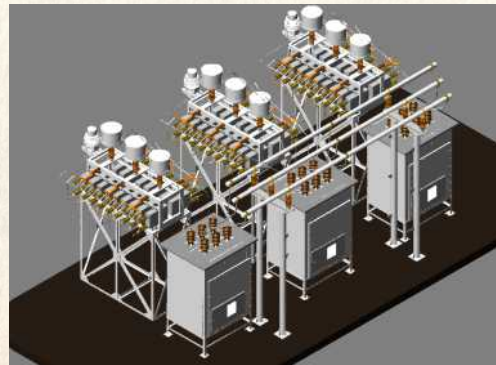
The reactive power of shunt capacitors and capacitor banks is determined by their capacitance, the r.m.s value of the operating voltage and the system frequency

$$Q_c = U^2 \cdot \omega c$$

The nominal rating as stated on the rating plate of shunt capacitors and capacitor banks is the relation of their capacitance, their rated voltage  $U_n$  and the rated frequency  $f_n$ .

Shunt capacitors shall be suitable for continuous operation at a r.m.s. current of 1,30 times the current that occurs at rated sinusoidal voltage and rated frequency, excluding transients. Depending on the actual capacitance value, which may be a maximum of 1,1  $C_n$ , the maximum current can reach 1,3  $I_n$ . These over current factors are intended to take care of the combined effects due to harmonics and over voltage up to and including of 1,10  $U_n$  with a maximum duration of 12 h in every 24 h.

Shunt capacitors are classified in temperature categories, each category being specified by a number followed by a letter. The number represents the lowest ambient air temperature at which the shunt capacitor may operate. The letters represent upper limits of temperature variation ranges according to IEC 871.



Each shunt capacitor and capacitor bank shall be provided with means for discharging to 75 V or less from an initial peak voltage of  $\sqrt{2}$  times rated voltage  $U_n$ . The maximum discharge time is 10 min for shunt capacitors and capacitor banks. A shorter discharge time of 5 min only is possible.

## Installation

Capacitors shall be installed at a place where is adequate dissipation by convection and radiation of the heat of the capacitor losses possible. The ventilation of any enclosure and the arrangement of the shunt capacitors shall provide good air circulation around each unit. This is of importance for units mounted in row above each other.

## Switching and Protective devices

The switching and protective devices and the connection should be designed to carry continuously a current of 1,3 times the current which should be obtained with a sinusoidal voltage of r.m.s. value equal to the rated voltage at the rated frequency. Depending on the actual capacitance value this current may have a maximum value of 1,5  $I_n$  for individual units and lower values for capacitor banks.

The switching and protective devices and the connections should be capable of withstanding the electrodynamic and thermal stresses which are caused by transient over currents of high amplitude and frequency which may occur when switching on. The switching should be such that restriking part which during breaking operation cannot be occurred. For the protection of PKC capacitor banks mainly the neutral unbalanced protection is used. The shunt capacitor of the capacitor banks are arranged in two parallel stars (ungrounded) with a current transformer between the neutrals. An internal failure within one of the capacitor units will cause a current to flow in the neutrals. This current will be measured by the current transformer. The monitoring relay connected to the secondary terminals of the current transformer will trip switching off the switching device ahead of the capacitor bank. The current transformer should be rated to the full system voltage.





## Shunt capacitors for a.c. power systems having a rated voltage above 1000 V

### Range of type: PK .../... D..

Capacitors with 2 bushings. Internal connection: Single phase, both poles are connected through the bushings to the terminals. Capacitor container has to be grounded.

### Range of type: PK .../... S..

Capacitor with 1 bushing. Internal connection: Single phase, one pole connected to the capacitor container, the other pole connected through the bushing to terminal. The capacitor has to be installed on insulated supports.

### Technical Data

<b>Rated output</b>	100 kvar ... 550 kvar
<b>Rated voltage</b>	1,3 up to 19.05 kV
<b>Rated frequency</b>	50 Hz (60 Hz on request)
<b>Dielectric</b>	Polypropylene Film
<b>Impregnant</b>	JARYLEC C 101 D / PCB Free
<b>Losses</b>	<0,15 W/kvar at +40° C ambient air temperature and rated operation
<b>Internal fuses</b>	Capacitors with and without internal fuses available
<b>Discharge resistor</b>	Standard design without discharge resistor. On request with built-in discharge resistor available. Discharge time < 10 min.



### Operating Conditions

**Maximum altitude 1000 m above sea level at rated operation available -40°/C acc. to IEC 871. and PCB-free.**

**Other temperature classes on request.**

**Admissible ambient air temperature values**

- + 40°C highest mean over 24 h
- + 30°C highest mean over 1 year
- + 55°C maximum
- 40°C minimum

**Mounting** Indoor or outdoor mounting



## Permissible Overload

<b>Current</b>	1,3 x $I_n$ continuously
<b>Voltage</b>	1,0 x $U_n$ continuously 1,1 x $U_n$ 12 h in every 24 h

## General Data

<b>Capacitor container</b>	Indoor mounting: Steel 1.0330, DIN 1624 Outdoor mounting: Stainless steel 1.4512, DIN 1744
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<b>Colour</b>	RAL 9002
<b>Rating plate</b>	Durable Plastic type
<b>Terminals</b>	M 16
<b>Bushings</b>	Porcelain

Fixing brackets can be changed on request.

## Standards

PKC shunt capacitors for a. c. systems having a rated voltage over 1000 V comply with IEC- 60 871.

## Quality Assurance

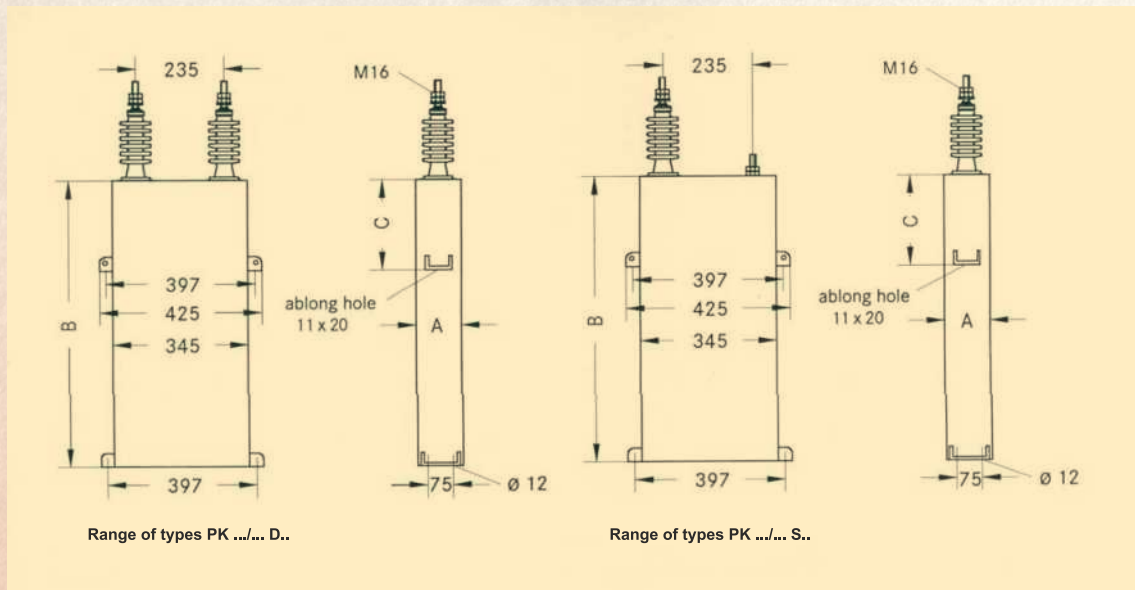
Quality control ISO 9001 : 2015 / ISO 14001 : 2015 / ISO 45001 : 2018



All capacitors are subject to the following tests unless otherwise agreed between the customer and the manufacturer:

- Test voltage between the terminals
  - d. c. voltage  $4 \times U_n$ , 10 s or
  - a. c. voltage  $2 \times U_n$ , 10 s
- Test voltage between terminals and container
  - Type: PK .../... D&T&S ...
  - a. c. voltage acc. to IEC 871, 10 s
- Capacitance measurement
- Capacitor loss tangent ( $\tan \delta$ ) measurement





**Table 1**

Output rate in Kvar	A	B	Weight approx. in Kg	A*	B*	Weight approx. in Kg	C
100	135	340	27				140
125	135	390	30				140
150	135	440	36				140
175	135	490	41				140
200	135	540	45				200
225	135	580	48				200
250	135	620	52	135	720	58	200
275	135	690	57	135	790	63	200
300	135	750	61	135	850	67	200
325	135	800	65	135	900	71	200
350	135	870	68	135	970	74	200
375	180	700	74	180	800	80	200
400	180	740	79	180	840	85	200
425	180	800	83	180	900	89	250
450	180	850	87	180	950	93	250
475	190	910	92	210	900	98	250
500	190	1000	98	210	970	104	250
550	200	1080	105	230	1190	118	250

All Dimention in mm. A\* and B\* apply with internal fuse

**Table 2**

Bushing BIL in KV	Dimensions in mm
75	190
95	370
125	620
170	762

**Example for an order: PK 200/11.56 EDRI**

**PK** : manufactured by PKC (Paro Khazen Co.)

**Rated Power** : 200Kvar

**Rated voltage** : 11.56 kV

1<sup>st</sup> digit for identifying of fuse type :

E : Ext. fuse

I : Int. fuse

2<sup>nd</sup> digit for type of Bushing :

D : Double Bushing

S : Single Bushing

T : Three Bushing

**R** with built-in discharge resistor

**I** Capacitor container made from stainless steel or outdoor installation







## Capacitor banks for a. c. power systems having a rated voltage above 1000 V

### Range of types Double Star: PK ... / ... YY D 00

Capacitor banks for a. c. power systems in rack design, protection degree IP 00, up to  $U_{max} = 145$  kV.

All capacitor banks can be equipped with current transformers for neutral unbalanced protection on request.

### Technical Data

<b>Rated output</b>	On request
<b>Rated voltage</b>	3.3 up to 63kV (three phase)
<b>Frequency</b>	50 Hz or 60 Hz on request
<b>Insulation level</b>	Depend on rated voltage
<b>Connection</b>	YY
<b>Dielectric</b>	Polypropylene Film
<b>Impregnant</b>	JARYLEC C 101 Chlor- and PCB -free
<b>Losses</b>	$\leq 0,15$ W/kvar at +40°C ambient temperature and rated operation

<b>Internal fuses</b>	On request
<b>Discharge resistor</b>	Standard design without discharge resistor. On request with built-in discharge resistor available. Discharge time $\leq 10$ min.

### Operating Conditions

<b>Maximum altitude</b>	1000 m above sea level at rated operation
<b>Temperature class</b>	-40°C acc. to IEC 871. Other temperature classes on request.

### Admissible ambient air temperature values

+40°C highest mean over 24 h
+30°C highest mean over 1 year
+50°C maximum
-40°C minimum

<b>Mounting</b>	Outdoor installation
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### Permissible Overload

<b>Current</b>	$1,3 \times I_n$ continuously
<b>Voltage</b>	$1,0 \times U_n$ continuously $1,1 \times U_n$ 12 h in every 24 h

## General Data

<b>Capacitor container</b>	<b>Outdoor mounting:</b> Stainless steel 1.4512, DIN 17441
<b>Colour</b>	RAL 9002
<b>Protection degree</b>	IP 00
<b>Rating plate</b>	Durable plastic type
<b>Terminals</b>	M 16
<b>Bushings</b>	Porcelain

## Standards

PKC shunt capacitors for a. c. systems having a rated voltage over 1000 V comply with VDE 0560, part 410 and IEC publication 871.

## Quality Assurance

**Quality control** ISO 9001 : 2015 / ISO 14001 : 2015 /  
ISO 45001 : 2018

All capacitors are subject to the following tests unless otherwise agreed between the customer and the manufacturer:

- Test voltage between the terminals
  - d. c. voltage  $4 \times U_n$ , 10 sec or
  - a. c. voltage  $2 \times U_n$ , 10 sec
- Test voltage between terminals and container
  - a. c. voltage acc. to IEC 871, 10 s
- Capacitance measurement
- Capacitor loss tangent ( $\tan \delta$ ) measurement





**Dimensions are subject to alterations to optimize the capacitor container without changing the technical data in case of placing an order. All Data in this brochure are subject to necessary changes without prior notice.**



**PARTO KHAZEN Co.**

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