ICAR
technology looking ahead

2017

PRODUCT CATALOGUE

PARTS AND TRAYS
POWER FACTOR CORRECTION LV

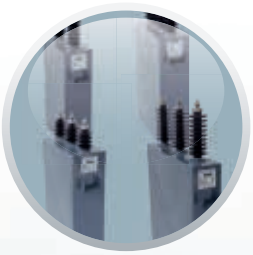
QUALITY MADE IN ITALY

ICAR: products and solutions

Founded in 1946, ICAR is a leading manufacturer of capacitors and power factor correction systems in low and medium voltage; it controls with its own companies all production phases: the polypropylene/paper film, metallization, winding,manufacturing of the finished product.

The entire process is checked in order to obtain a product of high quality level that guarantees its functioning even in the most burdensome plant configurations.
The ICAR Group has 6 plants, all located in Europe.
For details on the individual families, download the full catalogs on the website, www.icar.com. Here are all equipment and the solutions ICAR proposes.

Bank for power factor correction



Capacitors and MT power factor correction systems

Power electronics capacitors

Active filters

LV voltage stabilizers

EMI RFI filters

Motor run capacitors

Capacitors for energy storage and rapid discharge

Lighting capacitors

Reactors and LV/LV special transformers

Power factor correction

An advantageous choice under the technological and ecological prospective

The proper power factor correction of an electric plant, brings to several implications far beyond the simple technical considerations. In an electric plant, the useful energy that is transformed into work is the active energy.

The electric devices that determine a low cos phi, require a quote of ("reactive") energy for their proper functioning that causes a greater load in both the manufacturing power plant and the electric lines that convey the plant up to the user plant.
The power factor correction enables to "produce" the reactive energy within the plant with clearly visible advantage for the user and the electric network behind it.

The proper power factor correction of an electric plant, has, technically, the following advantages:

- Avoid the fines applied by the energy suppliers to the users with low cos phi.
- For new plants, optimize the dimensioning of the plant depending on the actual planned production capability
- For existing plants, recover productive capability without adding/increasing the performances of what already installed (transformers, cables)
- Reduce line voltage drop (that could cause problems in motors starting or plants served by long MV power lines with low short circuit power).
- Reduce energy losses due to Joule effect in transformers and cables

The payback of a power factor correction system often occurs within a little more than a year.
Beside these technical/economical considerations, it can not be forgotten the ecological importance of the power factor correction. In fact, the growing energy demand makes necessary to:

- increase the total power installed by building new generating plants with the resulting environmental impact for pollution emission during their life cycle
- improve the performances of the transmission and distribution networks with the addition of new lines and/or the expansion of the existing ones.

A politic of power factor correction bringing the average Italian cos phi to 0, 95 would make saving, according to preventive estimates, about a million of MWh/year with evident advantage in terms of stress reduction for the power plant park and the energy transmission /distribution network, reducing, at the same time, CO2 emission of about a million tons.

Quality

ICAR has always regarded product quality and effectiveness of internal processes as key factors of corporate strategy.
In ICAR we believe that compliance with international standards is a basic requirement to offer equipment that can meet the needs of our customers.

Quality System

The ICAR Quality management system is certified according to ISO 9001 since 1994.
We participate actively in international standards committees that draft regulations applicable to our production equipment, and in particular to industrial capacitors: this guarantees to be always up with changes in legislation, or rather pre-empt it.

Since 2011 the ICAR quality management system is certified by IRIS (International Railway Industry Standard). Promoted by UNIFE (Association of European companies operating in the railway sector) and supported by operators, system integrators and equipment manufacturers, IRIS integrates the ISO 9001 quality standard introducing additional requirements, specific to the railway industry.

Certificato UNI EN Iso9001:2008

IRIS is modeled on quality standards similar to those already in use in the automotive and aerospace industries.

Independent certification bodies and approved by the promulgators of the standard ensure objectivity and transparency in the evaluation.
IRIS certification, while being oriented in the rail sector, has a positive effect on the whole ICAR quality system, with benefits for all types of produced devices.

The valid certificates can be downloaded from the website www.icar.com the section "Company - Quality"

Product quality

The equipment produced in ICAR are tested both in our laboratories and in the most important internationally recognized laboratories, in order to ensure compliance with the highest standards.

Certificates and Approvals

THE INTERNATIONAL CERTIFICATION NETWORK

CERTIFICATE

IQNet and its partner
CISQ/IMQ-CSQ
hereby certify that the organization

ICAR SPA
VIA ISONZO 10 - 20900 MONZA (MB)
VIA NOSEA 1/3 - 24030 VILLA D'ADDA (BG)
ROMCAP CONDENSATORI SRL
PLOIESTI IND. PARC, 100066, PIRAMIDEI N. 5 - PLOIESTI ROMANIA

for the following field of activities

Design and manufacture of capacitors, equipment for power factor correction and harmonic filter for low/medium/high voltage, transformer coupling capacitors, EMI filters, special equipment, metallized film

has implemented and maintains a
Quality Management System
which fulfills the requirements of the following standard

ISO 9001:2008

Issued on: 2014 – 07 – 07 Expiry date: 2017 – 07 – 07

Registration Number: IT – 30436

Michael Drechsel
President of IQNET

Ing. Claudio Provetti
President of CISQ

CERTIFICATO N.
CERTIFICATE N. 9170.ICAR

SI CERTIFICA CHE IL SISTEMA QUALITA' DI
WE HEREBY CERTIFY THAT THE QUALITY SYSTEM OPERATED BY

ICAR SPA
CORSO MAGENTA 65 - 20123 MILANO (MI)
UNITA' OPERATIVE
OPERATIVE UNITS
VIA ISONZO 10 - 20900 MONZA (MB)
VIA NOSEA 1/3 - 24030 VILLA D'ADDA (BG)
ROMCAP CONDENSATORI SRL
PLOIESTI IND. PARC, 100066, PIRAMIDEI N. 5 - PLOIESTI ROMANIA

E' CONFORME ALLA NORMA
IS IN COMPLIANCE WITH THE STANDARD

ISO 9001:2008

PER LE SEGUENTI ATTIVITA'
FOR THE FOLLOWING ACTIVITIES

Progettazione e costruzione di condensatori, sistemi di rifasamento e filtraggio di armoniche per bassa/media/alta tensione, trasformatori di tensione capacitivi, filtri antidisturbo, apparecchiature speciali, film metallizzato
Design and manufacture of capacitors, equipment for power factor correction and harmonic filter for low/medium/high voltage, transformer coupling capacitors, EMI filters, special equipment, metallized film

1994-10-05	2014-07-07	2017-07-07

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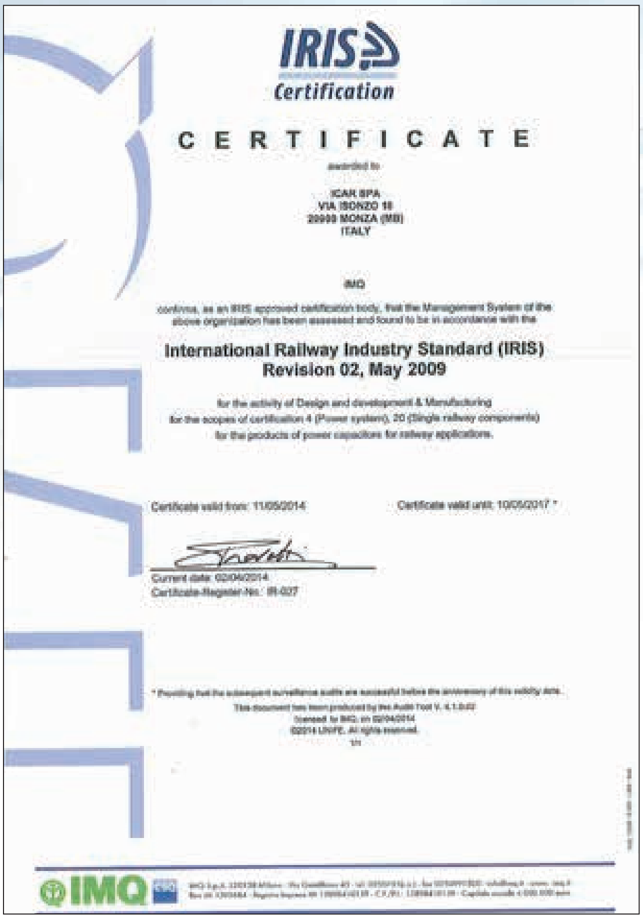

IRIS Certification

C E R T I F I C A T E

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ICAR SPA
VIA ISONZO 10
20900 MONZA (MB)
ITALY

IMQ

confirms, as an IRIS approved certification body, that the Management System of the above organization has been assessed and found to be in accordance with the

International Railway Industry Standard (IRIS)
Revision 02, May 2009

for the activity of Design and development & Manufacturing
for the scopes of certification 4 (Power system), 20 (Single railway components)
for the products of power capacitors for railway applications.

Certificate valid from: 11/05/2014 Certificate valid until: 10/05/2017 *

Current date: 02/04/2014
Certificate-Register-No.: IR-027

ТАМОЖЕННЫЙ СОЮЗ
ДЕКЛАРАЦИЯ О СООТВЕТСТВИИ

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Power Quality in your hands with new regulators RPC 8LGA and 5LGA

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Optical port
for adjustment and quick reference by PC using USB cable or WIFI dongle.

RPC 5LGA is on MICROmatic and MINImatic, RPC 8LGA on MIDImatic.

Electronic Fast Switches

Static compensation is very often the only way to afford networks with relatively high fluctuating loads (milliseconds). The main advantages of this compensation system are:

- an immediate answer to the compensation request;
- no electromagnetic contactors: the total absence of mobile mechanic parts increase the number of switching operations and reduce the maintenance;
- the lack of transients in the capacitor switching connections minimizes disturbance such as flicker, noise, voltage drop.

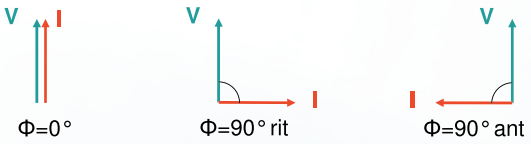
Summary

CHAPTER 1

Introductory Notes

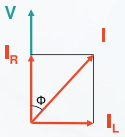
Power factor correction: why?

In electrical circuits the current is in phase with the voltage whenever are in presence of resistors, whereas the current is lagging if the load is inductive (motors, transformers with no load conditions), and leading if the load is capacitive (capacitors).



The total absorbed current, for example, by a motor is determined by vector addition of:

1. I_R resistive current;
2. I_L inductive reactive current;



$$\cos\varphi = \frac{I_R}{I}$$

These currents are related to the following powers:

1. active power linked to I_R;
2. reactive power linked to I_L;

The reactive power doesn't produce mechanical work and it is an additional load for the energy supplier.
The parameter that defines the consumption of reactive power is the power factor.

We define power factor the ratio between active power and apparent power:

$$FP = \frac{P}{A}$$

$$A = \sqrt{P^2 + Q^2}$$

As for as there are not harmonic currents power factor coincide to cosφ of the angle between current and voltage vectors. cosφ decreases as the reactive absorbed power increases.

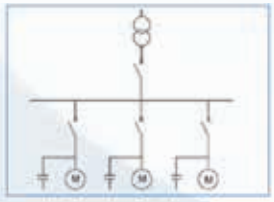
Low cosφ, has the following disadvantages:

1. High power losses in the electrical lines
2. High voltage variation in the electrical lines
3. Over sizing of generators, electric lines and transformers.

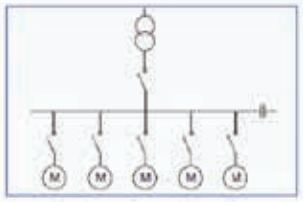
From this we understand the importance to improve (increase) the power factor. Capacitors need to obtain this result.

Power factor correction: how?

By installing a capacitor bank it is possible to reduce the reactive power absorbed by the inductive loads in the system and consequently to improve power factor.
It is suitable to have cosφ a little in excess of 0.9 to avoid paying the penalties provided for by the law. cosφ must not be too close to unity, to avoid the leading currents in of the electrical system.
The choice of the correct power factor correction equipment depends on the type of loads present and by their way of working.
The choice is between CENTRAL COMPENSATION and INDIVIDUAL COMPENSATION.
Individual compensation: power factor correction is wired at each single load (i.e. motor terminals)
Central compensation: there is only one bank of capacitors on the main power distribution switch board or substation.



Individual Compensation



Central Compensation

The individual compensation is a simple technical solution: the capacitor and the user equipment follow the same sorts during the daily work, so the regulation of the cosφ becomes systematic and closely linked to the load.
Another great advantage of this type of power factor correction is the simple installation with low costs.
The daily trend of the loads has a fundamental importance for the choice of most suitable power factor correction.
In many systems, not all the loads work in the same time and some of them work only a few hours per day.
It is clear that the solution of the individual compensation becomes too expensive for the high number of capacitors that have to be installed. Most of these capacitors will not be used for long period of time.
The individual compensation is more effective if the majority of the reactive power is concentrated on a few substatios loads that work long period of time.
Central compensation is best suited for systems where the load fluctuates throughout the day.
If the absorption of reactive power is very variable, it is advisable the use of automatic regulation in preference to fixed capacitors.

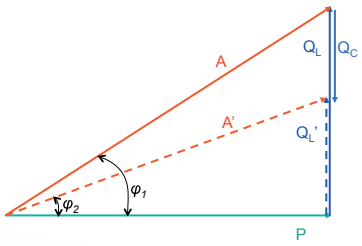
Power factor correction: How many capacitors?

The choice of capacitor bank to install in a system is closely depended from:

- $\cos\varphi_2$ value that we would obtain
- $\cos\varphi_1$ starting value
- installed active power.

By the following equation:

$Q_C = P * (\tan\varphi_1 - \tan\varphi_2)$



Q_C = Required Capacitors Reactive Output [kvar];
P = Active Power [kW];
Q_L, Q'_L = Inductive Reactive Output before and after the installation of the capacitor bank;
A, A'= apparent power before and after the power factor correction [kVA].

As example if we have installed a load that absorbs an active power of 300 kW having a power factor 0.7 and we want to increase it until 0.95.
From the table 1 we find: k = 0,692

Which means: $Q_c = 0{,}692 * 300 = 207{,}6$ kvar

Can be also written $Q_c = k * P$

Starting power factor	Final power factor					
	0,9	0,91	0,92	0,93	0,94	0,95
0,40	1,807	**1,836**	1,865	**1,896**	1,928	**1,963**
0,41	1,740	**1,769**	1,799	**1,829**	1,862	**1,896**
0,42	1,676	**1,705**	1,735	**1,766**	1,798	**1,832**
0,43	1,615	**1,644**	1,674	**1,704**	1,737	**1,771**
0,44	1,557	**1,585**	1,615	**1,646**	1,678	**1,712**
0,45	1,500	**1,529**	1,559	**1,589**	1,622	**1,656**
0,46	1,446	**1,475**	1,504	**1,535**	1,567	**1,602**
0,47	1,394	**1,422**	1,452	**1,483**	1,515	**1,549**
0,48	1,343	**1,372**	1,402	**1,432**	1,465	**1,499**
0,49	1,295	**1,323**	1,353	**1,384**	1,416	**1,450**
0,50	1,248	**1,276**	1,306	**1,337**	1,369	**1,403**
0,51	1,202	**1,231**	1,261	**1,291**	1,324	**1,358**
0,52	1,158	**1,187**	1,217	**1,247**	1,280	**1,314**
0,53	1,116	**1,144**	1,174	**1,205**	1,237	**1,271**
0,54	1,074	**1,103**	1,133	**1,163**	1,196	**1,230**
0,55	1,034	**1,063**	1,092	**1,123**	1,156	**1,190**
0,56	0,995	**1,024**	1,053	**1,084**	1,116	**1,151**
0,57	0,957	**0,986**	1,015	**1,046**	1,079	**1,113**
0,58	0,920	**0,949**	0,979	**1,009**	1,042	**1,076**
0,59	0,884	**0,913**	0,942	**0,973**	1,006	**1,040**
0,60	0,849	**0,878**	0,907	**0,938**	0,970	**1,005**
0,61	0,815	**0,843**	0,873	**0,904**	0,936	**0,970**
0,62	0,781	**0,810**	0,839	**0,870**	0,903	**0,937**
0,63	0,748	**0,777**	0,807	**0,837**	0,870	**0,904**
0,64	0,716	**0,745**	0,775	**0,805**	0,838	**0,872**
0,65	0,685	**0,714**	0,743	**0,774**	0,806	**0,840**
0,66	0,654	**0,683**	0,712	**0,743**	0,775	**0,810**
0,67	0,624	**0,652**	0,682	**0,713**	0,745	**0,779**
0,68	0,594	**0,623**	0,652	**0,683**	0,715	**0,750**
0,69	0,565	**0,593**	0,623	**0,654**	0,686	**0,720**
0,70	0,536	**0,565**	0,594	**0,625**	0,657	**0,692**
0,71	0,508	**0,536**	0,566	**0,597**	0,629	**0,663**
0,72	0,480	**0,508**	0,538	**0,569**	0,601	**0,635**
0,73	0,452	**0,481**	0,510	**0,541**	0,573	**0,608**
0,74	0,425	**0,453**	0,483	**0,514**	0,546	**0,580**
0,75	0,398	**0,426**	0,456	**0,487**	0,519	**0,553**
0,76	0,371	**0,400**	0,429	**0,460**	0,492	**0,526**
0,77	0,344	**0,373**	0,403	**0,433**	0,466	**0,500**
0,78	0,318	**0,347**	0,376	**0,407**	0,439	**0,474**
0,79	0,292	**0,320**	0,350	**0,381**	0,413	**0,447**
0,80	0,266	**0,294**	0,324	**0,355**	0,387	**0,421**
0,81	0,240	**0,268**	0,298	**0,329**	0,361	**0,395**
0,82	0,214	**0,242**	0,272	**0,303**	0,335	**0,369**
0,83	0,188	**0,216**	0,246	**0,277**	0,309	**0,343**
0,84	0,162	**0,190**	0,220	**0,251**	0,283	**0,317**
0,85	0,135	**0,164**	0,194	**0,225**	0,257	**0,291**
0,86	0,109	**0,138**	0,167	**0,198**	0,230	**0,265**
0,87	0,082	**0,111**	0,141	**0,172**	0,204	**0,238**

Table 1
See the full table in Appendix

A typical example of power factor correction, sometimes not much considered but surely important, concerns the power factor correction of transformers for the distribution of energy. It is essentially a fixed power factor correction that must compensate for the reactive power absorbed by the transformer in its no load condition (this happens often during the night). The calculation of the needed reactive output is very easy and it bases itself on this equation:

$$Q_c = I_0\% * \frac{A_N}{100}$$

where
I_0%= magnetising current of the transformer
A_N= Apparent rated power in kVA of the transformer

If we don't have these parameters, it is convenient to use the following table.

Power transformer KVA	Oil transformer kvar	Resin transformer kvar
10	**1**	1,5
20	**2**	1,7
50	**4**	2
75	**5**	2,5
100	**5**	2,5
160	**7**	4
200	**7,5**	5
250	**8**	7,5
315	**10**	7,5
400	**12,5**	8
500	**15**	10
630	**17,5**	12,5
800	**20**	15
1000	**25**	17,5
1250	**30**	20
1600	**35**	22
2000	**40**	25
2500	**50**	35
3150	**60**	50

Table 2

Another very important example of power factor correction concerns asynchronous three-phase motors that are individually corrected. The reactive power likely needed is reported on table 3:

Motor power		Required Reactive Power (kvar)				
HP	kW	3000 rpm	1500 rpm	1000 rpm	750 rpm	500 rpm
0,4	0,55	-	-	0,5	0,5	-
1	0,73	0,5	0,5	0,6	0,6	-
2	1,47	0,8	0,8	1	1	-
3	2,21	1	1	1,2	1,6	-
5	3,68	1,6	1,6	2	2,5	-
7	5,15	2	2	2,5	3	-
10	7,36	3	3	4	4	5
15	11	4	5	5	6	6
30	22,1	10	10	10	12	15
50	36,8	15	20	20	25	25
100	73,6	25	30	30	30	40
150	110	30	40	40	50	60
200	147	40	50	50	60	70
250	184	50	60	60	70	80

Table 3

Be careful: the capacitor output must not be dimensioned too high for individual compensated machines where the capacitor is directly connected with the motor terminals. The capacitor placed in parallel may act as a generator for the motor which will cause serious overvoltages (self-excitation phenomena). In case of wound rotor motor the reactive power of the capacitor bank must be increased by 5%.

Power factor correction: technical reasons

Recent energy market deregulation, along with new potential energy supplier rising, had lead to many and different type of invoicing which are not very clear in showing Power Factor up.
However as energy final price is steady growing, to correct power factor is becoming more and more convenient.
In most of the cases power factor improvement device prime cost is paid back in few months.
Technical-economical advantages of the installation of a capacitor bank are the following:

- decrease of the losses in the network and on the transformers caused by the lower absorbed current
- decrease of voltage drops on lines
- optimisation of the system sizing.

The current I, that flows in the system, is calculated by:

$$I = \frac{P}{\sqrt{3} * V * \cos\varphi}$$

where
P= Active power
V= Nominal Voltage
While cosφ increases, with the same absorbed power we can obtain a reduction in the value of the current and as a consequence the losses in the network and on the transformers are reduced. Therefore we have an important saving on the size of electrical equipment used on a system. The best system sizing has some consequence on the line voltage drop. We can easily see that looking at the following formula:

$$\Delta V = R * \frac{P}{V} + X * \frac{Q}{V}$$

where
P= active power on the network (kW)
Q= reactive power on the network (kvar)
while R is the cable resistance and X its reactance (R<<X).
The capacitor bank installation reduces Q so we have a lower voltage drop. If, for a wrong calculation of the installed capacitor bank value, the reactive part of the above equation becomes negative, instead of a reduction of the voltage drop we have an increasing of the voltage at the end of the line (Ferranti Effect) with dangerous consequence for the installed loads.
Some examples clarify the concepts set out above:

1. Power loss (kW), in function of cosφ, from a copper cable 3 x 25mm² 100m long carrying 40kW at 400Vac.
2. Supplied active power (kW) by a transformer 100kVA, in function of cosφ

cos φ	1)	2)
0,5	3,2	50
0,6	2,3	60
0,7	1,6	70
0,8	1,3	80
0,9	1	90
1		100

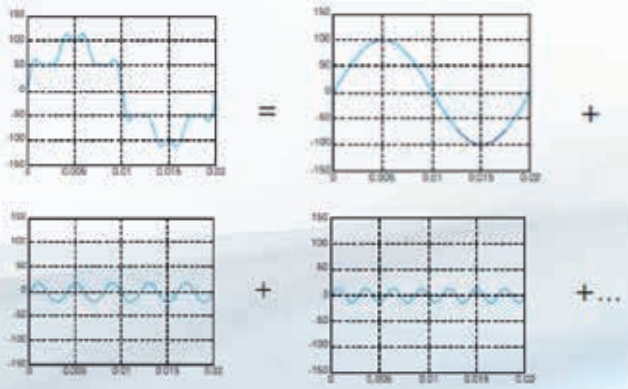
As we can see as the power factor increases we have fewer losses in the network and more active power from the same KVA.
This allows us to optimise on the system sizing.

Power factor correction: Harmonics in the network

The distortions of the voltage and current waveforms are generated by non-linear loads (inverter, saturated transformers, rectifier, etc.) and produce the following problems:

- On the A.C. motors we find mechanical vibration that can reduce expected life. The increase of the losses creates overheating with consequent damaging of the insulating materials;
- In transformers they increase the copper and iron losses with possible damaging of the windings. The presence of direct voltage or current could cause the saturation of the cores with consequent increasing of the magnetising current;
- The capacitors suffer from the overheating and the increasing of the voltage that reduce their life.

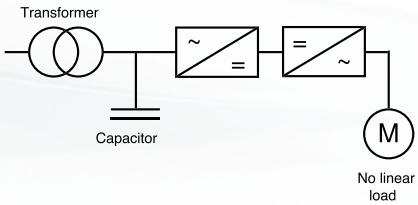
The waveform of the current (or voltage) generated by a non-linear load (fig. 1), being periodical, could be represented by the sum of many sinusoidal waves (a 50Hz component called fundamental and other components with multiple frequency of the fundamental component so called HARMONICS).

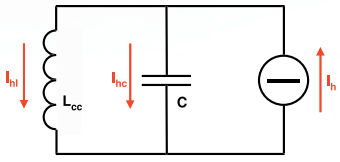


$$I = I_1 + I_2 + I_3 + I_4 + \ldots I_n$$

It is not advisable to install the power factor correction without considering the harmonic content of a system.
This is because, even if we could manufacture capacitors that can withstand high overloads, capacitors produce an increase of harmonic content, with the negative effects just seen. We speak about resonance phenomena when an inductive reactance is equal to the capacitive one:

$$2\pi f L = \frac{1}{2\pi f C}$$





Ideal current generator represents motor as harmonic current components generator, these are independent from circuit inductance, while L_{CC} is obtainable by capacitor upstream short circuit power (in general it is equal to transformer short-circuit inductance) the resonance frequency is obtained as follows:

$$N = \sqrt{\frac{S_{cc}}{Q}} \cong \sqrt{\frac{A * 100}{Q * v_{cc}\%}}$$

S_{cc} = Short-circuit power of the network (MVA)

Q = Output of power factor correction bank (kvar)

A = Rated power transformer (kVA)

v_{cc}% = Short-circuit voltage %

N = Resonance harmonic order

In parallel resonance conditions the current and the voltage of the circuit L_{CC} - C are heavily amplified as well as the nearby harmonic currents. Hereinafter an example:

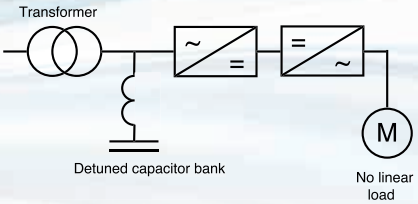
A = 630kVA (rated power transformer)

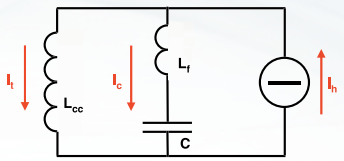
V_{cc}% = 6 (shot-circuit voltage %)

Q = 300kvar (output of power factor correction bank)

$$N = \sqrt{\frac{A * 100}{Q * v_{cc}\%}} = \sqrt{\frac{630 * 100}{300 * 6}} \cong 6$$

The result shows that in these conditions the system transformer-capacitor bank has the parallel resonance frequency of 300Hz (Nx50Hz). This means likely amplification of 5^h and 7^{th} harmonic current.
The most convenient solution to avoid this is the detuned filter, formed introducing a filter reactor in series with the capacitors, making this a more complex resonant circuit but with the desired feature of having a resonance frequency below the first existing harmonic.





With this type of solution, the parallel resonance frequency is modified from

$$f_{rp} = \frac{1}{2 * \pi * \sqrt{L_{cc} * C}}$$

to

$$f_{rp} = \frac{1}{2 * \pi * \sqrt{(L_{cc} + L_f) * C}}$$

Normally the resonance frequency between the capacitor and the series reactance is shifted lower than 250Hz and it is generally between 135Hz and 210Hz.
The lower frequencies correspond to higher harmonic loads. The installation of a reactance in series with the capacitor bank produces a series resonance frequency:

$$f_{rs} = \frac{1}{2 * \pi * \sqrt{L_f * C}}$$

If a harmonic current I_h with the same frequency of the resonance in series exists, this one will be totally absorbed by the system capacitors - reactors without any effect on the network. The realisation of a **tuned passive filter** is based on this simple principle. This application is required when we want the reduction of the total distortion in current (THD) on the system:

$$THD = \frac{\sqrt{I_3^2 + I_5^2 + I_7^2 + ...I_n^2}}{I_1}$$

I_1 = Component at the fundamental frequency (50Hz) of the total harmonic current

I_3 , I_5... = Harmonic components at the multiple frequency of the fundamental (150Hz, 250Hz, 350Hz, ...)

The dimensioning of tuned/passive filters is linked to the circuit parameter:

- impedance of the network (attenuation effect less as the short-circuit power on the network increases: in some cases could be useful to add in series with the network a reactance to increase the filtering effect);
- presence of further loads that generate harmonics linked to other nodes on the network
- capacitor types;

On this last point we have to make some considerations.
It is known that the capacitors tend to decrease capacity over time: varying the capacity inevitably varies the resonance series frequency

$$f_{rs} = \frac{1}{2 * \pi * \sqrt{L_f * C}}$$

and this drawback can be very dangerous because the system could lead in parallel resonance conditions. In this case, the filter does not absorb more harmonics but even amplifies them.
In order to have a constant capacity guarantee over time we need to use another type of capacitors made in bimetallized paper and oil impregnated polypropylene.In addition to the passive absorption filter realized with capacitors and inductances is possible to eliminate the network harmonics, with another type of absorption filter: the Active Filter.

The operation principle is based on the in-line injection of the same current harmonics produced by non-linear loads, but out of phase.

Selection criteria depending on the type of plant (for EUROrack trays)

The choice of power factor correction equipment must be made by evaluating the design data of the system or, better yet, your electricity bills.

The choice of the power factor correction type must be carried out according to the following table, which shows on the ordinate the rate of harmonic distortion of the plant current ($THDI_R$%) and in abscissa the ratio between the reactive power Q_C (in kvar) of the PFC bank and LV/MV transformer apparent power (kVA).

In light of these data, it identifies the box with proposed families, starting from the family that ensures the proper functioning with the best quality/price ratio.

So you choose the power factor corrector series.
The table was made starting from the following assumptions:

- Network voltage 400V
- Initial power factor of the plant 0.7 inductive
- Power factor target 0.95 inductive
- Non linear load with 5°-7°-11°-13° harmonics current

The hypotheses used are general and valid in the most of cases. In particular situations (harmonics coming from other branch of network, presence of rank equal to or a multiple of 3rd harmonics) previous considerations may be invalid.

In these cases, the guarantee of a correct choice of the equipment occurs only as a result of a measurement campaign of harmonic analysis of the network and/or the appropriate calculations.
ICAR disclaims any responsibility for incorrect choice of the product.

$THDI_R$: it is the maximum THD present in the plant without any capacitor battery installed on the basis of which to select the type of the capacitor to be installed in the plant. It 'an empirical fact, based on the construction technology used and the experience of the manufacturer.
There is no theoretical link between $THDI_R$ and $THDI_C$ valid for all plants. The $THDI_R$ can also be very different, for capacitors with the same $THDI_C$ produced by different manufacturers, depending on the risk tolerance of the manufacturer.

$THDI_C$: it is the harmonic overload suggested in order to satisfy the technical requirements of the components. It 'a characteristic value of each capacitor, indicative of its robustness: much higher is the $THDI_C$, more robust is the capacitor. The $THDI_C$ is the most significant value to compare different capacitors, together with the maximum temperature of use.

Automatic PFC systems selection guidelines

$THDI_R$% > 27	HP10/HP20	FH20/FH30	FH20/FH30	FH20/FH30	FH20/FH30	FH20/FH30	FH20/FH30
20 < $THDI_R$% ≤ 27	HP10/HP20	FH20/FH30	FH20/FH30	HP20/HP30	HP30/FH20	FH20/FH30	FH20/FH30
12 < $THDI_R$% ≤ 20	HP10/HP20	FH20/FH30	FH20/FH30	HP20/HP30	HP20/HP30	FH20/FH30	FH20/FH30
$THDI_R$% ≤ 12	HP10/HP20	HP20/HP30	HP30/FH20	HP10/HP20	HP20/HP30	HP30/FH20	FH20/FH30
	$Q_C / A_T ≤ 0,05$	**$0,05 < Q_C / A_T ≤ 0,1$**	**$0,1 < Q_C / A_T ≤ 0,15$**	**$0,15 < Q_C / A_T ≤ 0,2$**	**$0,2 < Q_C / A_T ≤ 0,25$**	**$0,25 < Q_C / A_T ≤ 0,3$**	**$Q_C / A_T > 0,3$**

Application Example

For example, consider a MV connected system through a LV/MV 1000kVA transformer, and with a $THDI_R$% equal to 25%.
Assuming that the power factor correction system to be installed has a reactive power of 220kvar, the ratio QC/AT is equal to 0.22.
The recommended power factor correction is therefore that in the box identified from the abscissa 0.2 < QC/AT ≤ 0.25 and the ordinate 20 <$THDI_R$ ≤ 27%.
You can choose an HP30 family device, or for even greater reliability of the solution, choose the FH20 family.

CHAPTER 2

CRTE Power Capacitors

In its power factor correction systems, ICAR uses only capacitors entirely made within the facilities of its group.
This way, ICAR guarantees the highest quality of the finished product.
The film used in the CRTE power capacitors comes directly from the ICAR experience in the high performance capacitors, in particular it is defined as “High density metalized polypropylene film”.

High density metalized polypropylene film capacitors

The main difference in comparison to standard polypropylene capacitors is the way in which the dielectric film is metalized.
In standard polypropylene capacitors the thickness of the metal layer deposited on the film surface is constant; in 1995, instead, ICAR has developed a manufacturing process that enables obtaining a metal layer with properly modulated thickness and achieving extraordinary results in the capacitors field for direct current and energy accumulation applications.
Subsequently this technology has been extended to capacitors for alternating current applications, with same remarkable results in power factor correction of industrial facilities.
The modulation of the metallization thickness, considerably betters capacitors performances (and therefore those of the power factor corrector systems of which they are the basic component) in terms of:

- increased specific power (kvar/dm^3) with resulting reduction of power factor corrector systems dimension;
- improvement of the strengthens to continuous and temporaries overvoltage for a better reliability even in plants with voltage peaks due to the network or manoeuvres on the plant; CRTE capacitors are in fact tested at three times the rated voltage (type test);
- better reaction to the internal short circuit thanks to the special metallization with variable thickness.

General description

CRTE is the ICAR last generation of metallized polypropylene film capacitors to be used for power factor correction and harmonic filtering in low voltage plants.
The main features are:

- Three phase windings delta connected in a cylindrical aluminum case;
- Rated power from 2,5kvar up to 50kvar;
- Rated voltage from 230V up to 800V;
- Rated frequency 50 / 60 Hz;
- IP20 terminal board;
- Reduced mounting cost thanks terminal lid connections;
- Up to 130.000 hours service life design;
- Dry, environment friendly construction;
- Suitable for any mounting position (vertical preferable for better cooling);
- Indoor installation;
- Made under Quality System in accordance with ISO 9001 standard.

Applications

- Individual fixed Power Factor Correction for motors, low voltage transformers, etc;
- Low voltage automatic Power Factor Correction Capacitor Banks;
- Low voltage detuned/tuned Capacitor Banks.

Damping of Inrush Current

Capacitors used for power factor correction have to withstand a lot of switching operations.
The switching of a capacitor in parallel with energized capacitor banks, produces extremely high inrush currents and voltage transients.
The connection of a low voltage power factor correction capacitor without damping to an AC power supply, could lead to a reduced lifetime.
For this reason, capacitors should be protected during the switching operation by means of suitable contactors equipped with damping resistors (AC6b).

Harmonics

Harmonics are sinusoidal voltages and currents with multiple frequencies of the 50 or 60 Hz line frequency.
In presence of harmonics the resonance phenomena can be avoided by connecting capacitors in series with reactors (detuned filters). Components for detuned filter must be carefully selected (see next chapter). Particular care has to be taken for capacitors because the voltage across them will be higher than the nominal voltage when they have a reactor in series.

Discharging

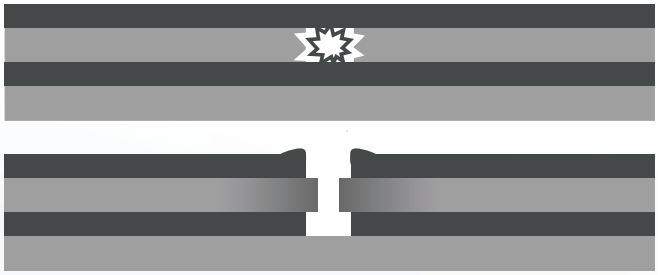
Capacitors must be discharged in 3 minutes to 75V or less.
There shall be no switch, fuse or any other isolating device between the capacitor unit and the discharging device.
ICAR supplies capacitor discharge resistors to all series.
.

Safety features

CRTE capacitors are equipped with the most modern and reliable safety features to keep capacitor working in proper conditions and to prevent heavy breakdowns.

Self-healing metallized polypropylene

This metallized polypropylene feature is widely used in Power Capacitors as a mean to keep capacitors working even when voltage breakdown between the metal layers occurs. In case of arc, the metallized surface around is evaporated but the breakdown is kept in limited area and it does not enlarge its effects.



Over pressure safety device

In the case or fault, due to over voltage, overload or normal ageing, the self-healing process may accelerate and so to create a increasing pressure within the case. In order to prevent the case from bursting, capacitor is fitted with an over pressure device that set out of service the capacitor from the supply; two of the supply leads have reduced section, and while the pressure increases leads are strained by the top lid till breaking of cables (see figure below).

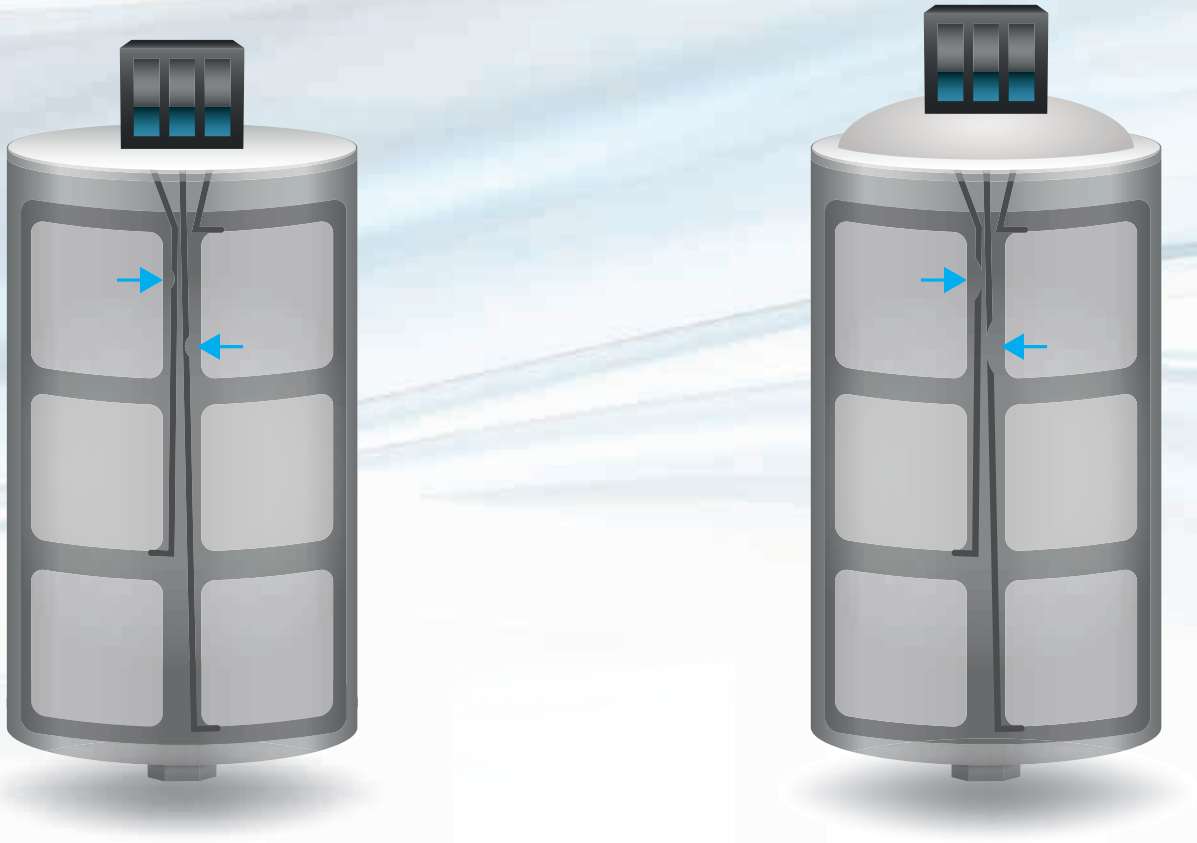
Dry technology

As CRTE capacitor is filled with resin, there is no risk of leaking oil or gas.

Touch proof terminals

CRTE is equipped with terminal board of IP20 protection degree (see product tables for specific feature application).

Overpressure safety device



CAPACITOR IN WORKING CONDITIONS

CAPACITOR WITH OPERATED MECHANISM

Inside layout

Metallized Polypropylene

ICAR has its own manufacturing of base polypropylene and relevant metallization: further it has developed a peculiar process that enables obtaining a metal layer with properly modulated thickness and achieving extraordinary performances in terms of voltage withstand and overall reliability.
The film is then cut and wound on high precision and fully automated winding machines, sprayed with abundant metal contact layer to reduce the contact resistance.

Wave cut film

CRTE capacitors are also fitted with wave cut film to reduce the stress between the polypropylene film layers and the contact layer. This enable capacitors to withstand higher inrush currents during the switching operations.

Environmentally friendly filler

Capacitors need filler around capacitive elements in order to protect metal layers from oxidation and to help heat dissipation.
Without this feature capacitors would cope with accelerated self healing and so a shorter service life.
ICAR filler are all PCB free.

Inside wiring

Power factor correction Capacitors for applications in nominal voltages networks of 600/660/690V (eg. Applications such as mining, highway tunnels and rail cargoes on board ship, port cranes, steel mills, paper mills and other "heavy“ applications) can be realized in different ways described as follows.

Capacitors with star connection

A widely used mode embodiment, but risky, provides a capacitors star connection (fig 1): in this way capacitors are subjected to a voltage equal to the nominal plant divided by √ 3.

- Advantages: capacitors are smaller and cheaper, getting more compact and lightweight banks.
- Disadvantages: in case capacitor capacity degradations, the voltage across the capacitors of the star will no longer be balanced, but it will increase on the side with greater capacity degradation, till to reach values higher than the rated voltage of the capacitors themselves. In this situation, the risk of overvoltage with possible consequent capacitors explosion/fire increases dramatically.

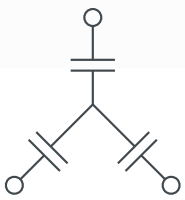


Fig 1: Capacitors star connection

Delta-connected Capacitors

This solution calls for the use of capacitor elements with a voltage rating at least equal to that of the network, as can be seen in Figure 2.

- Advantages: capacitor is electrically robust. Even in case of loss of capacity of a capacitor element, the others do not suffer any consequences: malfunctions risks and capacitors damages are reset.
- Disadvantages: capacitors bulkier and heavier, with higher costs.

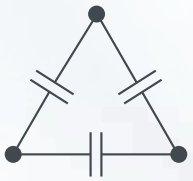


Fig 2: Capacitors delta connection

The ICAR way

CRTE for working voltages higher than 550V are made with delta connected capacitors, and so they have a nominal voltage equal or higher than the system network working voltage; this is the most sound and reliable solution.

Installation and maintenance

Handling and Storage

Capacitors shall have to be handled and stored with care in order to avoid any mechanical damage during transportation. Protection against environmental influences shall also be taken.

Installation

Capacitors are suitable for indoor installation and vertical mounting position is preferable for better coolig.
Capacitors must be installed in such a way that the specified limit temperature is not overcome.
Not being in compliance with the above instructions will result as a reduction of the expected service life.
Installation of capacitors shall have to be performed in such a way that any dangerous resonance phenomena due to harmonics is avoided.

Automatic power factor correction banks

The switching of a capacitor bank in parallel with energized capacitor(s), produces extremely high inrush currents and voltage transients. For this reason, it is extremely important to wait for the unit discharge before a new switching.

Assembly

Capacitors shall have to be assembled by means of the threaded M12 bottom stud. The maximum applicable tightening torque is 10Nm.
The catalogue specifies the recommended cross section of the supplying cables.
The recommended tightening torque is 3Nm.
With terminals screw design two antagonist spanners shall be used.
In order to ensure a proper operation of the internal overpressure safety device, an extra minimum 15mm clearance distance between the upper part of capacitors

and assembly enclosures shall have to be provided.
Capacitors shall be placed in such a way that there is an adequate dissipation by convection and radiation of the heat produced by the capacitor losses.

The ventilation of the operating room and the arrangement of the capacitor units shall provide good air circulation around each unit. A minimum 20mm distance between the units has to be maintained.

Maintenance

Periodical checks and inspections are required to ensure reliable operation of capacitors.
Monitoring and recording of the electrical service parameters are also recommended to become acquainted with progressive capacitors stress conditions.

Protections

Capacitors shall have to be protected against inrush peak currents during switching operations of automatic banks by means of suitable contactors equipped with pre-making resistors.

Safety Instructions

DO NOT MISAPPLY CAPACITORS FOR POWER FACTOR CORRECTION APPLICATIONS
Capacitors according to the Standards, are equipped with a suitable discharge device such as discharge resistors, permanently connected. They are able to reduce the residual voltage so that any dangerous resonance phenomena due to harmonics is avoided.

Automatic power factor correction banks

DO NOT TOUCH ANY CAPACITOR TERMINAL IF NOT SHORT CIRCUITED AND EAR THED IN ADVANCE To prevent damage to people and goods due to improper usage and/or application of capacitors, the “RECOMMENDATION FOR THE SAFE USE OF STATIC CAPACITORS, BANKS AND EQUIPMENT FOR POWERFACTOR CORRECTION” published by ANIE shall have to be strictly respected.

ICAR is not responsible for any kind of possible damages occurred to people or things, derived from the improper installation and application of Power Factor Correction capacitors.

Most common misapplication forms

- Current, voltage, harmonics and frequency above specification;
- Working or storage temperature beyond the specified limits;
- Unusual service conditions as mechanical shock and vibrations, corrosive or abrasive conductive parts in cooling air, oil or water vapour or corrosive substances, explosive gas or dust, radioactivity, excessive and fast variations of ambient conditions, service areas higher than 2000 m above sea level...

In case of doubt in choice or in performances of the capacitors ICAR technical service MUST be contacted.

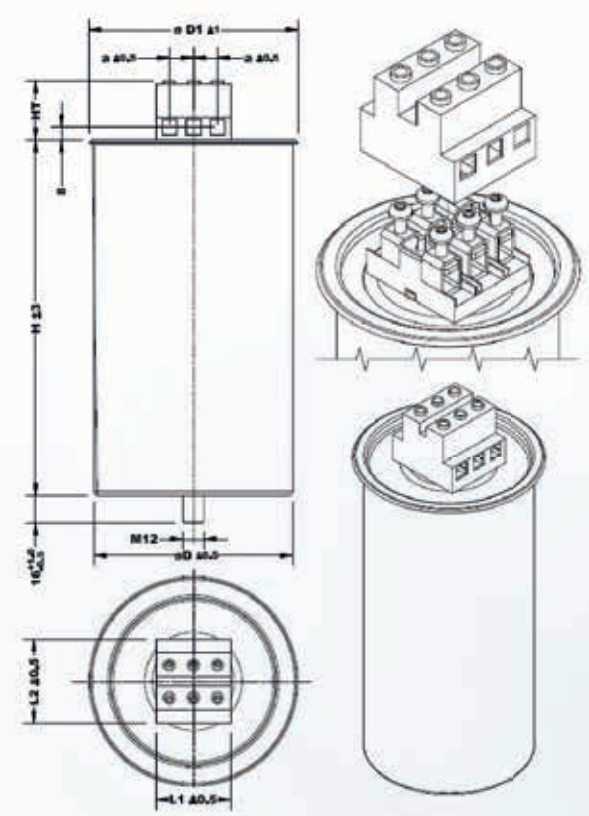
Personal Safety

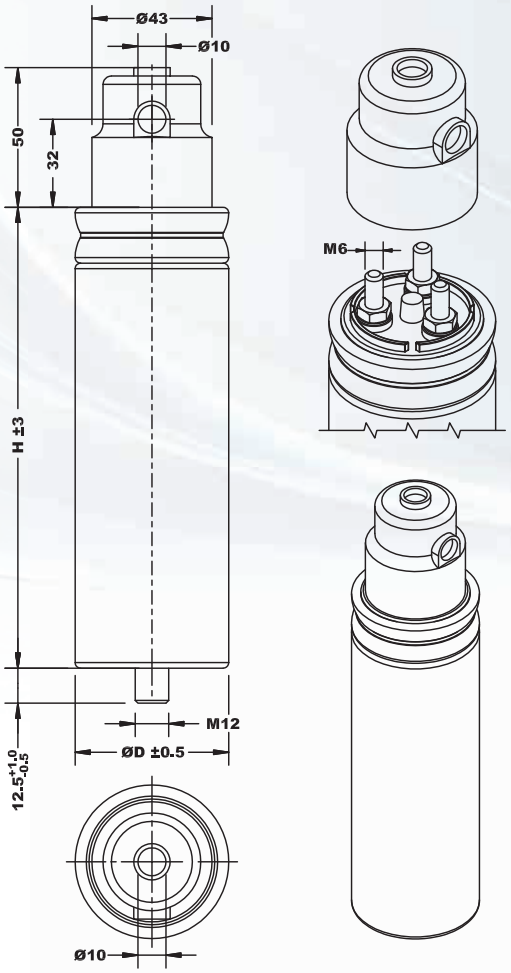
Electrical or mechanical misapplications of CRTE capacitors may become hazardous. Personal injury or property damage may result from disruption of the capacitor and consequent expulsion of melted material. Before using the capacitors in any application, please read carefully the technical information contained in this catalogue.

The energy stored in a capacitor may become lethal.
The capacitor should be short circuited and earthed before handling to prevent any chance of shock.
Special attention must be taken to make sure the capacitors are correctly used for each application and that warnings and instructions are strictly followed.
Capacitors are made with polypropylene that is a flammable material.

The risk of fire cannot be totally eliminated; therefore suitable precautions shall be taken. Reliability data have a statistical value (i.e. based on a large number of components), it is not possible to transfer automatically data from a limited quantity or even to a batch of capacitors.
This applies in particular to consequential damage caused by component failure.

Dimensions and connecting cable cross section





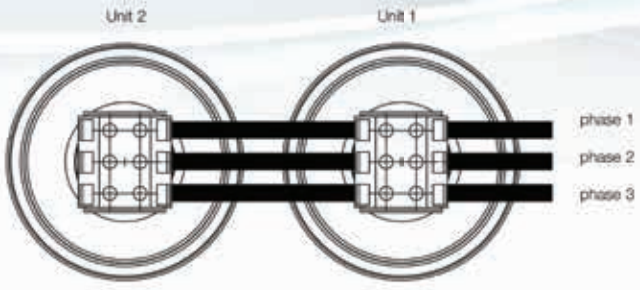
- Aluminium finishing: black painted for diameter ØD 100, ØD 116, ØD 136. naked for diameter ØD 75, ØD 85
- Terminals: 25mm² for ØD 85, ØD 100, ØD 116, ØD 136 16mm² for ØD 75
- Maximum continuative terminal current:
  25mm² 60Arms
  16mm² 35Arms
- 35mm2 75 Arms
- Degree of protection: IP20
- Creepage 19mm
- Clearance 19mm
- Humidity class: F. Max relative humidity 75% annual on average, 95% 30 days per year, condensation not permitted.

ØD1	L1	L2	HT	a
ØD 75..... 81	**39,0**	**45,0**	**32±1**	13
ØD 85..... 91	**43,5**	**49,0**	**35±1**	14
ØD 100..... 106	**43,5**	**49,0**	**35Max**	14
ØD 116..... 122	**43,5**	**49,0**	**35Max**	14
ØD 136..... 142	**43,5**	**49,0**	**35Max**	14
ØD136 (50 Kvar)..142	**52**	**63**	**50Max**	17

Max case elangation in case of over pressure disconnetor activated < 12,7 mm. Below table is a guidelines for operation in normal conditions at ambient temperature up to 40°C (or 55°C capacitor sorroundig air). Various parameter such us harmonics, temperature inside the cabinet, cable length have to be considered for proper selection.

	RATED POWER Qn [kvar]	In [A]	CROSS SECTION mm² Cu
Rated voltage 415V, 50 Hz	2,5	**3,5**	2,5
	5	**7**	2,5
	7,5	**10,5**	4
	10	**13,9**	6
	12,5	**17,4**	6
	15	**20,9**	10
	20	**27,8**	10
	25	**34,8**	16
	40	**55,6**	25
	50	**72,2**	35

Limits for parallel of CRTE capacitors



The maximum number of parallel connected units should not have a total output higher than 40kvar.
The cross section of cables in the Unit 1 (phase 1, 2, 3) have to be selected considering the total amount of the Unit 1 and Unit 2 output. **Leave enough space** to allow longitudinal expansion of the can for proper operation of the internal over pressure safety device (15 mm).
A minimum space of 20 mm between capacitors is necessary to ensure **proper cooling**.

CRT-E 230V - 50Hz

TECHNICAL CHARACTERISTICS	
Dielectric	**polypropylene metallized film**
Winding connection	**delta**
Safety device	**Internal overpressure disconnector**
Capacitance tolerance	**-5%, +10%**
Rated Voltage	**230V**
Rated Frequency	**50 Hz**
Over voltages	**According to IEC Un + 10% (up to 8 hours daily) Un + 15% (up to 30 minutes daily) Un + 20% (up to 5 minutes daily) Un + 30% (up to 1 minute daily)**
Over current (not continuative)	**2 In (including harmonics)**
Maximum inrush current	**200 In**
Insulation level	**3 / 12 kV**
Voltage test between terminals	**2,15 Un, 50Hz, 10 seconds (routine test)**
Voltage test between terminals	**3,00 Un, 50Hz, 60 seconds (type test)**
Voltage test terminals/case	**3000V, 50Hz, 10 seconds**
Dielectric losses	**< 0.2 W/kvar**
Temperature class	**-25/D**
Cooling	**Natural air of forced ventilation**
Permissible humidity	**95%**
Service life	**130.000 operating hours (hot spot 50°C)**
Service life	**100.000 operating hours (hot spot 55°C)**
Altitude above sea level	**2000 m**
Impregnation	**resin filled, PCB free**
Terminals	**Terminal board / screws (D ≤ 65mm)**
Fixing and Ground	**Threaded M12 stud on case bottom**
Mounting position	**vertical preferable for better cooling**
Protection degree	**IP20 (only D ≥ 85mm)**
Installation	**Indoor**
Discharge resistors	**Included**
Discharge time	**< 3 minutes to 75V or less**
Applicable standards	**IEC 60831-1/2**

Vn = 230V - 50Hz

PART NUMBER	MODEL	Q POWER (KVar)	C Capacity (µF)	In Current (A)	D Diameter (mm)	H Heigh (mm)	Weight (Kg)	Pcs/box	Box dimensions	Discharge resistor
CRT233100156V00	**CRT-56V-1-230 ****	1	**3 x 20**	3 x 2,5	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT233150156V00	**CRT-56V-1,5-230 ****	1,5	**3 x 30,1**	3 x 3,8	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT233200166V00	**CRT-66V-2-230 ****	2	**3 x 40,1**	3 x 5	**65**	205	**0,7**	6	**370x370x106**	Internal
CRT233250166V00	**CRT-66V-2,5-230 ****	2,5	**3 x 50,1**	3 x 6,3	**65**	205	**0,7**	6	**370x370x106**	Internal
CRE501233M50322	**CRTE08520805023**	5	**3 x 100**	3 x 12,6	**85**	208	**1,6**	4	**370x370x106**	External
CRE751233M50323	**CRTE10020807523**	7,5	**3 x 150**	3 x 18,9	**100**	208	**2**	3	**370x370x106**	External
CRE102233M50315	**CRTE10020810023**	10	**3 x 200**	3 x 25,2	**100**	208	**2**	3	**370x370x106**	External
CRE1D2233M50324	**CRTE11620812523**	12,5	**3 x 250**	3 x 31,5	**116**	208	**2,6**	3	**370x370x125**	External
CRE152233M50325	**CRTE13620815023**	15	**3 x 300**	3 x 37,6	**136**	208	**3,2**	2	**370x370x161**	External

* File number E99479
** Not UL approved

CRT-E 400/415V - 50Hz

TECHNICAL CHARACTERISTICS	
Dielectric	**polypropylene metallized film**
Winding connection	**delta**
Safety device	**Internal overpressure disconnector**
Capacitance tolerance	**-5%, +10%**
Rated Voltage	**400V/415V**
Rated Frequency	**50 Hz**
Over voltages	**According to IEC Un + 10% (up to 8 hours daily) Un + 15% (up to 30 minutes daily) Un + 20% (up to 5 minutes daily) Un + 30% (up to 1 minute daily)**
Over current (not continuative)	**2 In (including harmonics)**
Maximum inrush current	**200 In**
Insulation level	**3 / 12 kV**
Voltage test between terminals	**2,15 Un, 50Hz, 10 seconds (routine test)**
Voltage test between terminals	**3,00 Un, 50Hz, 60 seconds (type test)**
Voltage test terminals/case	**3000V, 50Hz, 10 seconds**
Dielectric losses	**< 0.2 W/kvar**
Temperature class	**-25/D**
Cooling	**Natural air of forced ventilation**
Permissible humidity	**95%**
Service life	**130.000 operating hours (hot spot 50°C)**
Service life	**100.000 operating hours (hot spot 55°C)**
Altitude above sea level	**2000 m**
Impregnation	**resin filled, PCB free**
Terminals	**Terminal board / screws (D ≤ 65mm)**
Fixing and Ground	**Threaded M12 stud on case bottom**
Mounting position	**vertical preferable for better cooling**
Protection degree	**IP20 (only D ≥ 85mm)**
Installation	**Indoor**
Discharge resistors	**Included**
Discharge time	**< 3 minutes to 75V or less**
Applicable standards	**IEC 60831-1/2**

Vn = 400V (415V) - 50Hz

PART NUMBER	MODEL	Q POWER (KVar)	C Capacity (µF)	In Current (A)	D Diameter (mm)	H Heigh (mm)	Weight (Kg)	Pcs/box	Box dimensions	Discharge resistor
CRT403100156V00	**CRT-56V-1-400 ****	1	**3 x 6,6**	3 x 1,4	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT403150156V00	**CRT-56V-1,5-400 ****	1,5	**3 x 9,9**	3 x 2,2	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT403200156V00	**CRT-56V-2-400 ****	2	**3 x 13,3**	3 x 2,9	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT403250156V00	**CRT-56V-2,5-400 ****	2,5	**3 x 16,6**	3 x 3,6	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT403300166V00	**CRT-66V-3-400 ****	3	**3 x 19,9**	3 x 4,3	**65**	205	**0,7**	6	**370x370x106**	Internal
CRT403400166V00	**CRT-66V-4-400 ****	4	**3 x 26,5**	3 x 5,8	**65**	205	**0,7**	6	**370x370x106**	Internal
CRT403500166V00	**CRT-66V-5-400 ****	5	**3 x 33,2**	3 x 7,2	**65**	205	**0,7**	6	**370x370x106**	Internal
CRE501403M50028	**CRTE07520805040**	5	**3 x 33,2**	3 x 7,2	**75**	208	**1,2**	5	**370x370x106**	External
CRE751403M50033	**CRTE07520807540**	7,5	**3 x 49,7**	3 x 10,8	**75**	208	**1,2**	5	**370x370x106**	External
CRE102403M50053	**CRTE08520810040**	10	**3 x 66,3**	3 x 14,4	**85**	208	**1,6**	4	**370x370x106**	External
CRE1D2403M50036	**CRTE08520812540**	12,5	**3 x 82,9**	3 x 18	**85**	208	**1,6**	4	**370x370x106**	External
CRE152403M50054	**CRTE10020815040**	15	**3 x 99,5**	3 x 21,7	**100**	208	**2**	3	**370x370x106**	External
CRE202403M50001	**CRTE10020820040**	20	**3 x 132,6**	3 x 28,9	**100**	208	**2**	3	**370x370x106**	External
CRE252403M50002	**CRTE11620825040**	25	**3 x 165,8**	3 x 36,1	**116**	208	**2,6**	3	**370x370x125**	External
CRE302403M50003	**CRTE11620830040**	30	**3 x 198,9**	3 x 43,3	**116**	208	**2,6**	3	**370x370x125**	External
CRE402403M50108	**CRTE13628340040 ****	40	**3 x 265,4**	3 x 57,7	**136**	283	**3,8**	2	**370x370x161**	External
CRE502403M50416	**CRTE13636050040 ****	50	**3 x 332**	3 x 72,2	**136**	360	**5,5**	2	**470x280x160**	External

* File number E99479
** Not UL approved

CRT-E 450V - 50Hz

TECHNICAL CHARACTERISTICS	
Dielectric	**polypropylene metallized film**
Winding connection	**delta**
Safety device	**Internal overpressure disconnector**
Capacitance tolerance	**-5%, +10%**
Rated Voltage	**450V**
Rated Frequency	**50 Hz**
Over voltages	**According to IEC Un + 10% (up to 8 hours daily) Un + 15% (up to 30 minutes daily) Un + 20% (up to 5 minutes daily) Un + 30% (up to 1 minute daily)**
Over current (not continuative)	**2 In (including harmonics)**
Maximum inrush current	**200 In**
Insulation level	**3 / 12 kV**
Voltage test between terminals	**2,15 Un, 50Hz, 10 seconds (routine test)**
Voltage test between terminals	**3,00 Un, 50Hz, 60 seconds (type test)**
Voltage test terminals/case	**3000V, 50Hz, 10 seconds**
Dielectric losses	**< 0.2 W/kvar**
Temperature class	**-25/D**
Cooling	**Natural air of forced ventilation**
Permissible humidity	**95%**
Service life	**130.000 operating hours (hot spot 50°C)**
Service life	**100.000 operating hours (hot spot 55°C)**
Altitude above sea level	**2000 m**
Impregnation	**resin filled, PCB free**
Terminals	**Terminal board / screws (D ≤ 65mm)**
Fixing and Ground	**Threaded M12 stud on case bottom**
Mounting position	**vertical preferable for better cooling**
Protection degree	**IP20 (only D ≥ 85mm)**
Installation	**Indoor**
Discharge resistors	**Included**
Discharge time	**< 3 minutes to 75V or less**
Applicable standards	**IEC 60831-1/2**

Vn = 450V - 50Hz EAC cULus*

PART NUMBER	MODEL	Q POWER (KVar)	C Capacity (µF)	In Current (A)	D Diameter (mm)	H Heigh (mm)	Weight (Kg)	Pcs/box	Box dimensions	Discharge resistor
CRT453100156V00	**CRT-56V-1-450 ****	1	**3 x 5,2**	3 x 1,3	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT453150156V00	**CRT-56V-1,5-450 ****	1,5	**3 x 7,9**	3 x 1,9	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT453200156V00	**CRT-56V-2-450 ****	2	**3 x 10,5**	3 x 2,6	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT453250156V00	**CRT-56V-2,5-450 ****	2,5	**3 x 13,1**	3 x 3,2	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT453300166V00	**CRT-66V-3-450 ****	3	**3 x 15,7**	3 x 3,8	**65**	205	**0,7**	6	**370x370x106**	Internal
CRT453400166V00	**CRT-66V-4-450 ****	4	**3 x 21**	3 x 5,1	**65**	205	**0,7**	6	**370x370x106**	Internal
CRT453500166V00	**CRT-66V-5-450 ****	5	**3 x 26,2**	3 x 6,4	**65**	205	**0,7**	6	**370x370x106**	Internal
CRE501453M50015	**CRTE07520805045**	5	**3 x 26,2**	3 x 6,4	**75**	208	**1,2**	5	**370x370x106**	External
CRE751453M50034	**CRTE07520807545**	7,5	**3 x 39,3**	3 x 9,6	**75**	208	**1,2**	5	**370x370x106**	External
CRE102453M50055	**CRTE08520810045**	10	**3 x 52,4**	3 x 12,8	**85**	208	**1,6**	4	**370x370x106**	External
CRE1D2453M50037	**CRTE08520812545**	12,5	**3 x 65,5**	3 x 16	**85**	208	**1,6**	4	**370x370x106**	External
CRE152453M50056	**CRTE10020815045**	15	**3 x 78,6**	3 x 19,2	**100**	208	**2**	3	**370x370x106**	External
CRE202453M50010	**CRTE10020820045**	20	**3 x 104,8**	3 x 25,7	**100**	208	**2**	3	**370x370x106**	External
CRE252453M50004	**CRTE11620825045**	25	**3 x 131**	3 x 32,1	**116**	208	**2,6**	3	**370x370x125**	External
CRE302453M50009	**CRTE11620830045**	30	**3 x 157,2**	3 x 38,5	**116**	208	**2,6**	3	**370x370x125**	External
CRE402453M50162	**CRTE13628340045 ****	40	**3 x 209,7**	3 x 51,3	**136**	283	**3,8**	2	**370x370x161**	External

* File number E99479
** Not UL approved

CRT-E 525V - 50Hz

TECHNICAL CHARACTERISTICS	
Dielectric	**polypropylene metallized film**
Winding connection	**delta**
Safety device	**Internal overpressure disconnector**
Capacitance tolerance	**-5%, +10%**
Rated Voltage	**525V**
Rated Frequency	**50 Hz**
Over voltages	**According to IEC Un + 10% (up to 8 hours daily) Un + 15% (up to 30 minutes daily) Un + 20% (up to 5 minutes daily) Un + 30% (up to 1 minute daily)**
Over current (not continuative)	**2 In (including harmonics)**
Maximum inrush current	**200 In**
Insulation level	**3 / 12 kV**
Voltage test between terminals	**2,15 Un, 50Hz, 10 seconds (routine test)**
Voltage test between terminals	**3,00 Un, 50Hz, 60 seconds (type test)**
Voltage test terminals/case	**3000V, 50Hz, 10 seconds**
Dielectric losses	**< 0.2 W/kvar**
Temperature class	**-25/D**
Cooling	**Natural air of forced ventilation**
Permissible humidity	**95%**
Service life	**130.000 operating hours (hot spot 50°C)**
Service life	**100.000 operating hours (hot spot 55°C)**
Altitude above sea level	**2000 m**
Impregnation	**resin filled, PCB free**
Terminals	**Terminal board / screws (D ≤ 65mm)**
Fixing and Ground	**Threaded M12 stud on case bottom**
Mounting position	**vertical preferable for better cooling**
Protection degree	**IP20 (only D ≥ 85mm)**
Installation	**Indoor**
Discharge resistors	**Included**
Discharge time	**< 3 minutes to 75V or less**
Applicable standards	**IEC 60831-1/2**

Vn = 525V - 50Hz

PART NUMBER	MODEL	Q POWER (KVar)	C Capacity (µF)	In Current (A)	D Diameter (mm)	H Heigh (mm)	Weight (Kg)	Pcs/box	Box dimensions	Discharge resistor
CRT523100156V00	**CRT-56V-1-525 ****	1	**3 x 3,8**	3 x 1,1	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT523150156V00	**CRT-56V-1,5-525 ****	1,5	**3 x 5,8**	3 x 1,6	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT523200156V00	**CRT-56V-2-525 ****	2	**3 x 7,7**	3 x 2,2	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT523250156V00	**CRT-56V-2,5-525 ****	2,5	**3 x 9,6**	3 x 2,7	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT523300166V00	**CRT-66V-3-525 ****	3	**3 x 11,5**	3 x 3,3	**65**	205	**0,7**	6	**370x370x106**	Internal
CRT523400166V00	**CRT-66V-4-525 ****	4	**3 x 15,4**	3 x 4,4	**65**	205	**0,7**	6	**370x370x106**	Internal
CRT523500166V00	**CRT-66V-5-525 ****	5	**3 x 19,2**	3 x 5,5	**65**	205	**0,7**	6	**370x370x106**	Internal
CRE501523M50016	**CRTE07520805052**	5	**3 x 19,2**	3 x 5,5	**75**	208	**1,2**	5	**370x370x106**	External
CRE751523M50035	**CRTE07520807552**	7,5	**3 x 28,9**	3 x 8,2	**75**	208	**1,2**	5	**370x370x106**	External
CRE102523M50057	**CRTE08520810052**	10	**3 x 38,5**	3 x 11	**85**	208	**1,6**	4	**370x370x106**	External
CRE1D2523M50038	**CRTE08520812552**	12,5	**3 x 48,1**	3 x 13,7	**85**	208	**1,6**	4	**370x370x106**	External
CRE152523M50058	**CRTE10020815052**	15	**3 x 57,7**	3 x 16,5	**100**	208	**2**	3	**370x370x106**	External
CRE202523M50021	**CRTE10020820052**	20	**3 x 77**	3 x 22	**100**	208	**2**	3	**370x370x106**	External
CRE252523M50022	**CRTE11620825052**	25	**3 x 96,2**	3 x 27,5	**116**	208	**2,6**	3	**370x370x125**	External
CRE302523M50023	**CRTE11620830052**	30	**3 x 115,5**	3 x 33	**116**	208	**2,6**	3	**370x370x125**	External
CRE402523M50079	**CRTE13620840052**	40	**3 x 154**	3 x 44	**136**	208	**3,2**	2	**370x370x161**	External
CRE502523M50428	**CRTE13636050052 ****	50	**3 x 193**	3 x 55	**136**	360	**5,5**	2	**470x280x161**	External

* File number E99479
** Not UL approved

CRT-E 690V - 50Hz

TECHNICAL CHARACTERISTICS	
Dielectric	**polypropylene metallized film**
Winding connection	**delta**
Safety device	**Internal overpressure disconnector**
Capacitance tolerance	**-5%, +10%**
Rated Voltage	**690V**
Rated Frequency	**50 Hz**
Over voltages	**According to IEC Un + 10% (up to 8 hours daily) Un + 15% (up to 30 minutes daily) Un + 20% (up to 5 minutes daily) Un + 30% (up to 1 minute daily)**
Over current (not continuative)	**2 In (including harmonics)**
Maximum inrush current	**200 In**
Insulation level	**3 / 12 kV**
Voltage test between terminals	**2,15 Un, 50Hz, 10 seconds (routine test)**
Voltage test between terminals	**3,00 Un, 50Hz, 60 seconds (type test)**
Voltage test terminals/case	**6000V, 50Hz, 10 seconds**
Dielectric losses	**< 0.2 W/kvar**
Temperature class	**-25/D**
Cooling	**Natural air of forced ventilation**
Permissible humidity	**95%**
Service life	**130.000 operating hours (hot spot 50°C)**
Service life	**100.000 operating hours (hot spot 55°C)**
Altitude above sea level	**2000 m**
Impregnation	**resin filled, PCB free**
Terminals	**Terminal board**
Fixing and Ground	**Threaded M12 stud on case bottom**
Mounting position	**vertical preferable for better cooling**
Protection degree	**IP20**
Installation	**Indoor**
Discharge resistors	**Included**
Discharge time	**< 3 minutes to 75V or less**
Applicable standards	**IEC 60831-1/2**

Vn = 690V - 50Hz

PART NUMBER	MODEL	Q POWER (KVar)	C Capacity (µF)	In Current (A)	D Diameter (mm)	H Heigh (mm)	Weight (Kg)	Pcs/box	Box dimensions	Discharge resistor
CRE501693M50163	**CRTE07520805069**	5	**3 x 11,1**	3 x 4,2	**75**	208	**1,2**	5	**370x370x106**	External
CRE751693M50164	**CRTE08520807569**	7,5	**3 x 16,7**	3 x 6,3	**85**	208	**1,6**	4	**370x370x106**	External
CRE102693M50165	**CRTE10020810069**	10	**3 x 22,3**	3 x 8,4	**100**	208	**2**	3	**370x370x106**	External
CRE1D2693M50166	**CRTE10020812569**	12,5	**3 x 27,9**	3 x 10,5	**100**	208	**2**	3	**370x370x106**	External
CRE152693M50167	**CRTE11620815069**	15	**3 x 33,4**	3 x 12,5	**116**	208	**2,6**	3	**370x370x125**	External
CRE202693M50168	**CRTE11620820069**	20	**3 x 44,6**	3 x 16,7	**116**	208	**2,6**	3	**370x370x125**	External
CRE252693M50111	**CRTE13620825069**	25	**3 x 55,7**	3 x 20,9	**136**	208	**3,2**	2	**370x370x161**	External
CRE302693M50006	**CRTE11628330069**	30	**3 x 66,9**	3 x 25,1	**116**	283	**3,2**	3	**370x370x125**	External
CRE402693M50169	**CRTE13628340069**	40	**3 x 89,2**	3 x 33,5	**136**	283	**3,8**	2	**370x370x161**	External

CRT-E 750V - 50Hz

TECHNICAL CHARACTERISTICS	
Dielectric	**polypropylene metallized film**
Winding connection	**delta**
Safety device	**Internal overpressure disconnector**
Capacitance tolerance	**-5%, +10%**
Rated Voltage	**750V**
Rated Frequency	**50 Hz**
Over voltages	**According to IEC Un + 10% (up to 8 hours daily) Un + 15% (up to 30 minutes daily) Un + 20% (up to 5 minutes daily) Un + 30% (up to 1 minute daily)**
Over current (not continuative)	**2 In (including harmonics)**
Maximum inrush current	**200 In**
Insulation level	**3 / 12 kV**
Voltage test between terminals	**2,15 Un, 50Hz, 10 seconds (routine test)**
Voltage test between terminals	**3,00 Un, 50Hz, 60 seconds (type test)**
Voltage test terminals/case	**6000V, 50Hz, 10 seconds**
Dielectric losses	**< 0.2 W/kvar**
Temperature class	**-25/D**
Cooling	**Natural air of forced ventilation**
Permissible humidity	**95%**
Service life	**130.000 operating hours (hot spot 50°C)**
Service life	**100.000 operating hours (hot spot 55°C)**
Altitude above sea level	**2000 m**
Impregnation	**resin filled, PCB free**
Terminals	**Terminal board**
Fixing and Ground	**Threaded M12 stud on case bottom**
Mounting position	**vertical preferable for better cooling**
Protection degree	**IP20**
Installation	**Indoor**
Discharge resistors	**Included**
Discharge time	**< 3 minutes to 75V or less**
Applicable standards	**IEC 60831-1/2**

Vn = 750V - 50Hz

PART NUMBER	MODEL	Q POWER (KVar)	C Capacity (µF)	In Current (A)	D Diameter (mm)	H Heigh (mm)	Weight (Kg)	Pcs/box	Box dimensions	Discharge resistor
CRE501753M50170	**CRTE07520805075**	5	**3 x 9,4**	3 x 3,8	**75**	208	**1,2**	5	**370x370x106**	External
CRE751753M50171	**CRTE08520807575**	7,5	**3 x 14,1**	3 x 5,8	**85**	208	**1,6**	4	**370x370x106**	External
CRE102753M50172	**CRTE10020810075**	10	**3 x 18,9**	3 x 7,7	**100**	208	**2**	3	**370x370x106**	External
CRE1D2753M50173	**CRTE11620812575**	12,5	**3 x 23,6**	3 x 9,6	**116**	208	**2,6**	3	**370x370x125**	External
CRE152753M50174	**CRTE11620815075**	15	**3 x 28,3**	3 x 11,5	**116**	208	**2,6**	3	**370x370x125**	External
CRE202753M50175	**CRTE13620820075**	20	**3 x 37,7**	3 x 15,4	**136**	208	**3,2**	2	**370x370x161**	External
CRE252753M50042	**CRTE11628325075**	25	**3 x 47,2**	3 x 19,2	**116**	283	**3,2**	3	**370x370x125**	External
CRE302753M50176	**CRTE13628330075**	30	**3 x 56,6**	3 x 23,1	**136**	283	**3,8**	2	**370x370x161**	External
CRE352753M50177	**CRTE13628335075**	35	**3 x 66**	3 x 26,9	**136**	283	**3,8**	2	**370x370x161**	External

CRT-E 800V - 50Hz

TECHNICAL CHARACTERISTICS	
Dielectric	**polypropylene metallized film**
Winding connection	**delta**
Safety device	**Internal overpressure disconnector**
Capacitance tolerance	**-5%, +10%**
Rated Voltage	**800V**
Rated Frequency	**50 Hz**
Over voltages	**According to IEC Un + 10% (up to 8 hours daily) Un + 15% (up to 30 minutes daily) Un + 20% (up to 5 minutes daily) Un + 30% (up to 1 minute daily)**
Over current (not continuative)	**2 In (including harmonics)**
Maximum inrush current	**200 In**
Insulation level	**3 / 12 kV**
Voltage test between terminals	**2,15 Un, 50Hz, 10 seconds (routine test)**
Voltage test between terminals	**3,00 Un, 50Hz, 60 seconds (type test)**
Voltage test terminals/case	**6000V, 50Hz, 10 seconds**
Dielectric losses	**< 0.2 W/kvar**
Temperature class	**-25/D**
Cooling	**Natural air of forced ventilation**
Permissible humidity	**95%**
Service life	**130.000 operating hours (hot spot 50°C)**
Service life	**100.000 operating hours (hot spot 55°C)**
Altitude above sea level	**2000 m**
Impregnation	**resin filled, PCB free**
Terminals	**Terminal board**
Fixing and Ground	**Threaded M12 stud on case bottom**
Mounting position	**vertical preferable for better cooling**
Protection degree	**IP20**
Installation	**Indoor**
Discharge resistors	**Included**
Discharge time	**< 3 minutes to 75V or less**
Applicable standards	**IEC 60831-1/2**

Vn = 800V - 50Hz

PART NUMBER	MODEL	Q POWER (KVar)	C Capacity (µF)	In Current (A)	D Diameter (mm)	H Heigh (mm)	Weight (Kg)	Pcs/box	Box dimensions	Discharge resistor
CRE501803M50178	**CRTE08520805080**	5	**3 x 8,3**	3 x 3,6	**85**	208	**1,6**	4	**370x370x106**	External
CRE751803M50044	**CRTE10020807580**	7,5	**3 x 12,4**	3 x 5,4	**100**	208	**2**	3	**370x370x106**	External
CRE102803M50179	**CRTE10020810080**	10	**3 x 16,6**	3 x 7,2	**100**	208	**2,6**	3	**370x370x106**	External
CRE1D2803M50180	**CRTE11620812580**	12,5	**3 x 20,7**	3 x 9	**116**	208	**2,6**	3	**370x370x125**	External
CRE152803M50181	**CRTE13620815080**	15	**3 x 24,9**	3 x 10,8	**136**	208	**3,2**	2	**370x370x161**	External
CRE202803M50182	**CRTE13620820080**	20	**3 x 33,2**	3 x 14,4	**136**	208	**3,2**	2	**370x370x161**	External
CRE252803M50183	**CRTE13628325080**	25	**3 x 41,5**	3 x 18	**136**	283	**3,8**	2	**370x370x161**	External
CRE302803M50184	**CRTE13628330080**	30	**3 x 49,8**	3 x 21,6	**136**	283	**3,8**	2	**370x370x161**	External

CRT-E 230V- 60Hz

TECHNICAL CHARACTERISTICS	
Dielectric	**polypropylene metallized film**
Winding connection	**delta**
Safety device	**Internal overpressure disconnector**
Capacitance tolerance	**-5%, +10%**
Rated Voltage	**230V**
Rated Frequency	**60 Hz**
Over voltages	**According to IEC Un + 10% (up to 8 hours daily) Un + 15% (up to 30 minutes daily) Un + 20% (up to 5 minutes daily) Un + 30% (up to 1 minute daily)**
Over current (not continuative)	**2 In (including harmonics)**
Maximum inrush current	**200 In**
Insulation level	**3 / 12 kV**
Voltage test between terminals	**2,15 Un, 50Hz, 10 seconds (routine test)**
Voltage test between terminals	**3,00 Un, 50Hz, 60 seconds (type test)**
Voltage test terminals/case	**3000V, 50Hz, 10 seconds**
Dielectric losses	**< 0.2 W/kvar**
Temperature class	**-25/D**
Cooling	**Natural air of forced ventilation**
Permissible humidity	**95%**
Service life	**130.000 operating hours (hot spot 50°C)**
Service life	**100.000 operating hours (hot spot 55°C)**
Altitude above sea level	**2000 m**
Impregnation	**resin filled, PCB free**
Terminals	**Terminal board / screws (D ≤ 65mm)**
Fixing and Ground	**Threaded M12 stud on case bottom**
Mounting position	**vertical preferable for better cooling**
Protection degree	**IP20 (only D ≥ 85mm)**
Installation	**Indoor**
Discharge resistors	**Included**
Discharge time	**< 3 minutes to 75V or less**
Applicable standards	**IEC 60831-1/2**

Vn = 230V - 60Hz

PART NUMBER	MODEL	Q POWER (KVar)	C Capacity (µF)	In Current (A)	D Diameter (mm)	H Heigh (mm)	Weight (Kg)	Pcs/box	Box dimensions	Discharge resistor
CRT233120156V60	**CRT-56V-1,2-230/60 ****	1,2	**3 x 20**	3 x 3	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT233180156V60	**CRT-56V-1,8-230/60 ****	1,8	**3 x 30,1**	3 x 4,5	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT133240166V60	**CRT-66V-2,4-230/60 ****	2,4	**3 x 40,1**	3 x 6	**65**	205	**0,7**	6	**370x370x106**	Internal
CRT233300166V60	**CRT-66V-3-230/60 ****	3	**3 x 50,1**	3 x 7,5	**65**	205	**0,7**	6	**370x370x106**	Internal
CRE601233M60059	**CRTE08520806023/60**	6	**3 x 100**	3 x 15	**85**	208	**1,6**	4	**370x370x106**	External
CRE901233M60060	**CRTE10020809023/60**	9	**3 x 150**	3 x 22,6	**100**	208	**2**	3	**370x370x106**	External
CRE122233M60031	**CRTE10020812023/60**	12	**3 x 200**	3 x 30	**100**	208	**2**	3	**370x370x106**	External
CRE152233M60032	**CRTE11620815023/60**	15	**3 x 250**	3 x 37,6	**116**	208	**2,6**	3	**370x370x125**	External
CRE182233M60186	**CRTE13620818023/60**	18	**3 x 300**	3 x 45,2	**136**	208	**3,2**	2	**370x370x161**	External

* File number E99479
** Not UL approved

CRT-E 400V - 60Hz

TECHNICAL CHARACTERISTICS	
Dielectric	**polypropylene metallized film**
Winding connection	**delta**
Safety device	**Internal overpressure disconnector**
Capacitance tolerance	**-5%, +10%**
Rated Voltage	**400V**
Rated Frequency	**60 Hz**
Over voltages	**According to IEC Un + 10% (up to 8 hours daily) Un + 15% (up to 30 minutes daily) Un + 20% (up to 5 minutes daily) Un + 30% (up to 1 minute daily)**
Over current (not continuative)	**2 In (including harmonics)**
Maximum inrush current	**200 In**
Insulation level	**3 / 12 kV**
Voltage test between terminals	**2,15 Un, 50Hz, 10 seconds (routine test)**
Voltage test between terminals	**3,00 Un, 50Hz, 60 seconds (type test)**
Voltage test terminals/case	**3000V, 50Hz, 10 seconds**
Dielectric losses	**< 0.2 W/kvar**
Temperature class	**-25/D**
Cooling	**Natural air of forced ventilation**
Permissible humidity	**95%**
Service life	**130.000 operating hours (hot spot 50°C)**
Service life	**100.000 operating hours (hot spot 55°C)**
Altitude above sea level	**2000 m**
Impregnation	**resin filled, PCB free**
Terminals	**Terminal board / screws (D ≤ 65mm)**
Fixing and Ground	**Threaded M12 stud on case bottom**
Mounting position	**vertical preferable for better cooling**
Protection degree	**IP20**
Installation	**Indoor**
Discharge resistors	**Included**
Discharge time	**< 3 minutes to 75V or less**
Applicable standards	**IEC 60831-1/2**

Vn = 400V - 60Hz

PART NUMBER	MODEL	Q POWER (KVar)	C Capacity (µF)	In Current (A)	D Diameter (mm)	H Heigh (mm)	Weight (Kg)	Pcs/box	Box dimensions	Discharge resistor
CRE501403M60432	**CRT-E-75208-5-400 60Hz**	5	**3 x 27,6**	3 x 7,2	**75**	208	**1,2**	5	**370x370x106**	External
CRE102403M60433	**CRT-E-85208-10-400 60Hz**	10	**3 x 55,3**	3 x 14,4	**85**	208	**1,6**	4	**370x370x106**	External
CRE1D2403M60431	**CRT-E-100208-12,5-400 60Hz**	12,5	**3 x 69,1**	3 x 18	**100**	208	**2**	3	**370x370x106**	External
CRE152403M60430	**CRT-E-100208-15-400 60Hz**	15	**3 x 82,9**	3 x 21,7	**100**	208	**2**	3	**370x370x106**	External
CRE252403M60404	**CRT-E-116208-25-400 60Hz**	25	**3 x 138,2**	3 x 36,1	**116**	208	**2,6**	3	**370x370x125**	External
CRE302403M60395	**CRT-E-136208-30-400 60Hz**	30	**3 x 165,9**	3 x 43,3	**136**	208	**3,2**	2	**370x370x161**	External

CRT-E 480V - 60Hz

TECHNICAL CHARACTERISTICS	
Dielectric	**polypropylene metallized film**
Winding connection	**delta**
Safety device	**Internal overpressure disconnector**
Capacitance tolerance	**-5%, +10%**
Rated Voltage	**480V**
Rated Frequency	**60 Hz**
Over voltages	**According to IEC Un + 10% (up to 8 hours daily) Un + 15% (up to 30 minutes daily) Un + 20% (up to 5 minutes daily) Un + 30% (up to 1 minute daily)**
Over current (not continuative)	**2 In (including harmonics)**
Maximum inrush current	**200 In**
Insulation level	**3 / 12 kV**
Voltage test between terminals	**2,15 Un, 50Hz, 10 seconds (routine test)**
Voltage test between terminals	**3,00 Un, 50Hz, 60 seconds (type test)**
Voltage test terminals/case	**3000V, 50Hz, 10 seconds**
Dielectric losses	**< 0.2 W/kvar**
Temperature class	**-25/D**
Cooling	**Natural air of forced ventilation**
Permissible humidity	**95%**
Service life	**130.000 operating hours (hot spot 50°C)**
Service life	**100.000 operating hours (hot spot 55°C)**
Altitude above sea level	**2000 m**
Impregnation	**resin filled, PCB free**
Terminals	**Terminal board /screws (D ≤ 65mm)**
Fixing and Ground	**Threaded M12 stud on case bottom**
Mounting position	**vertical preferable for better cooling**
Protection degree	**IP20 (only D ≥ 85mm)**
Installation	**Indoor**
Discharge resistors	**Included**
Discharge time	**< 3 minutes to 75V or less**
Applicable standards	**IEC 60831-1/2**

Vn = 480V - 60Hz

PART NUMBER	MODEL	Q POWER (KVar)	C Capacity (µF)	In Current (A)	D Diameter (mm)	H Heigh (mm)	Weight (Kg)	Pcs/box	Box dimensions	Discharge resistor
CRT483100156V60	**CRT-56V-1-480/60 ****	1	**3 x 3,8**	3 x 1,2	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT483150156V60	**CRT-56V-1,5-480/60 ****	1,5	**3 x 5,8**	3 x 1,8	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT483200156V60	**CRT-56V-2-480/60 ****	2	**3 x 7,7**	3 x 2,4	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT483250156V60	**CRT-56V-2,5-480/60 ****	2,5	**3 x 9,6**	3 x 3	**55**	165	**0,5**	30	**370x370x245**	Internal
CRT483300166V60	**CRT-66V-3-480/60 ****	3	**3 x 11,5**	3 x 3,6	**65**	205	**0,7**	6	**370x370x106**	Internal
CRT483400166V60	**CRT-66V-4-480/60 ****	4	**3 x 15,4**	3 x 4,8	**65**	205	**0,7**	6	**370x370x106**	Internal
CRT483500166V60	**CRT-66V-5-480/60 ****	5	**3 x 19,2**	3 x 6	**65**	205	**0,7**	6	**370x370x106**	Internal
CRE501483M60085	**CRTE07520805048/60**	5	**3 x 19,2**	3 x 6	**75**	208	**1,2**	5	**370x370x106**	External
CRE751483M60086	**CRTE07520807548/60**	7,5	**3 x 28,9**	3 x 9	**75**	208	**1,2**	5	**370x370x106**	External
CRE102483M60087	**CRTE08520810048/60**	10	**3 x 38,5**	3 x 12	**85**	208	**1,6**	4	**370x370x106**	External
CRE1D2483M60088	**CRTE08520812548/60**	12,5	**3 x 48,1**	3 x 15	**85**	208	**1,6**	4	**370x370x106**	External
CRE152483M60089	**CRTE10020815048/60**	15	**3 x 57,7**	3 x 18	**100**	208	**2**	3	**370x370x106**	External
CRE202483M60090	**CRTE10020820048/60**	20	**3 x 77**	3 x 24,1	**100**	208	**2**	3	**370x370x106**	External
CRE252483M60091	**CRTE11620825048/60**	25	**3 x 96,2**	3 x 30,1	**116**	208	**2,6**	3	**370x370x125**	External
CRE302483M60092	**CRTE11620830048/60**	30	**3 x 115,5**	3 x 36,1	**116**	208	**2,6**	3	**370x370x125**	External
CRE402483M60198	**CRTE13620840048/60**	40	**3 x 154**	3 x 48,1	**136**	208	**3,2**	2	**370x370x161**	External
CRE502483M60429	**CRTE13636050048/60**	50	**3 x 192**	3 x 60,1	**136**	360	**5,5**	2	**470x280x161**	External

* File number E99479
** Not UL approved

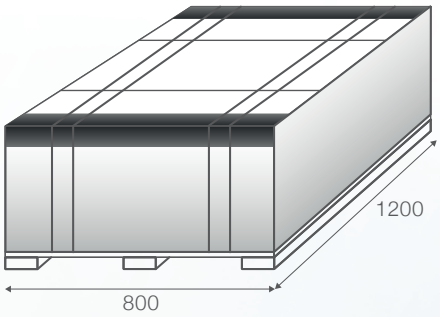
CRT-E 600V - 60Hz

TECHNICAL CHARACTERISTICS	
Dielectric	**polypropylene metallized film**
Winding connection	**delta**
Safety device	**Internal overpressure disconnector**
Capacitance tolerance	**-5%, +10%**
Rated Voltage	**600V**
Rated Frequency	**60 Hz**
Over voltages	**According to IEC Un + 10% (up to 8 hours daily) Un + 15% (up to 30 minutes daily) Un + 20% (up to 5 minutes daily) Un + 30% (up to 1 minute daily)**
Over current (not continuative)	**2 In (including harmonics)**
Maximum inrush current	**200 In**
Insulation level	**3 / 12 kV**
Voltage test between terminals	**2,15 Un, 50Hz, 10 seconds (routine test)**
Voltage test between terminals	**3,00 Un, 50Hz, 60 seconds (type test)**
Voltage test terminals/case	**3000V, 50Hz, 10 seconds**
Dielectric losses	**< 0.2 W/kvar**
Temperature class	**-25/D**
Cooling	**Natural air of forced ventilation**
Permissible humidity	**95%**
Service life	**130.000 operating hours (hot spot 50°C)**
Service life	**100.000 operating hours (hot spot 55°C)**
Altitude above sea level	**2000 m**
Impregnation	**resin filled, PCB free**
Terminals	**Terminal board / screws (D ≤ 65mm)**
Fixing and Ground	**Threaded M12 stud on case bottom**
Mounting position	**vertical preferable for better cooling**
Protection degree	**IP20**
Installation	**Indoor**
Discharge resistors	**Included**
Discharge time	**< 3 minutes to 75V or less**
Applicable standards	**IEC 60831-1/2**

Vn = 600V - 60Hz

PART NUMBER	MODEL	Q POWER (KVar)	C Capacity (µF)	In Current (A)	D Diameter (mm)	H Heigh (mm)	Weight (Kg)	Pcs/box	Box dimensions	Discharge resistor
CRE501603M60440	**CRTE07520805060/60**	5	**3 x 12,3**	3 x 4,8	**75**	208	**1,2**	5	**370x370x106**	External
CRE102603M60441	**CRTE10020810060/60**	10	**3 x 24,6**	3 x 9,6	**100**	208	**2**	3	**370x370x106**	External
CRE152603M60442	**CRTE11620815060/60**	15	**3 x 36,9**	3 x 14,4	**116**	208	**2,6**	3	**370x370x125**	External
CRE202603M60443	**CRTE13620820060/60**	20	**3 x 49,1**	3 x 19,2	**136**	208	**3,2**	2	**370x370x161**	External
CRE252603M60444	**CRTE11628325060/60**	25	**3 x 61,4**	3 x 24,1	**116**	283	**3,2**	3	**370x370x125**	External
CRE302603M60445	**CRTE13628330060/60**	30	**3 x 73,7**	3 x 28,9	**136**	283	**3,8**	2	**370x370x161**	External

Packing details: CRTE Capacitors



WOODEN FRAME ON STANDARD EURO-PALLET
(FUMIGATED IF REQUIRED)

CRTE Capacitor diameter (mm)	Number of Capacitors per box	Number of Capacitors per pallet/box	Package height H (mm)
75	**5**	180	**900**
85	**4**	144	**900**
100	**3**	108	**900**
116	**3**	108	**1050**
136	**2**	60	**1050**
136 (50 Kvar)	**2**	40	**1000**

CHAPTER 3

Harmonic blocking reactors

The growing use of power electronic devices is causing an increasing level of harmonic distortion in the electrical systems, which frequently leads to problems with capacitor installations. This is the reason why energy suppliers and actual conditions require the usage of harmonic blocking reactors.
A detuned capacitor system works out the function of power factor correction whilst preventing any amplification of harmonic currents and voltages caused by resonance between capacitor and inductance impedances of the electrical system.
By adding an appropriately rated series reactor to the power capacitor, both elements form a low-pass resonant circuit (usually below the 5th) which prevents higher order harmonics to flow into capacitors.
ICAR harmonic blocking reactors are made of high-class transformer sheets and aluminiun or copper coils.
They are fully manufactured at our premises, dried and impregnated in a vacuum with environmentally-friendly, low-styrole resin which ensures high voltage withstand, low noise levels, and enjoys a long operating life.

PARAMETERS AND SELECTION

Coupling of Capacitors and Reactors

Combination of capacitors and reactors is a delicate procedure which has to be properly done. The scheme ICAR is proposing in following pages comes from its experience in the Automatic Power Factor Correction systems design and manufacturing and it considers all of the aspects involved, such as:
Voltage increase across capacitor terminals

- Allowable harmonic overload of reactors and capacitors
- Actual reactive power output

It is then warmly recommended to respect the proposed coupling of capacitance and reactance, as well as capacitor rated voltage.

Detuning frequency [f_N]

Harmonic blocking reactor choice is based on the actual harmonic current spectrum; the most relevant and lowest harmonic current determines the harmonic blocking frequency, hence the reactor selection.
In detail

- 140Hz will be used if THD in current is substantial higher than 60%,
- 189Hz or 215Hz will be used if THD in current is up to 60%.

Rated inductance [l]

Inductance rating of reactor, measured at rated current In, epressed in mH (Milli-Henry) is the main component feature.

Capacitance [C]

It comes from the delta connection of three single phase capacitive elements. Stated value is the multiple by three of each element and it expressed in µF (micro Farad).

Capacitor Rated voltage [v]

The series connection of capacitor and reactor causes a voltage rise at the capacitor terminals as described by the following formula which must be considered when selecting a capacitor for the case.

$$U_c = \frac{U_N}{[1- \frac{p}{100\%}]}$$

where

$$p = 100\% \cdot \frac{X_L}{X_C}$$

examples:

Detung factor p	Resonance frequency Fr	
	F_N = 50 Hz	F_N = 60 Hz
5,67 %	210 Hz	227 Hz
7 %	189 Hz	252 Hz
14 %	134 Hz	160 Hz

Rated capacitor power [Q]

The rated capacitor output is defined as the power the capacitor can generate if supplied at rated voltage; it is important to follow the manufacturer recommendation in terms of voltage selection.
This parameter also makes easier the selection of proper CRTE capacitor in series to reactor.

Real output [Qc]

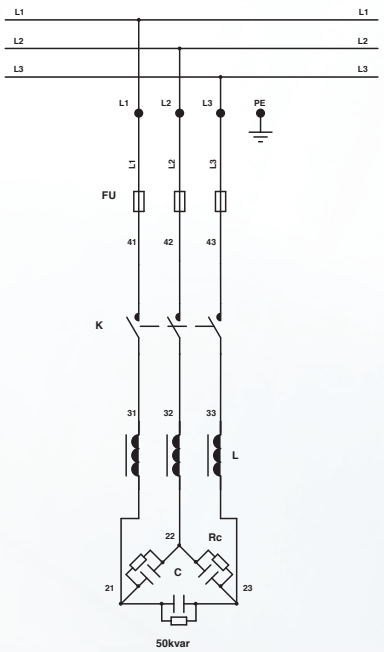
Actual capacitor output is increased respect to the rated value by the higher voltage at capacitor terminals.
However this effect is already incorporated in the table Qc Reactive Power.

RMS Current Ieff [I_{rms}]

Actual load flowing on the reactor in permanent operation, it is composed by the fundamental wave plus harmonic currents. Component selections described in this catalogue are made in respect to the maximum reactor and capacitor allowed manufacturer limits.

RECOMMENDED CONNECTING SCHEME

Reactors shown in this catalogue are designed for the following scheme of wiring.



INSTALLATION AND MAINTENANCE

Handling and Storage

Reactors shall have to be handled and stored with care in order to avoid any mechanical damage during transportation. Protection against environmental influences shall also be taken.

Installation

Reactors are suitable for indoor installation and for vertical position. Reactors must be installed in such a way that the specified limit temperature is not overcome.
Not being in compliance with the above instructions will result as a reduction of the expected service life.

Assembly

Total losses are sum of all iron, winding, and stray field losses at max. specified over voltage and harmonic content. Depending on the detuning factor, actual dissipation power of our reactors is between 4 and 6W/kvar.
While using capacitors and reactors within a capacitor bank, suitable means for heat dissipation and cooling of components shall be taken.
A minimum 20mm distance between the units has to be maintained.

Maintenance

Periodical checks and inspections are required to ensure reliable operation of reactors.
Monitoring and recording of the electrical service parameters are also recommended to become acquainted with progressive reactors stress conditions.

Protections

Temperature Switch All reactors are provided with a separate screw terminal for the temperature switch (opening switch) which is located inside everyl coil.
These leads shall be wired in series to contactor coils to switch off in case of over load.

SAFETY INSTRUCTIONS

DO NOT MISAPPLY REACTORS FOR POWER FACTOR CORRECTION APPLICATIONS
To prevent damage to people and goods due to improper usage and/or application of reactors, the “RECOMMENDATION FOR THE SAFE USE OF STATIC CAPACITORS, BANKS AND EQUIPMENT FOR POWERFACTOR CORRECTION”. Published by ANIE shall have to be strictly respected. ICAR is not responsible for any kind of possible damages occurred to people or things, derived from the improper installation and application of Power Factor Correction capacitors and reactors.

Most common misapplication forms

Current, voltage, harmonics and frequency above specification;

- Working or storage temperature beyond the specified limits;
- Unusual service conditions as mechanical shock and vibrations, corrosive or abrasive conductive parts in cooling air, oil or water vapour or corrosive substances, explosive gas or dust, radioactivity, excessive and fast variations of ambient conditions, service areas higher than 2000 m above sea level...

In case of doubt in choice or in performances of the capacitors and reactors ICAR technical service MUST be contacted.

Personal Safety

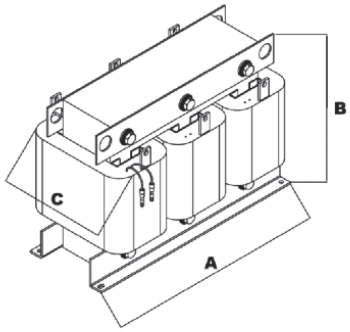
Electrical or mechanical misapplications of Harmonic Blocking Reactors capacitors may become hazardous.
Special attention must be taken to make sure the reactors are correctly used for each application and that warnings and instructions are strictly followed. Reactors are made not only but also with iron, aluminium, paper and resin that are partially flammable materials. The risk of fire cannot be totally eliminated; therefore suitable precautions shall be taken. Reliability data quoted by ICAR should be considered as statistical i.e. based on a number of components, and does not guarantee properties or performance in the legal sense. ICAR liability is limited to the replacement of defective components. This applies in particular to consequential damage caused by component failure.

U_N	f	f_N	P
400V	50Hz	215 Hz	5,4%

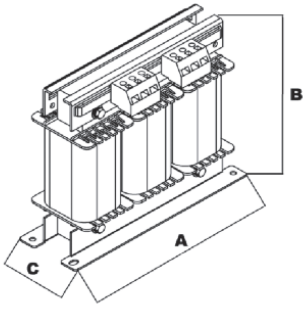
5,4% 400V - 50Hz Reactors

TECHNICAL CHARACTERISTICS	
Applicable standards	**IEC 60076-6**
Rated voltages	**230...690V**
Rated frequencies	**50 Hz**
Tolerance of inductance	**±5%(mean value across three phases)**
Linearity	**I lin= 1.6…1,8 In**
Insulation (winding-core)	**3 kV**
Temperature class	**F (155°C)**
Maximum Ambient Temperature	**40°C**
Protection class	**IP00 indoor mounting**
Humidity	**95%**
Cooling	**natural**
Design	**Three phase, iron core double air gap**
Winding material	**Aluminium foil/copper wires**
Impregnation	**Polyester resin, class H**
Terminals	**Terminal blocks, or cable lugs.**
Temperature Switch	**All reactors are provided with a separate screw terminal for the temperature switch (opening switch) which is located inside every coil**
Switching temperature	**140°C**
Voltage	**250Vac (<5A)**
Tolerance	**±5K**

PART NUMBER	Qc at 400V (kvar)	L (mH)	Irms (A)	Material	Dimensions (AxBxC) (mm)	Weight (Kg)	Qc at rated voltage (kvar)	Capacitor rated voltage (V)	Capacitance (µF)
46015810	**5**	5,8	**8**	copper	**205x167x68**	7	**7,5**	450	**112,5**
46012910	**10**	2,9	**16**	copper	**205x164x68**	8,6	**12,5**	450	**196**
46012401	**12,5**	2,4	**19**	copper	**205x184x68**	6	**15**	450	**236**
46011451	**20**	1,45	**32**	copper	**205x184x88**	9,5	**25**	450	**393**
46011452	**25**	1,22	**39**	copper	**180x180x170**	11,6	**30**	450	**471**
PRG0030DAB57579	**40**	0,73	**64,3**	aluminium	**320x220x120**	18	**50**	450	**786**
PRG0039DAB57871	**50**	0,6	**78**	aluminium	**340x220x135**	20	**60**	450	**942**



ALUMINIUM



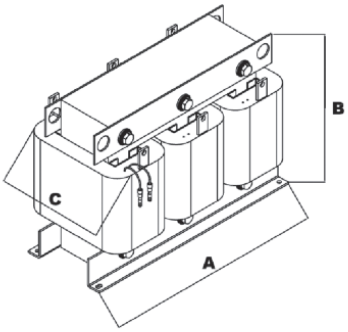
COPPER

7% 400V - 50Hz Reactors

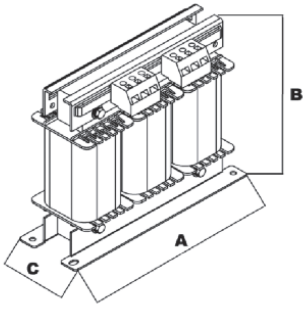
U_N	f	f_N	P
400V	50Hz	189 Hz	7%

TECHNICAL CHARACTERISTICS	
Applicable standards	**IEC 60076-6**
Rated voltages	**230...690V**
Rated frequencies	**50 Hz**
Tolerance of inductance	**±5%(mean value across three phases)**
Linearity	**I lin= 1.6…1.8 In**
Insulation (winding-core)	**3 kV**
Temperature class	**F (155°C)**
Maximum Ambient Temperature	**40°C**
Protection class	**IP00 indoor mounting**
Humidity	**95%**
Cooling	**natural**
Design	**Three phase, iron core double air gap**
Winding material	**Aluminium foil/copper wires**
Impregnation	**Polyester resin, class H**
Terminals	**Terminal blocks, or cable lugs.**
Temperature Switch	**All reactors are provided with a separate screw terminal for the temperature switch (opening switch) which is located inside every coil**
Switching temperature	**140°C**
Voltage	**250Vac (<5A)**
Tolerance	**±5K**

PART NUMBER	Qc at 400V (kvar)	L (mH)	Irms (A)	Material	Dimensions (AxBxC) (mm)	Weight (Kg)	Qc at rated voltage (kvar)	Capacitor rated voltage (V)	Capacitance (µF)
4618300	**5**	8,3	**8**	copper	**205x170x65**	6,0	**7,5**	450	**112,5**
46014200	**10**	4,2	**17**	copper	**205x181x79**	7,7	**12,5**	450	**196**
46014201	**12,5**	3,03	**21**	copper	**180x180x150**	11	**15**	450	**236**
PRG0028DAB57538	**20**	1,73	**40**	aluminium	**320x220x120**	17	**25**	450	**393**
PRG0025DAB57568	**25**	1,572	**39,5**	aluminium	**320x220x120**	17	**30**	450	**471**
PRG0056DAB57524	**40**	0,865	**80**	aluminium	**320x220x145**	26	**50**	450	**786**
PRG0050DAB57567	**50**	0,786	**79**	aluminium	**320x220x140**	26	**60**	450	**942**



ALUMINIUM



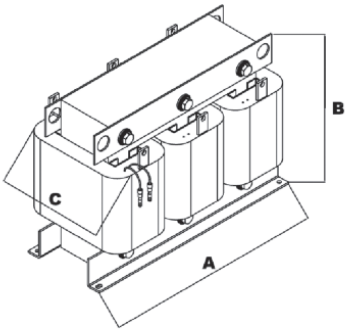
COPPER

U_N	f	f_N	P
400V	50Hz	134 Hz	14%

14% 400V - 50Hz Reactors

TECHNICAL CHARACTERISTICS	
Applicable standards	**IEC 60076-6**
Rated voltages	**230...690V**
Rated frequencies	**50 Hz**
Tolerance of inductance	**±5%(mean value across three phases)**
Linearity	**I lin= 1.6…1.8 In**
Insulation (winding-core)	**3 kV**
Temperature class	**F (155°C)**
Maximum Ambient Temperature	**40°C**
Protection class	**IP00 indoor mounting**
Humidity	**95%**
Cooling	**natural**
Design	**Three phase, iron core double air gap**
Winding material	**Aluminium foil/copper wires**
Impregnation	**Polyester resin, class H**
Terminals	**Terminal blocks, or cable lugs.**
Temperature Switch	**All reactors are provided with a separate screw terminal for the temperature switch (opening switch) which is located inside every coil**
Switching temperature	**140°C**
Voltage	**250Vac (<5A)**
Tolerance	**±5K**

PART NUMBER	Qc at 400V (kvar)	L (mH)	Irms (A)	Material	Dimensions (AxBxC) (mm)	Weight (Kg)	Qc at rated voltage (kvar)	Capacitor rated voltage (V)	Capacitance (µF)
46021480	**5**	14,8	**9**	copper	**205x170x78**	7,4	**7,5**	525	**87**
46017400	**10**	7,4	**18**	copper	**205x180x113**	12,8	**15**	525	**173**
46016300	**12,5**	6,3	**19**	copper	**205x170x113**	13,5	**20**	525	**231**
PRG0042DAB57551	**20**	3,7	**35**	aluminium	**320x220x130**	21	**30**	525	**345**
PRG0047DAB57427	**25**	3,13	**38**	aluminium	**320x220x135**	22	**35**	525	**404**
PRG0078DAB57592	**40**	2,056	**63**	aluminium	**320x220x165**	34	**60**	525	**692**
PRG0093DAB57418	**50**	1,57	**77**	aluminium	**380x215x165**	37	**75**	525	**865**



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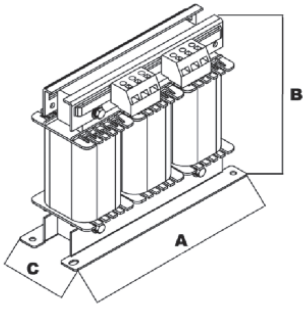


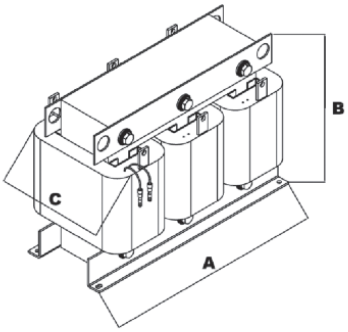
COPPER

7% 380V - 60Hz Reactors

U_N	f	f_N	P
380V	60Hz	252 Hz	7%

TECHNICAL CHARACTERISTICS	
Applicable standards	**IEC 60076-6**
Rated voltages	**230...690V**
Rated frequencies	**50 Hz**
Tolerance of inductance	**±5%(mean value across three phases)**
Linearity	**I lin= 1.6…1.8 In**
Insulation (winding-core)	**3 kV**
Temperature class	**F (155°C)**
Maximum Ambient Temperature	**40°C**
Protection class	**IP00 indoor mounting**
Humidity	**95%**
Cooling	**natural**
Design	**Three phase, iron core double air gap**
Winding material	**Aluminium foil/copper wires**
Impregnation	**Polyester resin, class H**
Terminals	**Terminal blocks, or cable lugs.**
Temperature Switch	**All reactors are provided with a separate screw terminal for the temperature switch (opening switch) which is located inside every coil**
Switching temperature	**140°C**
Voltage	**250Vac (<5A)**
Tolerance	**±5K**

PART NUMBER	Qc at 400V (kvar)	L (mH)	Irms (A)	Material	Dimensions (AxBxC) (mm)	Weight (Kg)	Qc at rated voltage (kvar)	Capacitor rated voltage (V)	Capacitance (µF)
46188300	**5**	8,3	**8**	copper	**205x170x65**	13,5	**6**	450	**78**
46012910	**10**	2,9	**16**	copper	**205x184x68**	8,6	**12**	450	**157**
46012600	**12,5**	2,6	**27**	copper	**205xx184x98**	11	**15**	450	**196**
46011451	**20**	1,45	**32**	copper	**205x184x88**	9,5	**24**	450	**314**
46011452	**25**	1,22	**39**	copper	**180x180x170**	13,6	**30**	450	**393**
PRG0030DAB57579	**40**	0,73	**64,3**	aluminium	**320x220x120**	18	**54**	450	**707**
PRG0037DAB57692	**50**	0,6	**78**	aluminium	**340x220x135**	20	**66**	450	**864**



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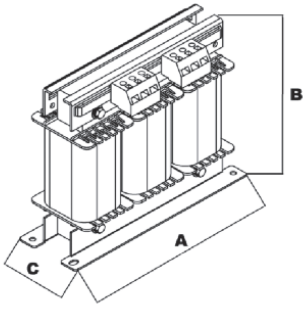


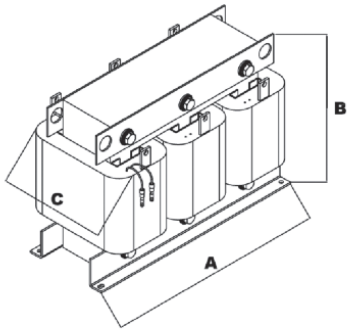
COPPER

U_N	f	f_N	P
400V	60Hz	227 Hz	5,4%

6% 400V - 60Hz Reactors

TECHNICAL CHARACTERISTICS	
Applicable standards	**IEC 60076-6**
Rated voltages	**230...690V**
Rated frequencies	**60 Hz**
Tolerance of inductance	**±5%(mean value across three phases)**
Linearity	**I lin= 1.6…1.8 In**
Insulation (winding-core)	**3 kV**
Temperature class	**F (155°C)**
Maximum Ambient Temperature	**40°C**
Protection class	**IP00 indoor mounting**
Humidity	**95%**
Cooling	**natural**
Design	**Three phase, iron core double air gap**
Winding material	**Aluminium foil/copper wires**
Impregnation	**Polyester resin, class H**
Terminals	**Terminal blocks, or cable lugs.**
Temperature Switch	**All reactors are provided with a separate screw terminal for the temperature switch (opening switch) which is located inside every coil**
Switching temperature	**140°C**
Voltage	**250Vac (<5A)**
Tolerance	**±5K**

PART NUMBER	Qc at 400V (kvar)	L (mH)	Irms (A)	Material	Dimensions (AxBxC) (mm)	Weight (Kg)	Qc at rated voltage (kvar)	Capacitor rated voltage (V)	Capacitance (µF)
46015810	**5**	5,8	**8**	copper	**205x167x68**	7	**6**	450	**78**
46012600	**10**	2,6	**27**	copper	**205xx184x98**	11	**12**	450	**157**
46012601	**12,5**	1,8	**26**	copper	**180x180x130**	8	**18**	450	**236**
46012602	**20**	1,31	**30**	copper	**180x180x140**	9,7	**24**	450	**314**
46012603	**25**	1,05	**44**	copper	**180x180x150**	11,4	**30**	450	**393**
PRG0030DAB57579	**40**	0,6	**78**	aluminium	**340x220x135**	20	**54**	450	**707**
PRG0035DAB57693	**50**	0,45	**88**	aluminium	**320x220x130**	19,5	**66**	450	**864**



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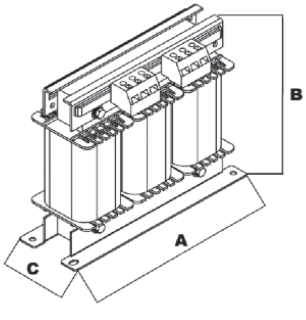


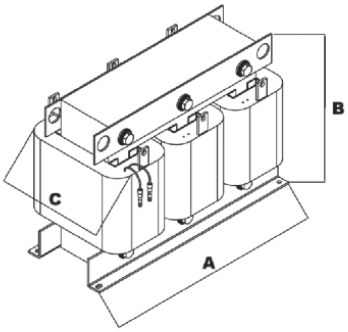
COPPER

7% 230V - 60Hz Reactors

U_N	f	f_N	P
230V	60Hz	252 Hz	7%

TECHNICAL CHARACTERISTICS	
Applicable standards	**IEC 60076-6**
Rated voltages	**230...690V**
Rated frequencies	**60 Hz**
Tolerance of inductance	**±5%(mean value across three phases)**
Linearity	**I lin= 1.6…1.8 In**
Insulation (winding-core)	**3 kV**
Temperature class	**F (155°C)**
Maximum Ambient Temperature	**40°C**
Protection class	**IP00 indoor mounting**
Humidity	**95%**
Cooling	**natural**
Design	**Three phase, iron core double air gap**
Winding material	**Aluminium foil/copper wires**
Impregnation	**Polyester resin, class H**
Terminals	**Terminal blocks, or cable lugs.**
Temperature Switch	**All reactors are provided with a separate screw terminal for the temperature switch (opening switch) which is located inside every coil**
Switching temperature	**140°C**
Voltage	**250Vac (<5A)**
Tolerance	**±5K**

PART NUMBER	Qc at 400V (kvar)	L (mH)	Irms (A)	Material	Dimensions (AxBxC) (mm)	Weight (Kg)	Qc at rated voltage (kvar)	Capacitor rated voltage (V)	Capacitance (µF)
46012100	**5**	2,1	**33**	copper	**205x180x113**	13,3	**15**	400	**249**
46012101	**10**	1,04	**35**	copper	**180x180x130**	7,9	**30**	400	**497**
46012102	**12,5**	0,82	**37**	copper	**180x180x130**	8	**12**	230	**602**
PRG0037DAB57692	**20**	0,6	**78**	aluminium	**320x220x130**	20	**54**	400	**896**
PRG0035DAB57693	**25**	0,45	**88**	aluminium	**320x220x130**	18,5	**24**	230	**1204**
PRG0033DAB57694	**40**	0,273	**109**	aluminium	**320x220x120**	18,5	**36**	230	**1806**
PRG0043DAB57695	**50**	0,2	**146**	aluminium	**320x220x135**	21,5	**48**	230	**2408**



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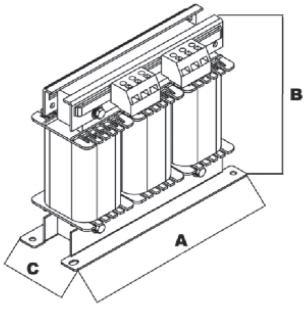


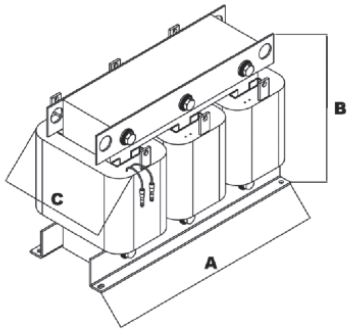
COPPER

U_N	f	f_N	P
230V	60Hz	227 Hz	5,67%

5,67% 230V - 60Hz Reactors

TECHNICAL CHARACTERISTICS	
Applicable standards	**IEC 60076-6**
Rated voltages	**230...690V**
Rated frequencies	**60 Hz**
Tolerance of inductance	**±5%(mean value across three phases)**
Linearity	**I lin= 1.6…1.8 In**
Insulation (winding-core)	**3 kV**
Temperature class	**F (155°C)**
Maximum Ambient Temperature	**40°C**
Protection class	**IP00 indoor mounting**
Humidity	**95%**
Cooling	**natural**
Design	**Three phase, iron core double air gap**
Winding material	**Aluminium foil/copper wires**
Impregnation	**Polyester resin, class H**
Terminals	**Terminal blocks, or cable lugs.**
Temperature Switch	**All reactors are provided with a separate screw terminal for the temperature switch (opening switch) which is located inside every coil**
Switching temperature	**140°C**
Voltage	**250Vac (<5A)**
Tolerance	**±5K**

PART NUMBER	Qc at 400V (kvar)	L (mH)	Irms (A)	Material	Dimensions (AxBxC) (mm)	Weight (Kg)	Qc at rated voltage (kvar)	Capacitor rated voltage (V)	Capacitance (µF)
460120103	**5**	1,6	**15**	copper	**180x180x120**	5,7	**15**	400	**249**
460120104	**10**	0,82	**37**	copper	**180x180x130**	8,2	**30**	400	**497**
460120105	**12,5**	0,66	**36**	copper	**180x180x120**	6,8	**12**	230	**602**
PRG0035DAB57693	**20**	0,45	**88**	aluminium	**320x220x130**	19,5	**54**	400	**896**
PRG0024DAB57696	**25**	0,282	**86**	aluminium	**320x220x115**	16	**24**	230	**1204**
PRG0026DAB57697	**40**	0,22	**108**	aluminium	**320x220x120**	16,5	**36**	230	**1806**
PRG0035DAB57698	**50**	0,167	**144**	aluminium	**320x220x130**	19,5	**48**	230	**2408**



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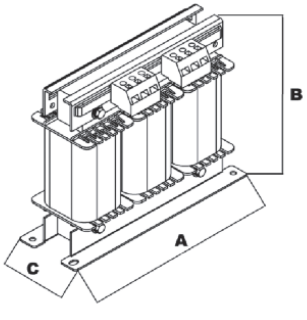
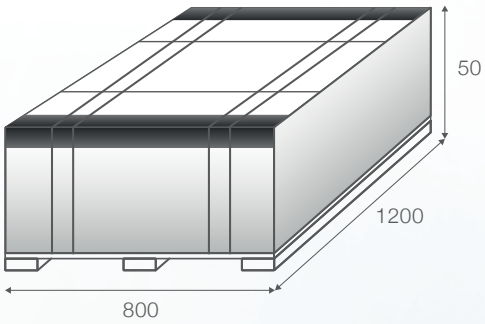


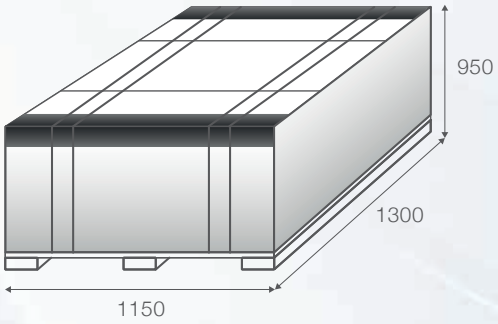
COPPER

Packing details: Reactors



PALLET

Reactor type	Reactors per package
Copper winding	**20**
Aluminium winding	**16**



WOODEN BOX

Reactor type	Reactors per package
Copper winding	**90**
Aluminium winding	**72**

CHAPTER 4

Reactive power regulators and protections

The reactive power regulator is, together with the capacitors and reactors (in detuned fi lter cabinets), the key component of the automatic power factor correction system. It is in fact the "intelligent" element, responsible for the verifi cation of the power factor of the load, in function of which controls the switching on and off of the capacitors batteries in order to maintain the power factor of the system beyond the target. The reactive power regulators RPC are designed to provide the desired power factor while minimizing the wearing on the banks of capacitors, accurate and reliable in measuring and control functions are simple and intuitive in installation and consultation. The fl exibility of ICAR regulators allows you to modify all the parameters to customize its operation to fi t the actual characteristics of the system to be corrected (threshold power factor, sensitivity of step switching, reconnecting time of the steps, presence of photovoltaics, etc.).

Reactive power regulators 5LGA RPC and RPC 8LGA

The new reactive power regulator RPC 5LGA equips Micromatic and Minimatic automatic power factor correction systems, while the new regulator RPC 8LGA equips MIDImatic. Both are managed by a microprocessor and offer many features maintaining a simple user interface locally or from a PC. They are characterized by a large LCD display with text messages (in 6 languages: ITA, ENG, FRA, SPA, POR, GER) and icons for quick and intuitive navigation.
The regulators are very flexible: they are in fact able to adjust the power factor between 0,8 inductive and 0,8 capacitive, to operating with power from 100 to 440 VAC, to run on the 4 quadrants for cogeneration installations, to accept in Input CT secondary 5A or 1A .
The regulators have standard temperature control and the ability to configure one of the available relays for activating visual alarms sound at a distance; also control the distortion of current and voltage.
Regulators RPC 5LGA-8LGA can operate in automatic or manual mode: in the first case in complete autonomy by switching batteries available up to the desired power factor; in the second case it will be the operator to force the insertion and disconnection of the battery: the regulator still oversee operations to prevent potential damage to the capacitors (for example by assessing compliance of discharge times before a subsequent insertion).
The slot allows you to add additional functions:

- OUT2NO for two additional digital outputs
- COM485 communication module for connection to network RS485 (Modbus)
- COM232 communication module for connection to network RS232 (Modbus)
- WEBETH communication module for connection to the Ethernet network (Modbus), available only for RPC 8LGA

Measurement functions

Regulators RPC 5LGA and 8LGA provide many standard measurements in order to check and monitor the correct electrical and temperature conditions of the power factor correction system. Display shows the following values: power factor, voltage, current, delta kvar (reactive power missing to reach the target power factor), average weekly power factor, total harmonic distortion of the current system ($THDI_R$%) with detailed harmonic for harmonic from 2nd to 15th, total harmonic distortion of the voltage (THDV%) with detail for harmonic harmonic from 2nd to 15th, total harmonic distortion in the current% (THDI%) capacitor, temperature. The controller stores and makes available for consultation the maximum value of each of these variables, to evaluate the most severe stress suffered by the automatic power factor correction since the last reset: the temperature, the voltage and the total harmonic distortion have a strong impact on the capacitors as if they hold more than the nominal values can drastically reduce the service life.

RPC 5LGA RPC 8LGA

Alarms

Regulators RPC ICAR show many different alarms:

- Under-compensation: the alarm is activated if, with all the steps of power factor correction switched on, the power factor is lower than the desired value
- Over-compensation: the alarm is activated if, with all the steps of power factor correction switched off, the power factor is greater than the desired value.
- Minimum and maximum current: to assess the condition of the system load
- Minimum and maximum voltage: to evaluate the stresses due to the variations of the supply voltage
- Maximum THD%: to assess the pollution of network as regards to harmonic current.
- Maximum temperature in the enclosure: to monitor the capacitor climatic conditions
- Short voltage interruptions.

Alarms are programmable (enable, threshold, time on / off).

Display Indications

The LCD display icons and text provides the following information for quick identification of the state of the system:

- Operating mode automatic/manual
- Status of each battery (on / off)
- Recognition power factor inductive / capacitive
- Type of value displayed
- Active alarm code, and explanatory text (in a language of choice among the 6 available: ITA, ENG, FRA, SPA, POR, GER)

Contacts

The regulators RPC 5LGA and 8LGA have power contacts for controlling the steps, to control the eventual cooling fan and for the activation of alarms to distance; contacts are NO and have a range of 1.5A to 5A at 250Vac or 440Vac. A contact is in exchange for alarm functions (NO or NC).

Technical characteristics

- Microprocessor control
- Auxiliary supply voltage: 100 to 440 VAC
- Frequency: 50Hz / 60Hz
- Voltage measuring input : 100 to 600V
- Current measuring input : 5A (1A programmable)
- Current reading range: from 25mA to 6A (from 25mA to 1.2A)
- Automatic current way sensing: yes
- Operation in systems with cogeneration: yes
- Power consumption: 9.5 VA
- Output relay : 5A - 250Vac
- Cos φ adjustment: from 0.5 ind to 0.5 cap
- Step Switching Time: 1s ÷ 1000s
- Alarm relay: yes
- Degree of protection: IP54 on front and IP20 at terminals
- Operating temperature: -20 ° C to + 60 ° C
- Storage temperature: -30 ° C to + 80 ° C
- Optical port Front: for communication USB or WIFI with dedicated accessories
- Compliance with the standards: IEC EN 61010-1; IEC / EN 61000-6-2; IEC / EN 61000-6-4; UL508; CSA C22-2 n ° 14

	RPC 5LGA	RPC 8LGA
Output relays:	5 (up to 7)	8 (up to 12)
Dimensions:	96x96mm	144x144mm
Weight:	0,35kg	0,65kg

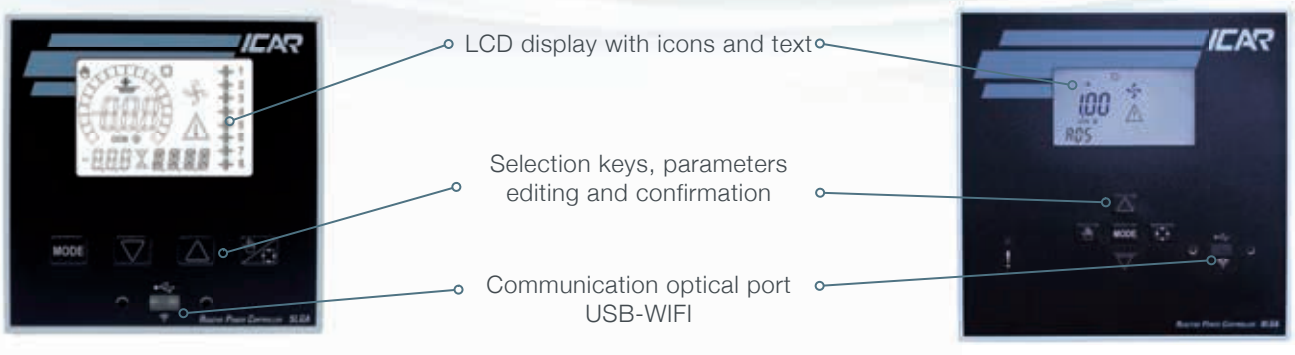
Additional modules

The regulator RPC 5LGA has the ability to accommodate, in the back slot, an additional module.

The regulator RPC 8LGA has two rear slots to accommodate up to two additional modules. Once installed an additional module, the controller recognizes and activates the menu for its programming. Additional modules can be installed even in the bank already in service.

Slots for additional module may be already used by ICAR to implement necessary functions to the context in which the controller is mounted. If you decide to add a module to an already operating, ensure that there is an available slot.

- OUT2NO two digital outputs device to control additional steps (two relays 5A 250Vac)
- COM232 interface RS232 isolated
- COM485 interface RS485 isolated
- WEBETH communication module for connection to the Ethernet network, available only for RPC 8LGA



RPC 5LGA

RPC 8LGA

Reactive power regulator RPC 8BGA

The RPC 8BGA reactive power regulator equips MULTImatic automatic power factor correction systems.
It is a very innovative controller, with exclusive features:

- High electrical performance
- Extended Capabilities
- Graphic display
- Advanced communication
- Upgradability, even after installation
- Powerful supervision software

More details below, referring to the following page tables and manuals for further information.

High electrical performance: The 8BGA controller is equipped with powerful hardware, which allows a considerable electrical performances: it can be connected to the CT secondary 5A or 1A, it can work on networks with voltages from 100 to 600Vac with a measuring range from 75VAC to 760VAC, it can be connected to a single CT (typical configuration of the power factor correction) or three-CTs (for a more accurate measurement of the power factor, and this fact makes the 8BGA controller to refocus and to be a multimeter as well).

Extended Capabilities: The 8BGA reactive power regulator is controlled by a powerful microprocessor that allows a set of new functions to solve problems even in complex plant.
8BGA can work master-slave functions, handles up to 10 languages simultaneously, can be used in MV systems managing the transformation ratio of the VT, it can support multiple inputs and outputs via optional modules, it can handle target cos phi from 0.5 inductive to 0.5 capacitive.
8BGA can build a network of 4 wired units (one master three slaves) to be able to handle up to 32 steps of power factor correction in a consistent and uniform way.

Graphical display with high readability: forget the regulators with small displays and diffi cult to read: 8BGA will amaze you with its display matrix graphic LCD 128x80 pixels.
The detail and sharpness allow intuitive navigation between the diff erent menus, represented with text and icons.

Advanced communication: 8BGA born to be a regulator able to communicate in a manner in line with the latest technology: Ethernet, RS485, GSM / GPRS modem, USB, WIFI.
Now you can see the information of the company cos phi, without having to go in front of the regulator. It will be the controller to inform you by posting, if you wish, SMS or email. Or you can consult a tablet, a smartphone, or PC.
The information about the cos phi is important, because it impacts heavily on the company's income statement.

Evolutivity: the "basic" 8BGA regulator can be enhanched with up to four additional modules "plug and play" which greatly expands its performance. And 'possible to add additional control relays (up to a total of 16), even for a static control (thyristors), digital and analog inputs, analog outputs, communication modules. Your controller can become a small PLC, and the PFC system can become a point of data aggregation, for remote communication.

Measurement functions and help to maintain

8BGA is a real evolved multimeter, thanks also to the graphic display of excellent readability and to the powerful microprocessor . The measured parameters are the basic ones (cos phi, FP, V, I, P, Q, A, Ea, Er) with the addition of the distortion of the voltage and current (THD, histogram of the value of each harmonic, waveform graphic visualization).

If 8BGA is connected to three CT, the harmonic analysis is detailed for each phase, in order to identify any anomalies of single phase loads. 8BGA measure and count values that can help in ruling the PFC (temperature, number of switching of each step). 8BGA also suggests the maintenance to be carried out by means of simple messages on the display.
Keep efficient capacitor becomes much easier.
8BGA stores the maximum values of current, voltage, temperature, each associated with the date and time of the event for a better analysis of what happened.

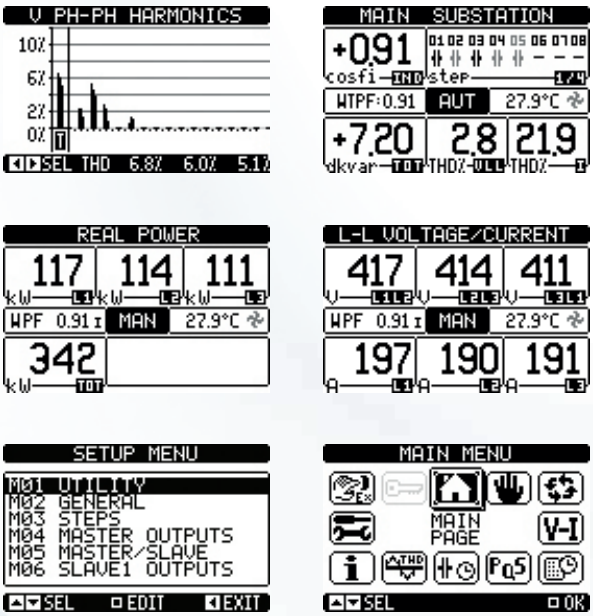
Alarms

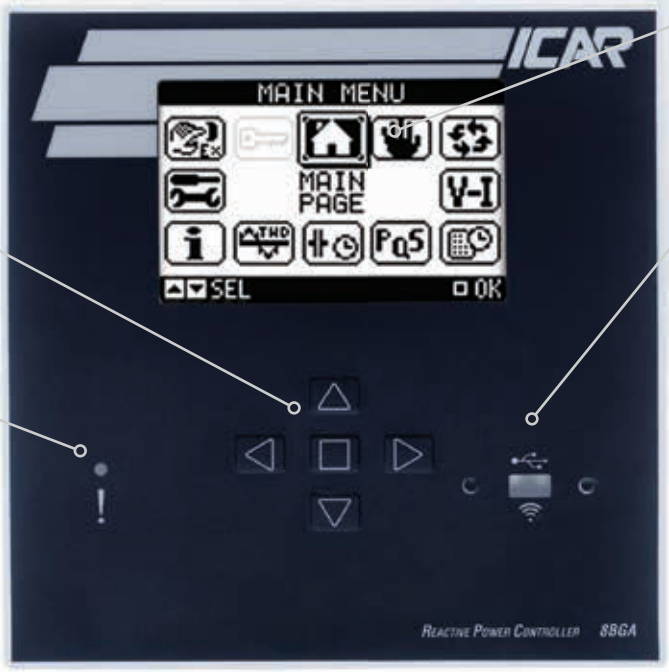
The set of alarms (maximum and minimum voltage, maximum and minimum current, over and under-compensation, overload of the capacitors, maximum temperature, microinterruption) associated with the readability of the messages on the display allows a better understanding of what happened.
Even alarm programming (enable / disable, delay, relapse etc.) is easier and faster.

8BGA Power Factor Correction Controller: Technical parameters

Technical characteristics

- Auxiliary supply voltage: 100÷440Vac
- Frequency: 50Hz/60Hz
- Voltage Measuring range: 100÷600Vac (-15% / +10%)
- Current Measuring range: 5A (1A selectable)
- Current incoming range: from 25mA to 6A (from 10mA to 1,2A)
- Automatic phase sequence reading: yes
- Compensation in cogeneration: yes
- Burden: 9,5 VA
- Output relay current: 5A – 250Vac
- Cos φ range: from 0,5 ind to 0,5 cap
- Step switching time: 1s÷1000s
- Alarm relay: yes
- Degree of protection: IP54
- Working temperature range: from -20°C to 60°C
- Storage temperature range: from -30°C to + 80°C
- USB optic communication port (with COMUSB)
- Temperature Control: from -30°C to +85°C
- Standards compliance: IEC EN 61010-1; IEC/EN 61000-6-2; IEC/EN 61000-6-3; UL508; CSA C22-2 n°14
- Step output relays: 5 (expandible till 7)
- Dimensions: 96x96mm
- Weight: 0,35Kg
- Part number: A25060046411000





Graphic display 128x80 pixel

Selection, modification and enter push buttons.

USB – WIFI Optic netport

LED watchdog and alarm

RPC 8BGA Power Factor Correction Controller: additional modules

The RPC 8BGA controller accommodates up to 4 additional modules "plug & play".
Once you have added an additional module, the controller recognizes and activates the menu for its programming.
Additional modules can also be installed in the rear.

Digital inputs and outputs

These modules allow you to increase the contacts funding for control of the steps contactors (OUT2NO module) or thyristors (STR4NO module) switched banks, or to add inputs and / or digital / analog acquisition of parameters and implementing simple logic.

- OUT2NO module 2 digital outputs to control additional steps (two relays 5A 250 Vac)
- STR4NO module 4 static outputs for thyristor control steps (range SPEED)
- INP4OC module 4 digital inputs
- 2IN2SO module 2 digital inputs and 2 static outputs
- INP2AN module 2 analog inputs
- OUT2AN module 2 analog outputs

Protection functions (MCP5) and data logging (DATLOG)

The control and protection module MCP5 allows a more detailed inspection of the electrical parameter that can damage the capacitors, thanks to algorithms particularly suitable for equipment consisting of capacitors and reactors (detuned filters MULTImatic FH20, FH30, FD25, FD25V, FD35, FH70, FD70).
The data logging module adds the ability to orodatare events, for a better understanding and diagnosis of troubled plants.

- MCP5 module for protection and control for additional safety of capacitors, especially suitable in the detuned banks
- DATLOG data logger module with real time clock and battery backup for data retention

Communication functions

RPC 8BGA regulator is very powerful in terms of communication.
The modules dedicated to these functions allow multiple solutions to remotely control the power factor system and all other variables measured, calculated or obtained from the instrument.

- COM232 isolated RS232 interface
- COM485 RS485 opto-isolated
- WEBETH Ethernet interface with webserver function
- COMPRO isolated Profibus-DP interface
- COMGSM GPRS / GSM modem
- CX01 cable connection from the RPC 8BGA optical port to the USB port of the computer for programming, downloading / uploading data, diagnostics etc..
- CX02 device to connect the optical port in the PRC 8BGA via WIFI: for programming, downloading / uploading data, diagnostics etc..
- CX03 antenna quad band GSM (800/900/1800

App[1]

App available for WIFI interfacing with the RPC 8BGA controller via tablet or smartphone. For iOS and Android.
You have the following functions:

- Set of up regulator
- Sending commands
- Reading information
- Download information and data residing on board

1. For availability contact us

CHAPTER 5

Electronic Fast Switches

Electronic Fast Switches is the best and sometimes the sole choice when it is necessary to compensate loads over short periods of time. Examples are steel companies, lifting apparatus (cranes, quay cranes, etc), cable makers (extruders, etc), welding machines, robots, compressors, skiing lift stations, LV industrial networks (chemical plants, paper mills, automotive suppliers). Thyristor switched capacitor bank are also an ergonomic solution where noise can be problematic, like hotels, banks, offices, service infrastructures (telecommunications board, informatics 'boards, hospitals, malls).

Limits of the traditional contactor switched banks

- High inrush current and over voltages
- Risk of over voltages due to the arc breaking
- Longer reconnecting time: more than 30 sec
- More demanding maintenance compared with static switches.

General advantages of Power Factor Correction

- Reduced losses on mains and power transformers
- Increase of plant available power
- Less voltage drop in the plant

Electronic Fast Switches benefits include:

- Minimises network disturbances such as Voltage Drop and Flicker
- No moving parts therefore reduced maintenance (i.e. no Electro-magnetic contactors)
- Enhanced capacitor life expectancy.

In general there is a comprehensive PLANT EFFICIENCY; because power factor correction is fast, the power transformer and line design can be done considering only the actual load.
Therefore longer working life and reliability of plant.
Static switches allow unlimited operations.
Steps switching is also done limiting transient phenomena that inside normal plants stresses the capacitors reducing their working life.

General Characteristics

ICAR ELECTRONIC FAST SWITCHES FEATURES are described below:

- Switching speed: 20ms ON - 20ms OFF
- Electronic components: SCR
- Connectable power: up to 100kvar-400/415V
- Possibility to switch capacitors without reactor
- Fan dedicated to the cooling radiator
- Protection circuit with signalling LED

Further ADVANTAGES

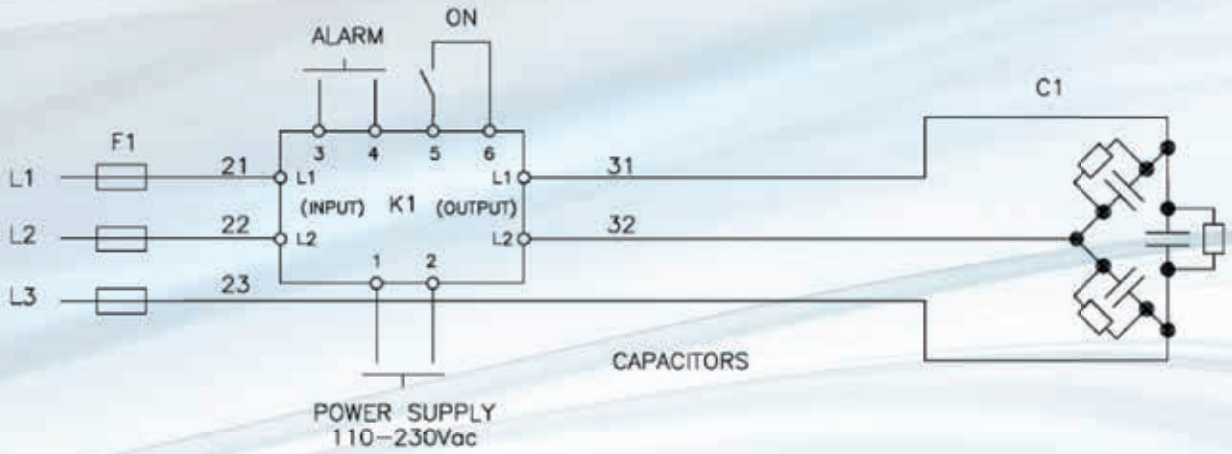
1. The control technology adopted doesn't allow switching that could generate self damage.
2. Very small dimensions.
3. High temperature protection.
4. Protection from high speed switching.
5. Electronic Fast Switch doesn't need any external supply.

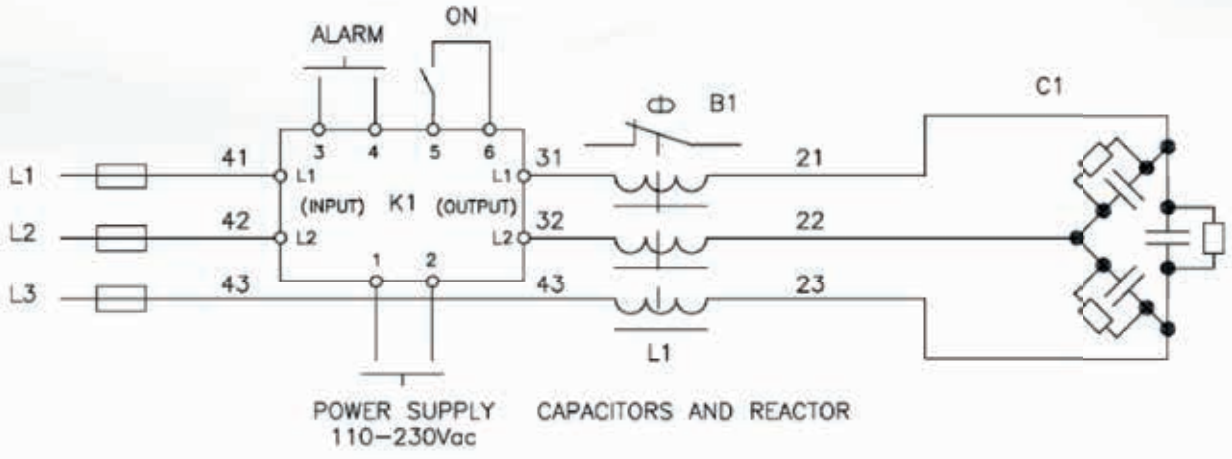
TECHNICAL DATA SHEETS AND TABLES

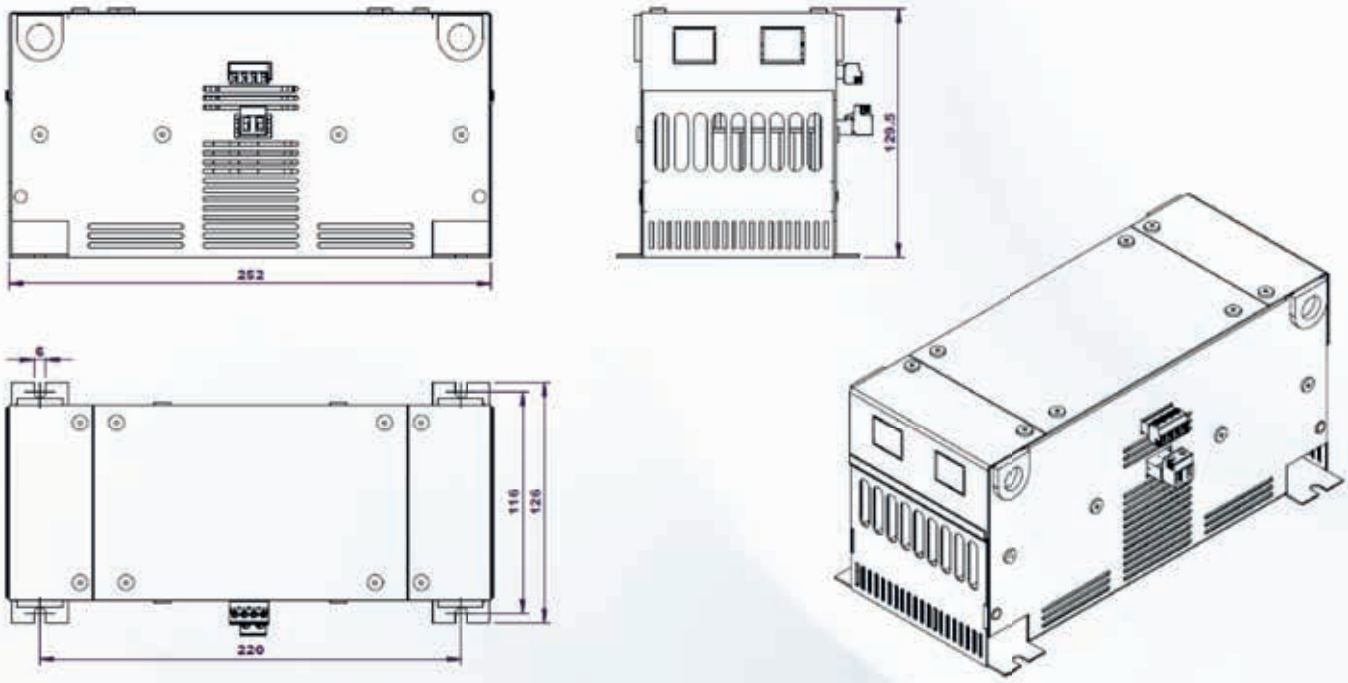
TECHNICAL CHARACTERISTICS	
Voltage	**400-415V**
Frequency	**50Hz**
Activation	**Using external contact voltage free (type SSR Bi-directional opto-mos recommended); no need for 24Vdc**
Duty cycle max speed	**20ms ON – 20ms OFF**
Operating ambient temperature	**-5/+45°C**

PART NUMBER	Max Power	Dimensions (mm) [WxHxD]	Weight (kg)
IS100K0IE100K	50kvar	252x220x129,5 (81)	**3 Kg**
IS100K0IE100K	100kvar	242x215x132 (82)	-

CONNECTING DIAGRAM







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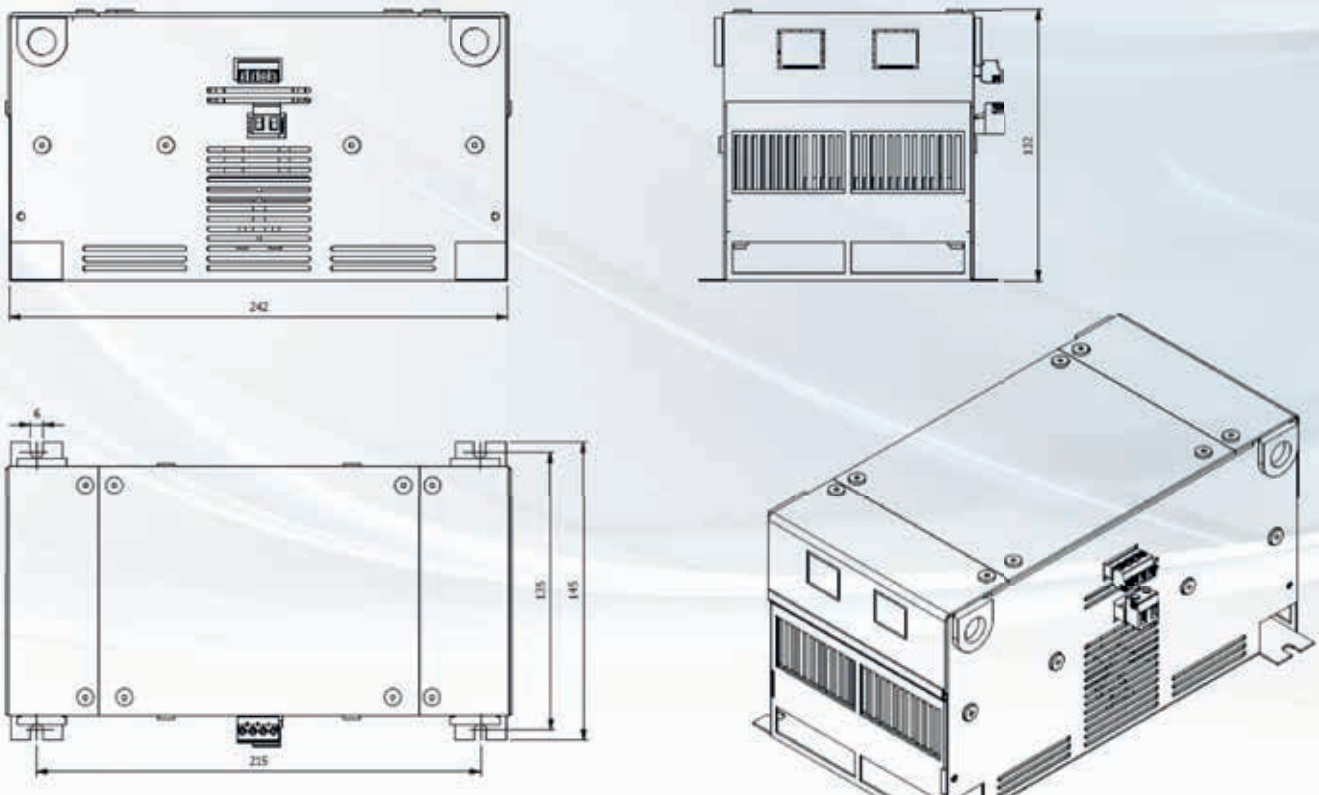

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CHAPTER 6

Fast Discharge device RPD 3A

GENERAL CHARACTERISTICS

Fast Discharge Resistor RPD 3A is designed to discharge power capacitors within few seconds. It can be used with rated network voltage up to 400V and frequency 50 or 60Hz. The highest capacitor bank power it can deal with is 75 kvar and its discharge time till residual capacitor voltage of 50V is 3 seconds.

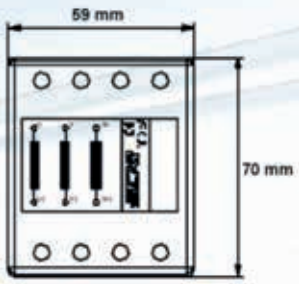
Several discharge times till residual capacitor voltage of 50V are shown in table below. They are shown for 230V and 400V capacitor rated voltage and frequency of 50 and 60 Hz.

Q (kvar)	230V - 50Hz (seconds)	230V - 60Hz (seconds)	380V - 60Hz (seconds)	400V - 50Hz (seconds)	400V - 60Hz (seconds)
5	0.5	0.4	0.2	0.2	0.2
10	0.9	0.8	0.4	0.4	0.3
12,5	1.1	1.0	0.4	0.5	0.4
20	1.8	1.5	0.7	0.8	0.7
25	2.3	1.9	0.9	1.0	0.8
40	3.7	3.1	1.4	1.6	1.3
50	4.6	3.8	1.8	2.0	1.6
75	6.9	5.7	2.7	3.0	2.5

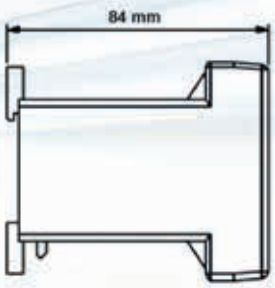
TECHNICAL CHARACTERISTICS

- Working voltage: 200÷400V
- Frequency: 50/60Hz
- Service: continous
- Phases: 3
- Working temperature: -5/+40°C
- Degree of protection: IP20
- Weight: 0,4Kg

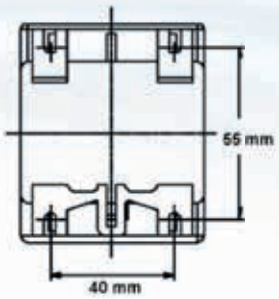
DIMENSIONS



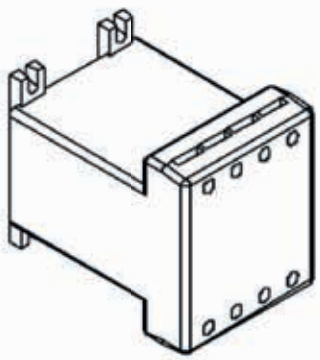
FRONT VIEW



SIDE VIEW

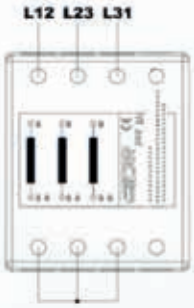


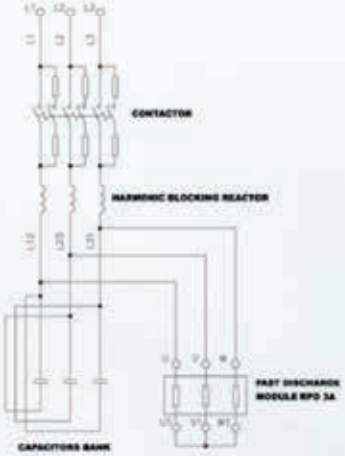
REAR VIEW (FIXING DETAILS)



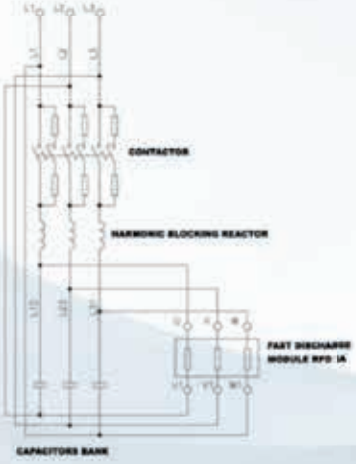
CONNECTING DIAGRAMS

CONTACTOR OUTSIDE TO THE CAPACITORS DELTA CONNECTION (SINGLE PHASE OR THREE PHASE CAPACITORS)

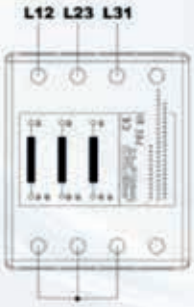


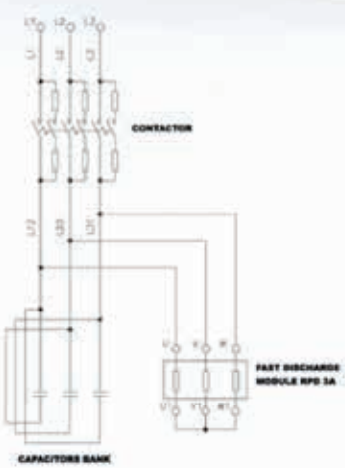


CONTACTOR INSIDE TO THE CAPACITORS DELTA CONNECTION (SINGLE PHASE CAPACITORS ONLY)

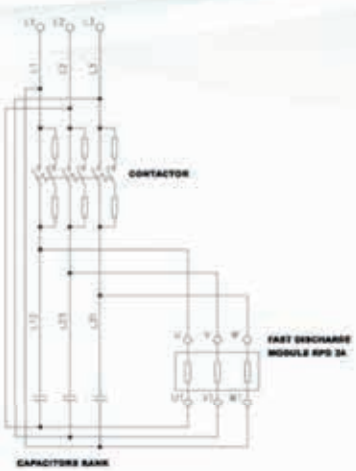


CONTACTOR OUTSIDE TO THE CAPACITORS DELTA CONNECTION (SINGLE PHASE OR THREE PHASE CAPACITORS)





CONTACTOR INSIDE TO THE CAPACITORS DELTA CONNECTION (SINGLE PHASE CAPACITORS ONLY)



CHAPTER 7

EUROrack TRAYS

GENERAL CHARACTERISTICS

EUROrack system is ideal solution for OEM and switchgears manufacturers, they are indeed suitable to the most common switchgears sizes, in addition:

- EUROrack is compact and with high power density,
- EUROrack is available detuned and not detuned,
- Powers from 12,5 kvar to 100kvar in a single tray.
- Bus bars suitable to bear up to 400kvar detuned or not detuned.
- Easy to assembly as power bus bars and NH fuses are incorporated in the tray support.

EUROracks are sound for plants where the current Total Harmonic Distortion is as much as 100% (detuned FH30). EUROracks are equipped with ICAR high energy density metallised polypropylene capacitors which assure elevated performances with low losses and small dimensions.

DESIGN FEATURES

Every tray is complete of:

- Capacitor Duty Contactors (230Vac coil).
- Self-extinguish cable harness according to EN 50267-2-1 standards.
- Three-phase fuse holder type NH00
- Power fuses NH00-gG
- Three phase self-healing polypropylene capacitors with 525V rated voltage (FH only).
- Three-phase tinned copper bus bar system
- Discharge resistors.
- Three phase detuning chokes (FH only) with dedicated frequency detuning; each coil winding temperature sensor and NC switch.
- All components inside these products are compliant with EU Safety Regulations

STANDARD ACCESSORIES

(supplied along with each tray)

- Side rack support brackets, suitable for 600-400 mm depth cabinets
- Connecting tinned copper bars and bolts,
- IP20 plexiglass protection.

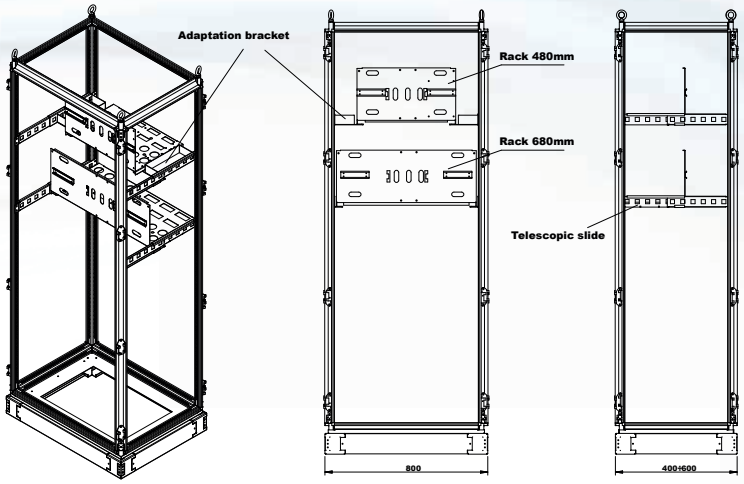
OPTION

- Adaptation bracket, for fitting of 600 mm width trays in 800 mm width cabinets, and 800 mm width trays in 1000 mm width cabinets.

CABINET FITTING

EUROracks FH trays are easy to fit inside any standard cabinet thanks to sliding and adjustable side supports. These brackets enable EUROracks to be used in variable dept cabinet, i.e. 400 mm (HP only) and 600 mm.
Furthermore thanks to extensible brackets, 480 mm width racks could be also fitted in 800 mm width cabinet (see drawing below), allowing a very flexible combination of steps and total reactive power.

The maximum reactive power the bus bar system can bear is 400kvar 415V 50Hz, both detuned and not detuned. Extesions of additional trays is possible at any time.
Every rack auxiliary and control component is supplied already wired to the terminal board, which is available on a DIN rail of any tray support.



HP10

Ue	U_N	U_{MAX}[1]	f	$THDI_R$%
400-415V	415V	455V	50 Hz	≤12%

TECHNICAL CHARACTERISTICS	
Rated operational voltage	**U_e= 400-415V**
Rated frequency	**50 Hz**
Max current overload In (tray)	**1.3xIn**
Max voltage overload Vn (bank)	**1.1xVn**
Max current overload In (capacitors)	**2xIn**
Max voltage overload Vn (capacitors)	**3xVn**
Insulating voltage (bank)	**690V**
Capacitors insulating level	**3/15kV**
Temperature range	**-5/+40 °C**
Discharge resistors	**on each capacitor**
Use	**indoor**
Service	**continuo/continous**
Capacitors connection	**delta**
Switching devices	**Capacitor duty contactors (AC6b)**
Total Tray losses	**2 W/kvar**
Capacitor Dielectric losses	**0,2 W/kvar**
Inner surface finish	**zinc passivation**
Tray Applicable standards	**IEC 61921**
Capacitor Applicable standards	**IEC 60831-1/2**

Main characteristics

Power factor correction banks indicated for the plants where the current harmonic distortion, without capacitors installed, has values lower than 10%. Use of high energy density metallised polypropylene capacitors assures elevated performances, high resistance to strong voltage overload, low losses and small dimensions.

Generalities:

- Contactors with damping resistors to limit capacitors' inrush current (230Vac coil).
- N07V-K self-extinguish cable according to IEC 50267-2-1 standards.
- Three-phase fuse holder type NH00
- Power fuses NH00-gG
- $3U_t$ three phase self-healing polypropylene capacitors with 415V rated voltage.
- Discharge devices.
- Degree of protection: IP20

All components inside this products are compliant with EU Safety Regulations.

PART NUMBER	POWER U_N=415V (kvar)	POWER U_e=415V (kvar)	POWER U_e=400V (kvar)	STEPS U_e=400V (kvar)	DIM IP20 WxHxD (mm)	OVERALL DRAWING
IY0AKK225050359	**25**	25	**25**	25	**480x275x340**	93, 95
IY0AKK250050359	**50**	50	**50**	2x25	**480x275x340**	93, 95
IY0AKK275050359	**75**	75	**75**	3x25	**480x275x340**	93, 95
IY0AKK310050359	**100**	100	**100**	4x25	**480x275x340**	93, 95
IY0AKK312550359	**125**	125	**125**	5x25	**680x275x336**	94, 96
IY0AKK315050359	**150**	150	**150**	6x25	**680x275x336**	94, 96

U_e: power factor correction bank working voltage
U_N: capacitors rated voltage
U_{MAX}: capacitor admissible maximum voltage
$THDI_R$%: current total harmonic distortion of the plant

HP20

Ue	U_N	U_{MAX}[1]	f	$THDI_R$%
400-415V	450V	445V	50 Hz	≤20%

TECHNICAL CHARACTERISTICS	
Rated operational voltage	**U_e= 400-415V**
Rated frequency	**50Hz**
Max current overload In (tray)	**1.3xIn**
Max voltage overload Vn (bank)	**1.1xVn**
Max current overload In (capacitors)	**2xIn**
Max voltage overload Vn (capacitors)	**3x Vn**
Insulating voltage (bank)	**690V**
Capacitors insulating level	**3/15kV**
Temperature range	**-5/+40 °C**
Discharge resistors	**on each capacitor**
Use	**indoor**
Service	**continuo/continous**
Capacitors connection	**delta**
Switching devices	**Capacitor duty contactors (AC6b)**
Total Tray losses	**2 W/kvar**
Capacitor Dielectric losses	**0,2 W/kvar**
Inner surface finish	**zinc passivation**
Tray Applicable standards	**IEC 61921**
Capacitor Applicable standards	**IEC 60831-1/2**

Main characteristics

Power factor correction banks indicated for the plants where the current harmonic distortion, without capacitors installed, has values lower than 18%.Use of high energy density metallised polypropylene capacitors assures elevated performances, high resistance to strong voltage overload, low losses and small dimensions.

Generalities:

- Contactors with damping resistors to limit capacitors' inrush current (230Vac coil).
- N07V-K self-extinguish cable according to IEC 50267-2-1 standards.
- Three-phase fuse holder type NH00
- Power fuses NH00-gG
- $3U_t$ three phase self-healing polypropylene capacitors with 450V rated voltage.
- Discharge devices.
- Degree of protection: IP20

All components inside this products are compliant with EU Safety Regulations.

PART NUMBER	POWER U_N=450V (kvar)	POWER U_e=415V (kvar)	POWER U_e=400V (kvar)	STEPS U_e=400V (kvar)	DIM IP20 WxHxD (mm)	OVERALL DRAWING
IY0JHK230050359	**30**	26	**25**	25	**480x275x340**	93, 95
IY0JHK260050359	**60**	52	**50**	2x25	**480x275x340**	93, 95
IY0JHK290050359	**90**	78	**75**	3x25	**480x275x340**	93, 95
IY0JHK312050359	**120**	104	**100**	4x25	**480x275x340**	93, 95
IY0JHK315050359	**150**	134	**125**	5x25	**680x275x336**	94, 96
IY0JHK318050359	**180**	160	**150**	6x25	**680x275x336**	94, 96

U_e: power factor correction bank working voltage
U_N: capacitors rated voltage
U_{MAX}: capacitor admissible maximum voltage
$THDI_R$%: current total harmonic distortion of the plant

HP30

Ue	U_N	U_{MAX}[1]	f	$THDI_R$%
400-415V	525V	580V	50 Hz	≤27%

TECHNICAL CHARACTERISTICS	
Rated operational voltage	**U_e= 400-415V**
Rated frequency	**50Hz**
Max current overload In (tray)	**1.3xIn**
Max voltage overload Vn (bank)	**1.1xVn**
Max current overload In (capacitors)	**2xIn**
Max voltage overload Vn (capacitors)	**3x Vn**
Insulating voltage (bank)	**690V**
Capacitors insulating level	**3/15kV**
Temperature range	**-5/+40 °C**
Discharge resistors	**on each capacitor**
Use	**indoor**
Service	**continuo/continous**
Capacitors connection	**delta**
Switching devices	**Capacitor duty contactors (AC6b)**
Total Tray losses	**2 W/kvar**
Capacitor Dielectric losses	**0,2 W/kvar**
Inner surface finish	**zinc passivation**
Tray Applicable standards	**IEC 61921**
Capacitor Applicable standards	**IEC 60831-1/2**

Main characteristics

Power factor correction banks indicated for the plants where the current harmonic distortion, without capacitors installed, has values lower than 25%.Use of high energy density metallised polypropylene capacitors assures elevated performances, high resistance to strong voltage overload, low losses and small dimensions.

Generalities:

- Contactors with damping resistors to limit capacitors' inrush current (230Vac coil).
- N07V-K self-extinguish cable according to IEC 50267-2-1 standards.
- Three-phase fuse holder type NH00
- Power fuses NH00-gG
- $3U_t$ three phase self-healing polypropylene capacitors with 525V rated voltage.
- Discharge devices.
- Degree of protection IP20

All components inside this products are compliant with EU Safety Regulations.

PART NUMBER	POWER U_N=525V (kvar)	POWER U_e=415V (kvar)	POWER U_e=400V (kvar)	BANKS U_e=415V (kvar)	DIM IP20 WxHxD (mm)
IY0SQK240050359	**40**	25	**25**	480x275x458	**480x275x340**
IY0SQK280050359	**80**	50	**2x25**	480x275x458	**480x275x340**
IY0SQK312050805	**120**	75	**3x25**	480x275x458	**480x275x340**
IY0SQK316050359	**160**	100	**4x25**	480x275x458	**480x275x340**
IY0SQK316050803	**160**	100	**2x12,5-25-50**	480x275x458	**680x275x336**
IY0SQK320050359	**200**	125	**5x25**	680x275x458	**680x275x336**
IY0SQK324050359	**240**	150	**6x25**	680x275x458	**680x275x336**
IY0SQK324050804	**240**	150	**2x12,5-25-2x50**	680x275x458	**680x275x336**

U_e: power factor correction bank working voltage
U_N: capacitors rated voltage
U_{MAX}: capacitor admissible maximum voltage
$THDI_R$%: current total harmonic distortion of the plant

FH05

Ue	f	$THDI_R$%	f_N	p
400-415V	50 Hz	≤20%	215 Hz	5,4%

TECHNICAL CHARACTERISTICS	
Rated operational voltage	**U_e= 400-415V**
Rated frequency	**50Hz**
Max current overload In (tray)	**1.3xIn**
Max voltage overload Vn (bank)	**1.1xVn**
Max current overload In (capacitors)	**2xIn**
Max current overload Vn (capacitors)	**1,3 Vn**
Insulating voltage (bank)	**690V**
Capacitors insulating level	**3/15kV**
Temperature range	**-5/+40 °C**
Discharge resistors	**on each capacitor**
Use	**indoor**
Service	**continuo/continous**
Capacitors connection	**delta**
Switching devices	**Capacitor duty contactors**
Total Tray losses	**6 W/kvar**
Capacitor Dielectric losses	**0,2 W/kvar**
Inner surface finish	**zinc passivation**
Tray Applicable standards	**IEC 61439-1/2 IEC 61921 IEC 61642**
Capacitor Applicable standards	**IEC 60831-1/2**

Main characteristics

Power factor correction banks indicated for the plants where the current harmonic distortion has values up to 20%. Use of high energy density metallised polypropylene capacitors assures elevated performances with low losses and small dimensions.

Generalities:

- Contactors(230Vac coil).
- N07V-K self-extinguish cable according to IEC 50267-2-1 standards.
- Three-phase fuse holder type NH00
- Power fuses NH00-gG
- Series $3U_t$ three phase self-healing polypropylene capacitors with 525V rated voltage.
- Discharge devices.
- Three phase detuning choke with tuning frequency 215 Hz.
- Degree of protection: IP20

All components inside this products are compliant with EU Safety Regulations.

PART NUMBER	POWER U_e=415V (kvar)	POWER U_e=400V (kvar)	STEPS U_e=400V (kvar)	DIM IP20 WxHxD (mm)	OVERALL DRAWING
IY7HFK212550368	**13.5**	12.5	**12.5**	480x275x450	**91, 97**
IY7HFK218850368	**20**	18.75	**6.25-12.5**	480x275x450	**91, 97**
IY7HFK225050369	**27**	25	**2x12.5**	480x275x450	**91, 97**
IY7HFK225050368	**27**	25	**25**	480x275x450	**91, 97**
IY7HFK250050425	**54**	50	**2x25**	480x275x450	**91, 97**
IY7HFK250050368	**54**	50	**50**	480x275x450	**91, 97**
IY7HFK275050368	**80**	75	**25-50**	680x275x450	**92, 98**
IY7HFK310050368	**107**	100	**50-50**	680x275x450	**92, 98**

U_e: power factor correction bank working voltage
$THDI_R$%: current total harmonic distortion of the plant

FH20

Ue	f	$THDI_R$%	f_N	p
400-415V	50 Hz	≤60%	180 Hz	7,7%

TECHNICAL CHARACTERISTICS	
Rated operational voltage	**U_e= 400-415V**
Rated frequency	**50Hz**
Max current overload In (tray)	**1.3xIn**
Max voltage overload Vn (bank)	**1.1xVn**
Max current overload In (capacitors)	**2xIn**
Max current overload Vn (capacitors)	**1,3 Vn**
Insulating voltage (bank)	**690V**
Capacitors insulating level	**3/15kV**
Temperature range	**-5/+40 °C**
Discharge resistors	**on each capacitor**
Use	**indoor**
Service	**continuo/continous**
Capacitors connection	**delta**
Switching devices	**Capacitor duty contactors**
Total Tray losses	**6 W/kvar**
Capacitor Dielectric losses	**0,2 W/kvar**
Inner surface finish	**zinc passivation**
Tray Applicable standards	**IEC 61439-1/2 IEC 61921 IEC 61642**
Capacitor Applicable standards	**IEC 60831-1/2**

Main characteristics

Power factor correction banks indicated for the plants where the current harmonic distortion, without capacitors installed, has values lower than 60%. Use of high energy density metallised polypropylene capacitors assures elevated performances, high resistance to strong voltage overload, low losses and small dimensions.

Generalities:

- Contactors with damping resistors to limit capacitors' inrush current (230Vac coil).
- N07V-K self-extinguish cable according to IEC 50267-2-1 standards.
- Three-phase fuse holder type NH00
- Power fuses NH00-gG
- $3U_t$ three phase self-healing polypropylene capacitors with 450V rated voltage.
- Discharge devices.
- Three phase detuning choke with tuning frequency 180 Hz
- Degree of protection: IP20

All components inside this products are compliant with EU Safety Regulations.

PART NUMBER	POWER U_e=415V (kvar)	POWER U_e=400V (kvar)	STEPS U_e=400V (kvar)	DIM IP20 WxHxD (mm)	OVERALL DRAWING
IY7TFK212550360	**13.5**	12.5	**12.5**	480x275x450	**91, 97**
IY7TFK218850360	**20**	18.75	**6.25-12.5**	480x275x450	**91, 97**
IY7TFK225050362	**27**	25	**2x12.5**	480x275x450	**91, 97**
IY7TFK225050360	**27**	25	**25**	480x275x450	**91, 97**
IY7TFK250050422	**54**	50	**2x25**	480x275x450	**91, 97**
IY7TFK250050360	**54**	50	**50**	480x275x450	**91, 97**
IY7TFK275050360	**80**	75	**25-50**	680x275x450	**92, 98**
IY7TFK310050360	**107**	100	**50-50**	680x275x450	**92, 98**

U_e: power factor correction bank working voltage
$THDI_R$%: current total harmonic distortion of the plant

FH30

Ue	f	$THDI_R$%	f_N	p
400-415V	50 Hz	100%	135 Hz	13,7%

TECHNICAL CHARACTERISTICS	
Rated operational voltage	**U_e= 400-415V**
Rated frequency	**50Hz**
Max current overload In (tray)	**1.3xIn**
Max voltage overload Vn (bank)	**1.1xVn**
Max current overload In (capacitors)	**2xIn**
Max current overload Vn (capacitors)	**1,3 Vn**
Insulating voltage (bank)	**690V**
Capacitors insulating level	**3/15kV**
Temperature range	**-5/+40 °C**
Discharge resistors	**on each capacitor**
Use	**indoor**
Service	**continuo/continous**
Capacitors connection	**delta**
Switching devices	**Capacitor duty contactors**
Total Tray losses	**6 W/kvar**
Capacitor Dielectric losses	**0,2 W/kvar**
Inner surface finish	**zinc passivation**
Tray Applicable standards	**IEC 61439-1/2 IEC 61921 IEC 61642**
Capacitor Applicable standards	**IEC 60831-1/2**

Main characteristics

Power factor correction banks indicated for the plants where the current harmonic distortion, without capacitors installed, has values lower than 100%. Use of high energy density metallised polypropylene capacitors assures elevated performances, high resistance to strong voltage overload, low losses and small dimensions.

Generalities:

- Contactors with damping resistors to limit capacitors' inrush current (230Vac coil).
- N07V-K self-extinguish cable according to IEC 50267-2-1 standards.
- Three-phase fuse holder type NH00
- Power fuses NH00-gG
- $3U_t$ three phase self-healing polypropylene capacitors with 450V rated voltage.
- Discharge devices.
- Three phase detuning choke with tuning frequency 180 Hz
- Degree of protection: IP20

All components inside this products are compliant with EU Safety Regulations.

PART NUMBER	POWER U_e=415V (kvar)	POWER U_e=400V (kvar)	STEPS U_e=400V (kvar)	DIM IP20 WxHxD (mm)	OVERALL DRAWING
IY7NFK212550426	**13.5**	12.5	**12.5**	480x275x450	**91, 97**
IY7NFK218850426	**20**	18.75	**6.25-12.5**	480x275x450	**91, 97**
IY7NFK225050427	**27**	25	**2x12.5**	480x275x450	**91, 97**
IY7NFK225050426	**27**	25	**25**	480x275x450	**91, 97**
IY7NFK250050428	**54**	50	**2x25**	480x275x450	**91, 97**
IY7NFK250050426	**54**	50	**50**	480x275x450	**91, 97**
IY7NFK275050426	**80**	75	**25-50**	680x275x450	**92, 98**

U_e: power factor correction bank working voltage
$THDI_R$%: current total harmonic distortion of the plant

HP10

(400V - 60Hz)

Ue	U_N	U_{MAX}[1]	f	$THDI_R$%
400V	400V	440V	60 Hz	≤12%

TECHNICAL CHARACTERISTICS	
Rated operational voltage	U_e= 400
Rated frequency	60Hz
Max current overload In (bank)	1.3xIn
Max voltage overload Vn (bank)	1.1xVn
Max voltage overload Vn (capacitors)	3xVn
Insulating voltage (bank)	690V
Capacitors insulating level	3/15kV
Temperature range	-5/+40 °C
Discharge device	on each capacitor
Use	indoor
Service	continous
Capacitors connection	delta
Operation devices	capacitor duty contactors (AC6b)
Total Joule losses	~2W/kvar
Surface finish	galvanisation
Banks applicable standards	IEC 61439-1/2 IEC 61921
Capacitors standards	IEC 60831-1/2

Main characteristics

Power factor correction banks indicated for the plants where the current harmonic distortion, without capacitors installed, has values lower than 18%.Use of high energy density metallised polypropylene capacitors assures elevated performances, high resistance to strong voltage overload, low losses and small dimensions.

Generalities:

- Contactors with damping resistors to limit capacitors' inrush current (230Vac coil).
- N07V-K self-extinguish cable according to IEC 50267-2-1 standards.
- Three-phase fuse holder type NH00
- Power fuses NH00-gG
- $3U_t$ three phase self-healing polypropylene capacitors with 400V rated voltage.
- Discharge devices.

Degree of protection: IP20

All components inside this products are compliant with EU Safety Regulations.

Part Number	Power (Kvar) Ue=400V	Steps (kvar) Ue=400V	DIM IP20 WxHxD (mm)	Overall Drawing
IY0AFF225060359	25	25	480x275x335	93,95
IY0AFF250060359	50	2 x 25	480x275x335	93,95
IY0AFF275060359	75	3 x 25	480x275x335	93,95
IY0AFF310060359	100	4 x 25	480x275x335	93,95

U_e: power factor correction bank working voltage
$THDI_R$%: current total harmonic distortion of the plant

HP30

(440V - 60Hz)

U_e	U_N	U_{MAX}[1]	f	$THDI_R$%
440V	480V	530V	60 Hz	≤20%

TECHNICAL CHARACTERISTICS	
Rated operational voltage	**U_e= 440V**
Rated frequency	**60Hz**
Max current overload In (bank)	**1.3xIn**
Max voltage overload Vn (bankt)	**1.1xVn**
Max voltage overload Vn (capacitors)	**3xVn**
Insulating voltage (bank)	**690V**
Capacitors insulating level	**3/15kV**
Temperature range	**-5/+40 °C**
Discharge device	**on each capacitor**
Use	**indoor**
Service	**continous**
Capacitors connection	**delta**
Operation devices	**capacitor duty contactors (AC6b)**
Total Joule losses	**~2W/kvar**
Surface finish	**galvanisation**
Banks applicable standards	**IEC 60439-1/2 IEC 61921-1**
Capacitors standards	**IEC 60831-1/2**

Main characteristics

Power factor correction banks indicated for the plants where the current harmonic distortion without existing capacitors has values up to 25%. Use of high energy density metallised polypropylene capacitors assures elevated performances with low losses and small dimensions.

Generalities:

- Contactors (230Vac coil).
- N07V-K self-extinguish cable according to IEC 20/22/2 – IEC 50267-2-1 standards.
- Three-phase fuse holder type NH00
- Power fuses NH00-gG
- Series $3U_t$ three phase self-healing polypropylene capacitors with 480V rated voltage.
- Discharge devices.
- Degree of protection IP20.

All components inside this products are compliant with EU Safety Regulations.

PART NUMBER	Power (kvar) U_N=480V	Power (kvar) U_e=440V	Steps (kvar) U_e=440V	DIM IP20 WxHxD(mm)	OVERALL DRAWING
Contact us	36	**25**	25	**480x275x340**	93,95
Contact us	72	**50**	2x25	**480x275x340**	93,95
Contact us	108	**75**	3x25	**480x275x340**	93,95
Contact us	144	**100**	4x25	**480x275x340**	93,95

U_e: power factor correction bank working voltage
$THDI_R$%: current total harmonic distortion of the plant

HP30

(480V - 60Hz)

Ue	U_N	U_{MAX}[1]	f	$THDI_R$%
480V	480V	530V	60 Hz	≤12%

TECHNICAL CHARACTERISTICS	
Rated operational voltage	U_e= 480V
Rated frequency	60Hz
Max current overload In (bank)	1.3xIn
Max voltage overload Vn (bankt)	1.1xVn
Max voltage overload Vn (capacitors)	3xVn
Insulating voltage (bank)	690V
Capacitors insulating level	3/15kV
Temperature range	-5/+40 °C
Discharge device	on each capacitor
Use	indoor
Service	continous
Capacitors connection	delta
Operation devices	capacitor duty contactors (AC6b)
Total Joule losses	~2W/kvar
Surface finish	galvanisation
Banks applicable standards	IEC 60439-1/2 IEC 61921-1
Capacitors standards	IEC 60831-1/2

Main characteristics

Power factor correction banks indicated for the plants where the current harmonic distortion, without capacitors installed, has values lower than 25%.Use of high energy density metallised polypropylene capacitors assures elevated performances, high resistance to strong voltage overload, low losses and small dimensions.

Generalities:

- Contactors with damping resistors to limit capacitors' inrush current (230Vac coil).
- N07V-K self-extinguish cable according to IEC 20/22I2 – IEC 50267-2-1 standards.
- Three-phase fuse holder type NH00
- Power fuses NH00-gG
- $3U_t$ three phase self-healing polypropylene capacitors with 480V rated voltage.
- Discharge devices.
- Degreeof protection IP20

All components inside this products are compliant with EU Safety Regulations.

PART NUMBER	Power (kvar) U_N=480V	Power (kvar) U_e=480V	Steps (kvar) U_e=480V	DIM IP20 WxHxD(mm)	OVERALL DRAWING
Contact us	30	**25**	25	**480x275x340**	93,95
Contact us	60	**50**	2x25	**480x275x340**	93,95
Contact us	90	**75**	3x25	**480x275x340**	93,95
Contact us	120	**100**	4x25	**480x275x340**	93,95

U_e: power factor correction bank working voltage
$THDI_R$%: current total harmonic distortion of the plant

FH20

(230V - 60Hz)

Ue	f	$THDI_R$%	f_N	P
230V	60 Hz	≤60%	227 Hz	7%

TECHNICAL CHARACTERISTICS	
Rated operational voltage	**Ue= 230V**
Rated frequency	**60Hz**
Max current overload In (bank)	**1.3xIn**
Max voltage overload Vn (bankt)	**1.1xVn**
Max voltage overload Vn (capacitors)	**3xVn**
Insulating voltage (bank)	**690V**
Capacitors insulating level	**3/15kV**
Temperature range (capacitors)	**-5/+40 °C**
Discharge device	**on each capacitor**
Use	**indoor**
Service	**continous**
Capacitors connection	**delta**
Operation devices	**contactors**
Total Joule losses	**~6W/kvar**
Inner surface finish	**zinc passivation**
Applicable standards	**IEC 61439-1/2 IEC 61921 IEC 61642**
Capacitors standards	**IEC 60831-1/2**

Main characteristics

Power factor correction banks indicated for the plants where the current harmonic distortion has values up to 60%. Use of high energy density metallised polypropylene capacitors assures elevated performances with low losses and small dimensions.

Generalities:

- Contactors(230Vac coil).
- N07V-K self-extinguish cable according to IEC 20/22/2 – IEC 50267-2-1 standards.
- Three-phase fuse holder type NH00
- Power fuses NH00-gG
- Series $3U_t$ three phase self-healing polypropylene capacitors with 270-380V rated voltage.
- Discharge devices.
- Three phase detuning choke with tuning frequency 227Hz.
- Degree of protection IP20

All components inside this products are compliant with EU Safety Regulations.

PART NUMBER	Power (kvar) Ue=480V	Steps (kvar) Ue=480V	DIM IP20 WxHxD(mm)	OVERALL DRAWING
IY7TGG225060360	25	25	480x275x450	92,98
IY7TGG250060360	50	2x25	680x275x450	92,98

U_e: power factor correction bank working voltage
$THDI_R$%: current total harmonic distortion of the plant

FH20

(400V - 60Hz)

Ue	f	$THDI_R$%	f_N	P
400V	60 Hz	≤60%	227 Hz	7%

TECHNICAL CHARACTERISTICS	
Rated operational voltage	**Ue= 400V**
Rated frequency	**60Hz**
Max current overload In (bank)	**1.3xIn**
Max voltage overload Vn (bankt)	**1.1xVn**
Max voltage overload Vn (capacitors)	**3xVn**
Insulating voltage (bank)	**690V**
Capacitors insulating level	**3/15kV**
Temperature range (capacitors)	**-5/+40 °C**
Discharge device	**on each capacitor**
Use	**indoor**
Service	**continous**
Capacitors connection	**delta**
Operation devices	**contactors**
Total Joule losses	**~6W/kvar**
Inner surface finish	**zinc passivation**
Applicable standards	**IEC 61439-1/2 IEC 61921 IEC 61642**
Capacitors standards	**IEC 60831-1/2**

Main characteristics

Power factor correction banks indicated for the plants where the current harmonic distortion has values up to 60%. Use of high energy density metallised polypropylene capacitors assures elevated performances with low losses and small dimensions.

Generalities:

- Contactors(230Vac coil).
- N07V-K self-extinguish cable according to IEC 61439-1/2 IEC 61921 IEC 61642 IEC 50267-2-1 standards.
- Three-phase fuse holder type NH00
- Power fuses NH00-gG
- Series $3U_t$ three phase self-healing polypropylene capacitors with 480V rated voltage.
- Discharge devices.
- Three phase detuning choke with tuning frequency 227Hz.
- Degree of protection: IP20

All components inside this products are compliant with EU Safety Regulations.

PART NUMBER	Power (kvar) Ue=400V	Steps (kvar) Ue=400V	DIM IP20 WxHxD(mm)	OVERALL DRAWING
IY7TFF225060360	**25**	25	**480x275x450**	92,98
IY7TFF250060360	**50**	50	**680x275x450**	92,98

U_e: power factor correction bank working voltage
$THDI_R$%: current total harmonic distortion of the plant

FH20

(480V - 60Hz)

Ue	f	$THDI_R$%	f_N	P
480V	60 Hz	≤60%	227 Hz	7%

TECHNICAL CHARACTERISTICS	
Rated operational voltage	**Ue= 480V**
Rated frequency	**60Hz**
Max current overload In (bank)	**1.3xIn**
Max voltage overload Vn (bankt)	**1.1xVn**
Max voltage overload Vn (capacitors)	**3xVn**
Insulating voltage (bank)	**690V**
Capacitors insulating level	**3/15kV**
Temperature range (capacitors)	**-5/+40 °C**
Discharge device	**on each capacitor**
Use	**indoor**
Service	**continous**
Capacitors connection	**delta**
Operation devices	**contactors**
Total Joule losses	**~6W/kvar**
Inner surface finish	**zinc passivation**
Applicable standards	**IEC 61439-1/2 IEC 61921 IEC 61642**
Capacitors standards	**IEC 60831-1/2**

Main characteristics

Power factor correction banks indicated for the plants where the current harmonic distortion has values up to 60%. Use of high energy density metallised polypropylene capacitors assures elevated performances with low losses and small dimensions.

Generalities:

- Contactors(230Vac coil).
- N07V-K self-extinguish cable according to IEC 50267-2-1 standards.
- Three-phase fuse holder type NH00
- Power fuses NH00-gG
- Series $3U_t$ three phase self-healing polypropylene capacitors with 575V rated voltage.
- Discharge devices.
- Three phase detuning choke with tuning frequency 227Hz.
- Degree of protection: IP20

All components inside this products are compliant with EU Safety Regulations.

PART NUMBER	Power (kvar) Ue=480V	Steps (kvar) Ue=480V	DIM IP20 WxHxD(mm)	OVERALL DRAWING
IY7TGG225060360	**25**	25	**480x275x335**	93,95
IY7TGG250060360	**50**	50	**480x275x335**	93,95

U_e: power factor correction bank working voltage
$THDI_R$%: current total harmonic distortion of the plant

FH30

(380V - 60Hz)

Ue	f	$THDI_R$%	f_N	P
380V	60 Hz	≤100%	168 Hz	13%

TECHNICAL CHARACTERISTICS	
Rated operational voltage	**Ue= 380V**
Rated frequency	**60Hz**
Max current overload In (bank)	**1.3xIn**
Max voltage overload Vn (bankt)	**1.1xVn**
Max voltage overload Vn (capacitors)	**3xVn**
Insulating voltage (bank)	**690V**
Capacitors insulating level	**3/15kV**
Temperature range (capacitors)	**-5/+40 °C**
Discharge device	**on each capacitor**
Use	**indoor**
Service	**continous**
Capacitors connection	**delta**
Operation devices	**contactors**
Total Joule losses	**~8W/kvar**
Inner surface finish	**zinc passivation**
Applicable standards	**IEC 61439-1/2 IEC 61921 IEC 61642**
Capacitors standards	**IEC 60831-1/2**

Main characteristics

Power factor correction banks indicated for the plants where the current harmonic distortion has values up to 100%. Use of high energy density metallised polypropylene capacitors assures elevated performances with low losses and small dimensions.

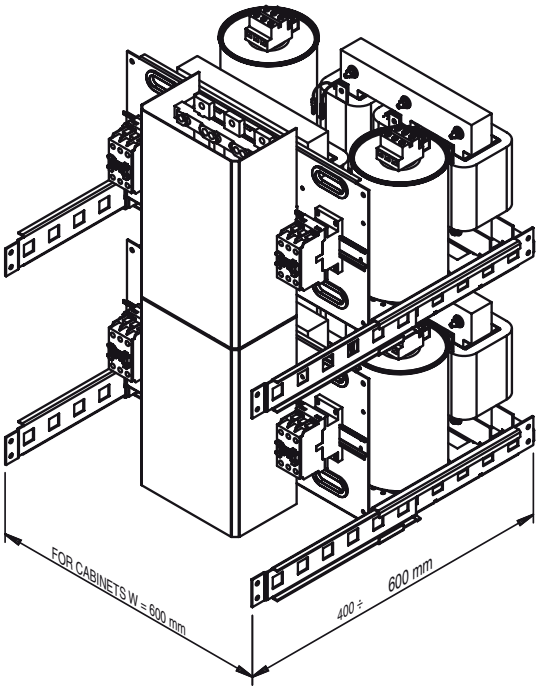
Generalities:

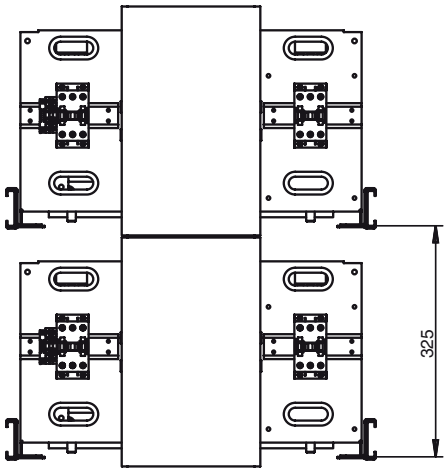
- Contactors(230Vaccoil).
- N07V-K self-extinguish cable according to IEC 20/22/2 – IEC 50267-2-1 standards.
- Three-phase fuse holder type NH00
- Power fuses NH00-gG
- Series $3U_t$ three phase self-healing polypropylene capacitors with 480V rated voltage.
- Discharge devices.
- Three phase detuning choke with tuning frequency 168Hz.
- Degree of protection: IP20

All components inside this products are compliant with EU Safety Regulations.

PART NUMBER	Power (kvar) Ue=380V	Power (kvar) Ue=380V	DIM IP20 WxHxD(mm)	OVERALL DRAWING
Contact us	**12,5**	12,5	**480x275x430**	92,98
Contact us	**25**	2x12,5	**480x275x430**	92,98
Contact us	**25**	25	**480x275x430**	92,98
Contact us	**50**	50	**480x275x430**	92,98

U_e: power factor correction bank working voltage
$THDI_R$%: current total harmonic distortion of the plant


FOR CABINETS W = 600 mm
400 ÷ 600 mm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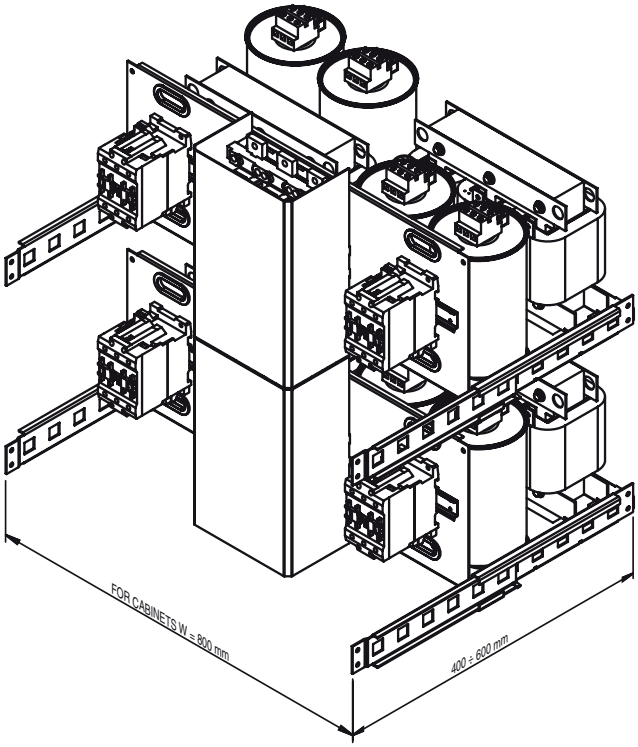
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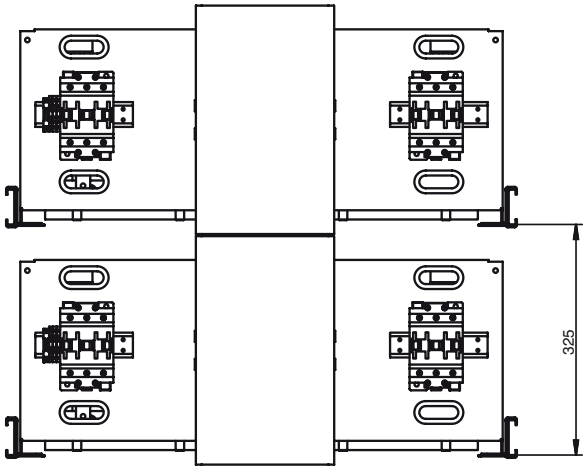
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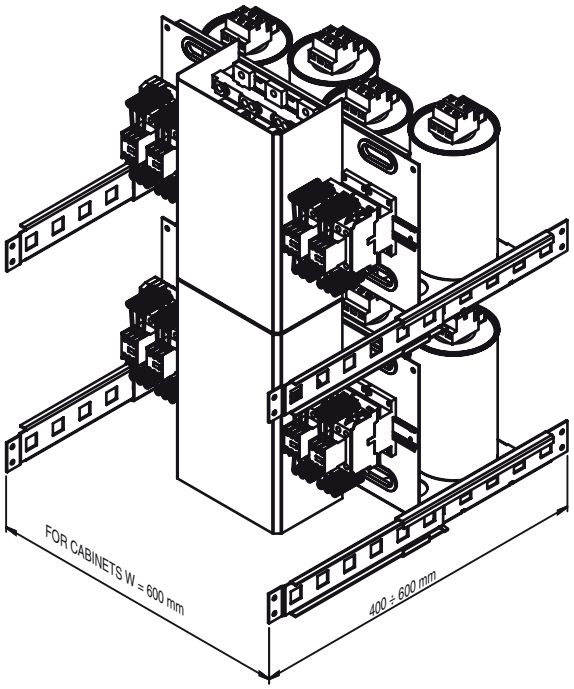
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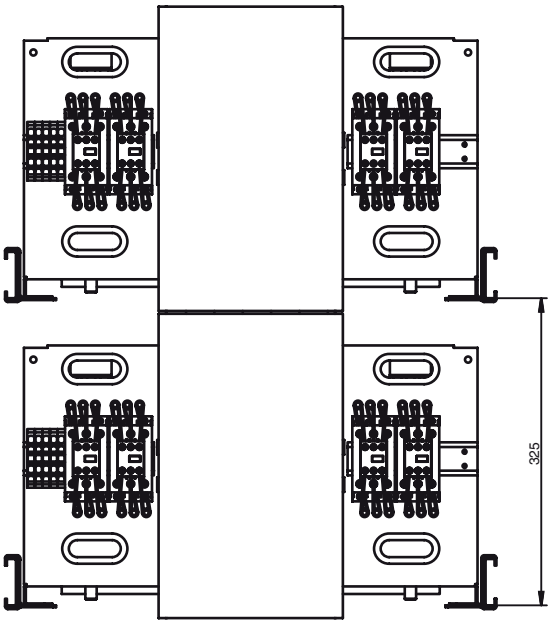
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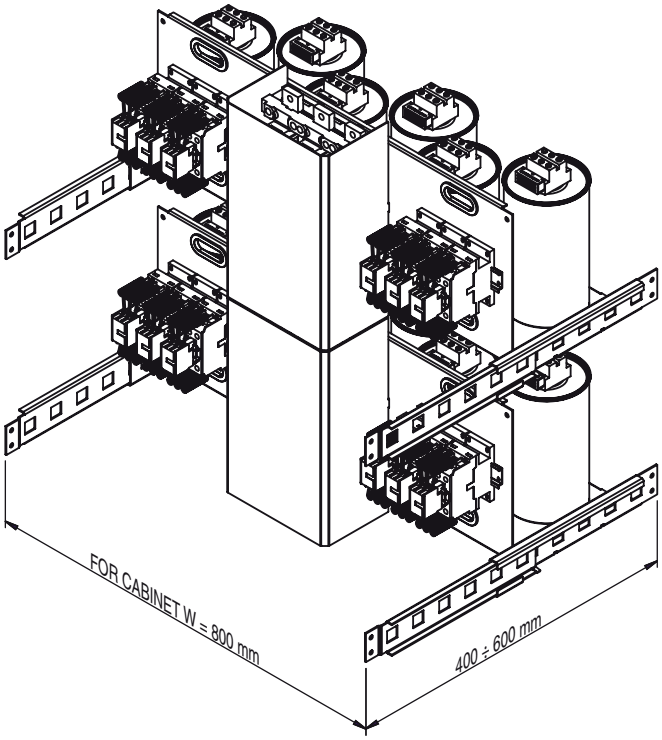
FOR CABINET W = 800 mm
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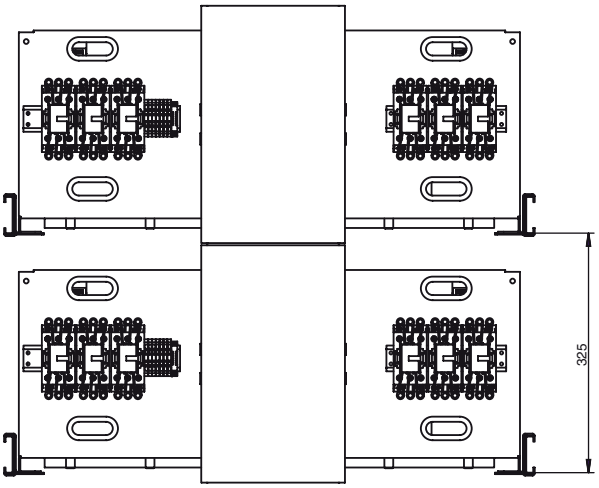
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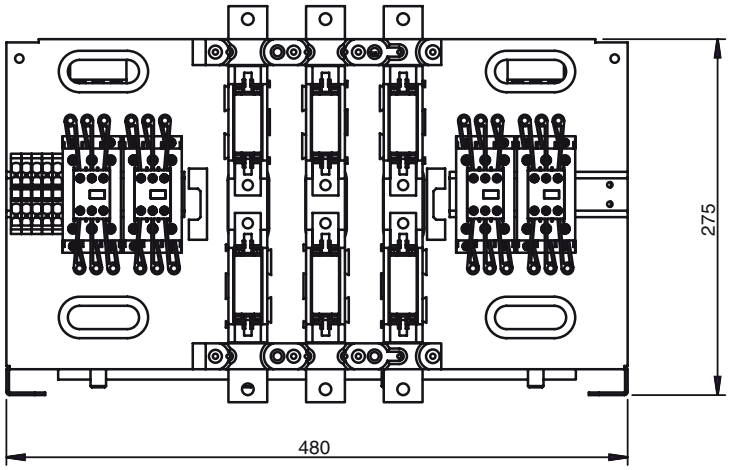

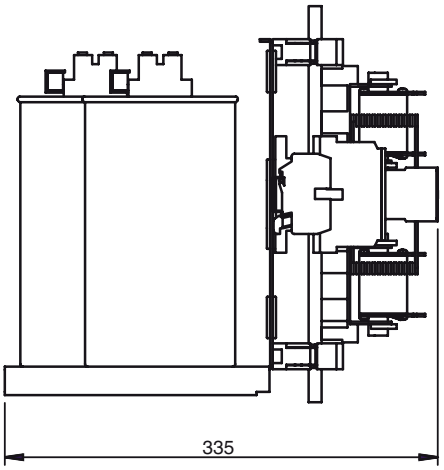

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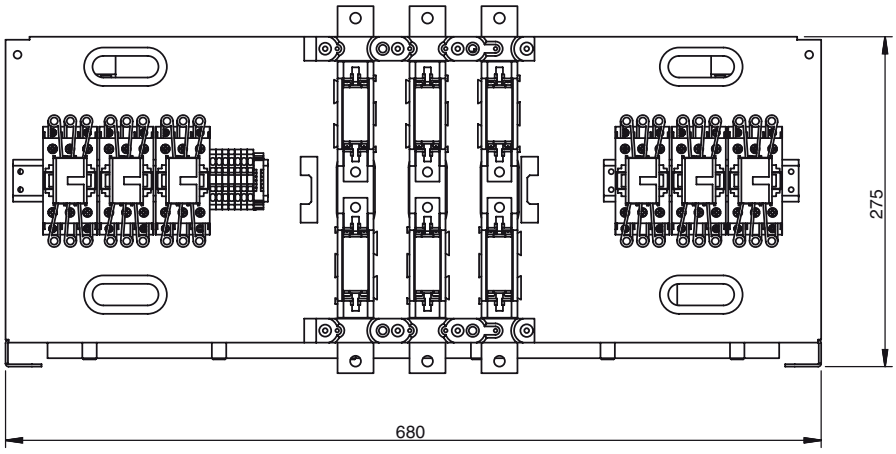

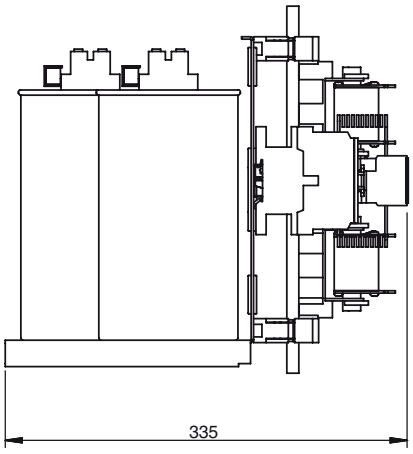

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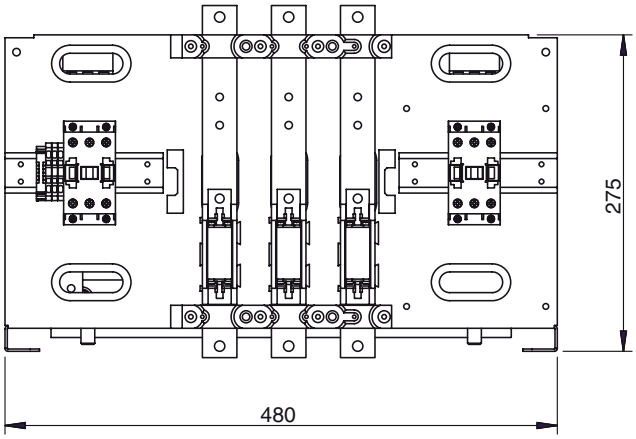

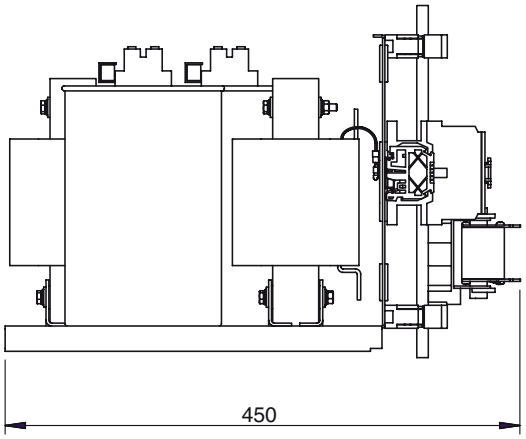

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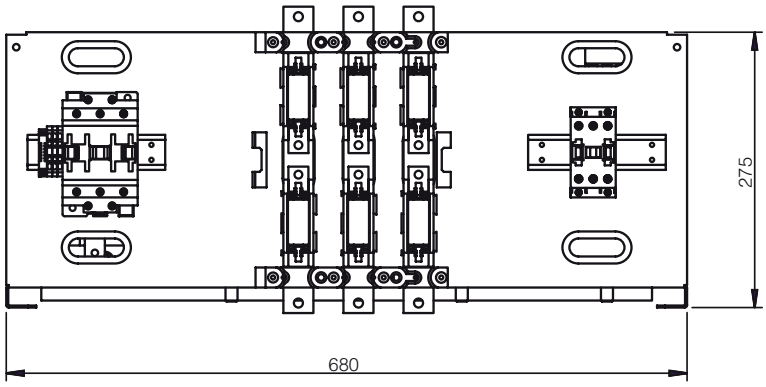

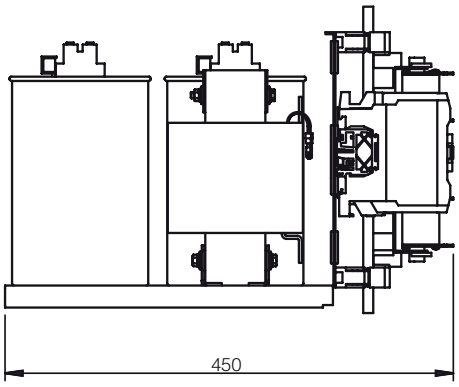

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NOTE

NOTE

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LV PARTS AND TRAYS POWER FACTOR CORRECTION

PRODUCT CATALOGUE

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