



POWER FACTOR CORRECTION

*Three phase
Power Factor
Correction Capacitors,
Accessories
and Trays*



1. COMPANY PROFILE



Founded in 1946, ICAR has rapidly reached and constantly maintained a position that is in the vanguard for the research and development of new products in the field of capacitors and components for which capacitors are key parts.

Since the early 60's, ahead of its time, ICAR started the production of metalized polypropylene film capacitors, developing the metallization by its own in order to have the whole manufacturing process under control.

Today ICAR Group is leader in the production of Low and Medium voltage power factor capacitors; by its companies ICAR controls all the manufacturing phases of the capacitor, core business of the group; from the polypropylene film to their metallization, the production of the finished capacitor, L.V. power factor correction switchboards and M.V. banks.

Nowadays ICAR group is made of 6 manufacturing locations all displaced in Europe and the entire direct control of the productive chain is the best quality guarantee of the final product.

Beside L.V. power factor corrector capacitors and associated components, object of this catalogue, ICAR produces:

- lighting capacitors;
- motor run capacitors;
- fixed or automatic L.V. power factor connection banks and active and passive L.V. filters
- power electronics and special capacitors
- M.V capacitors, and capacitor banks
- L.V. and M.V. voltage stabilizers;
- L.V. insulation transformers
- impulses formation lines



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2. ICAR MEANS CAPACITORS!



ICAR S.p.A. is synonym of capacitor from 1946, coniuugated over its multiple applications.

All along ICAR has believed in the quality of its products and in the strength of the International regulations for the achievements of the high performance standards required for capacitor in industrial applications.

Nowadays ICAR is one of the few companies able to manufacture capacitors starting from the raw material up to 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.

Today ICAR produces different type of capacitors, from the lighting and single phase motor types to the ones for power electronics (electric traction, industrial services) and those of medium voltage.

The various characteristics demanded to these products in terms of electric, mechanical and thermal stress, enabled to find technical solutions that have been applying in other fields with interesting results: for instance the optimization of capacitors for special applications enabled to find very strong solutions that have been then applied on power factor correction capacitors.

The production of the dielectric film (polypropylene or special paper), the metallization process, the production of the capacitor and the construction of the power factor correction banks are fully executed within companies of the Group; that guarantees the achievement of

the highest quality standard weather of the metalized film or, consequently, the capacitors manufactured.

Furthermore, the knowhow acquired in almost 50 years of metalized film production, has enabled ICAR to realize absolute innovative products like 3Ut range of capacitors.

Used to deal with International markets ICAR faced the requests of the strictest Certification Bodies and was awarded UNI EN ISO 9001: 2000 Certification,

ICAR periodically takes part to CEI/IEC committees for the compilation of the product regulations, aimed at setting the objective criterions to evaluate capacitors performances and safety.

It's constantly in the vanguard and able to anticipate the regulations requirements; in order to ensure the accordance with the International regulations and the most strict customers acceptance criterions, products are submitted to tests in the internal laboratories (where it's possible to test capacitors up to 700 μ F and voltage up to 80 kV) and in the greatest internationally recognized laboratories (CESI).

Everything is performed for the safety of the customer who entrusted a reliable partner with a pluridecennal experience in capacitors production for the most disparate applications.



Lighting capacitors



Motor run capacitors



Power electronics capacitors



M.V. capacitors



Automatic P.F.C. banks



L.V. insulation transformers

3. 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. Electric devices with 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 in less 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.

The improvement of power factor to 0,95 will bring Italy to save, 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, CO_2 emission of about a million tons.



4. 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 greater 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 (**3U₊** type) metalized polypropylene film".

3U₊: 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 storage 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, allows considerably better capacitors performances (and therefore the one of the power factor corrector systems of which they are the basic component) in terms of:

- increased specific power (kvar/dm³) 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; **3U₊** capacitors are in fact tested at three times the rated voltage (type test) from which procedure comes their name;
- better reaction to the internal short circuit thanks to the special metallization with variable thickness

4.1 GENERAL DESCRIPTION

CRTE is the last generation of ICAR 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 aluminium case;
- Rated power from 2,5kvar up to 40kvar;
- Rated voltage from 230V up to 800V;
- Rated frequency 50 / 60 Hz;
- Terminal board;
- Reduced mounting cost for terminal board connections;
- 130.000 hours service life design (temperature class -25/C);
- 100.000 hours service life design (temperature class -25/D);
- Dry, environment friendly construction;
- Suitable for any mounting position (vertical preferable for better cooling);
- Indoor installation;
- 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.

Safety

- Self-healing design;
- Over pressure safety device which prevents the capacitor from explosion at the end of its service life;
- Dry technology: as the capacitor is filled with resin, there is no risk of leaking oil or gas;
- Touch proof terminals for terminal board design (IP20 protection degree).

Environment safety

- PCB free.

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.

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 anyother isolating device between the capacitor unit and the discharging device. ICAR supplies capacitor discharge resistors to all series. Fast discharge resistors are described at chapter 9 of this catalogue.

4. CRTE POWER CAPACITORS



4.2 TECHNICAL DATA SHEETS AND TABLES

TECHNICAL CHARACTERISTICS

• Dielectric	polypropylene metallized film
• Winding connection	delta
• Safety device	Internal overpressure disconnector
• Capacitance tolerance	-5%, +10%
• Rated Voltage	230V, 400V/415V, 450V, 525V, 690V, 750V, 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	2 In (including harmonics)
• Maximum inrush current	200 In
• Insulation level	3 / 15 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,
• Voltage test terminals/case	6000V, 50Hz, 10 seconds (650V / 750V / 800V)
• 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 (temperature class -25/C)
• Service life	100.000 operating hours (temperature class -25/D)
• 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 = 230V - 50Hz   *

ORDER CODE	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

Vn = 400V (415V) - 50Hz   *

ORDER CODE	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	370x370x125	External

Vn = 450V - 50Hz   *

ORDER CODE	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

4. CRTE POWER CAPACITORS



Vn = 525V - 50Hz  *

ORDER CODE	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

Vn = 690V - 50Hz 

ORDER CODE	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

Vn = 750V - 50Hz 

ORDER CODE	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

Vn = 800V - 50Hz 

ORDER CODE	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

* File number E99479

** Not UL approved

4. CRTE POWER CAPACITORS



4.3 TECHNICAL DATA SHEETS AND TABLES

TECHNICAL CHARACTERISTICS

• Dielectric	polypropylene metallized film
• Winding connection	delta
• Safety device	Internal overpressure disconnecter
• Capacitance tolerance	-5%, +10%
• Rated Voltage	230V, 380V, 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	2 In (including harmonics)
• Maximum inrush current	200 In
• Insulation level	3 / 15 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 or forced ventilation
• Permissible humidity	95%
• Service life	130.000 operating hours (temperature class -25/C)
• Service life	100.000 operating hours (temperature class -25/D)
• 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 = 230V - 60Hz



ORDER CODE	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

Vn = 380V - 60Hz



ORDER CODE	MODEL	Q POWER (KVar)	C Capacity (µF)	In Current (A)	D Diameter (mm)	H Heigh (mm)	Weight (Kg)	Pcs/box	Box dimensions	Discharge resistor
CRT383110156V60	CRT-56V-1,1-380/60 **	1,1	3 x 6,6	3 x 1,7	55	165	0,5	30	370x370x245	Internal
CRT383160156V60	CRT-56V-1,6-380/60 **	1,6	3 x 9,9	3 x 2,4	55	165	0,5	30	370x370x245	Internal
CRT383220156V60	CRT-56V-2,2-380/60 **	2,2	3 x 13,3	3 x 3,3	55	165	0,5	30	370x370x245	Internal
CRT383270156V60	CRT-56V-2,7-380/60 **	2,7	3 x 16,6	3 x 4,1	55	165	0,5	30	370x370x245	Internal
CRT383320166V60	CRT-66V-3,2-380/60 **	3,2	3 x 19,9	3 x 4,9	65	205	0,7	6	370x370x106	Internal
CRT383430166V60	CRT-66V-4,3-380/60 **	4,3	3 x 26,5	3 x 6,5	65	205	0,7	6	370x370x106	Internal
CRT383540166V60	CRT-66V-5,4-380/60 **	5,4	3 x 33,2	3 x 8,2	65	205	0,7	6	370x370x106	Internal
CRE541383M60326	CRTE07520805438/60	5,4	3 x 33,2	3 x 8,2	75	208	1,2	5	370x370x106	External
CRE811383M60327	CRTE07520808138/60	8,1	3 x 49,7	3 x 12,3	75	208	1,2	5	370x370x106	External
CRE1E2383M60328	CRTE08520810838/60	10,8	3 x 66,3	3 x 16,4	85	208	1,6	4	370x370x106	External
CRE1L2383M60329	CRTE08520813538/60	13,5	3 x 82,9	3 x 20,5	85	208	1,6	4	370x370x106	External
CRE1Q2383M60330	CRTE10020816238/60	16,2	3 x 99,5	3 x 24,6	100	208	2	3	370x370x106	External
CRE2F2383M60331	CRTE10020821738/60	21,7	3 x 132,6	3 x 33	100	208	2	3	370x370x106	External
CRE2G2383M60193	CRTE11620827138/60	27,1	3 x 165,8	3 x 41,2	116	208	2,6	3	370x370x125	External

Vn = 480V - 60Hz



ORDER CODE	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-1-480/60 **	1	3 x 3,8	3 x 1,2	55	165	0,5	30	370x370x245	Internal
CRT523150156V00	CRT-56V-1,5-480/60 **	1,5	3 x 5,8	3 x 1,8	55	165	0,5	30	370x370x245	Internal
CRT523200156V00	CRT-56V-2-480/60 **	2	3 x 7,7	3 x 2,4	55	165	0,5	30	370x370x245	Internal
CRT523250156V00	CRT-56V-2,5-480/60 **	2,5	3 x 9,6	3 x 3	55	165	0,5	30	370x370x245	Internal
CRT523300166V00	CRT-66V-3-480/60 **	3	3 x 11,5	3 x 3,6	65	205	0,7	6	370x370x106	Internal
CRT523400166V00	CRT-66V-4-480/60 **	4	3 x 15,4	3 x 4,8	65	205	0,7	6	370x370x106	Internal
CRT523500166V00	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

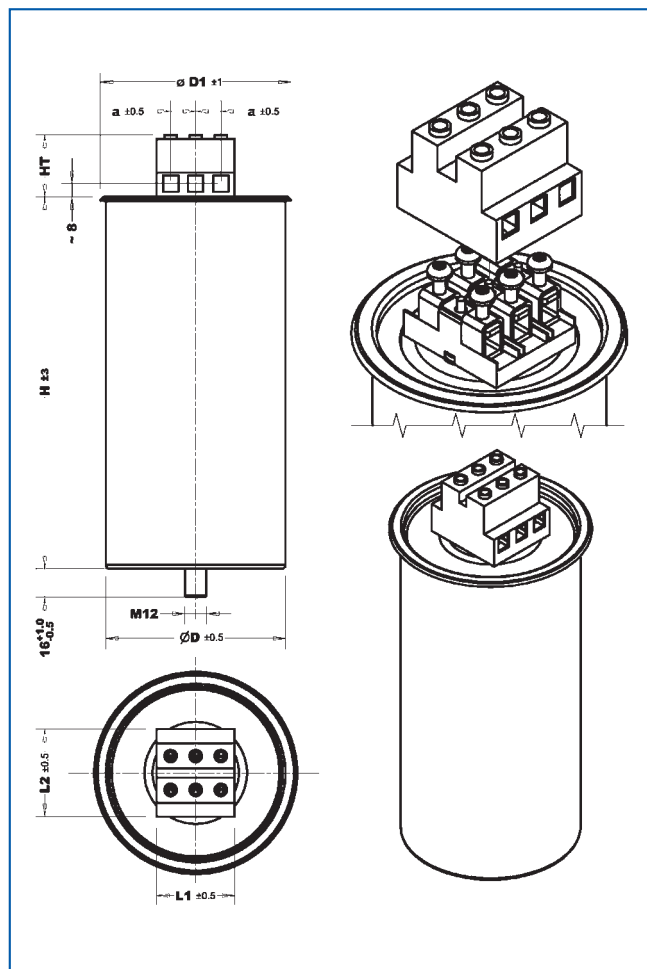
* File number E99479

** Not UL approved

4. CRTE POWER CAPACITORS



4.4 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

Degree of protection: IP20
Creepage 19 mm
Clearance 19 mm
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

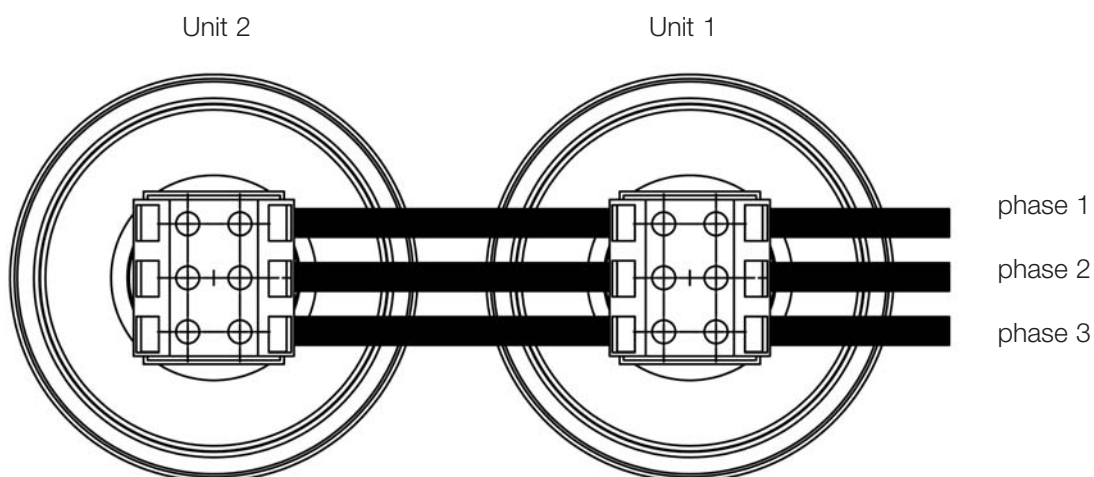
Max case elongation in case of over pressure disconnector activated < 12,7 mm.

Below table is a guidelines for operation in normal conditions at ambient temperature up to 40°C (or 55°C capacitor sorrounding air).

Various parameter such us harmonics, temperature inside the cabinet, cable length have to be considered for proper selection.

Rated voltage 415V, 50 Hz	RATED POWER Qn [kvar]	In [A]	CROSS SECTION mm ² Cu
	2.5	3.5	2.5
	5	7	2.5
	7.5	10.5	2.5
	10	13.9	4
	12.5	17.4	4
	15	20.9	6
	20	27.8	10
	25	34.8	16
	40	55.6	25

4.5 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**.

4. CRTE POWER CAPACITORS



4.6 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 for any mounting position. Vertical is preferable for better cooling. 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 suggested 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 cabinet 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.

4.7 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 across capacitor terminal to less than 75 V within 3 minutes or better.

DO NOT TOUCH ANY CAPACITOR TERMINAL IF NOT SHORT CIRCUITED AND EARTHED 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 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.

4. CRTE POWER CAPACITORS

4.8 CERTIFICATES AND APPROVALS



IQNet
THE INTERNATIONAL CERTIFICATION NETWORK

CERTIFICATE

IQNet and its partner
CISQ/IMO-CSQ
hereby certify that the organization
ICAR SPA
VIA ISONZO 10 - 20052 MONZA (MB) Italy
ICAR SPA: VIA NOSEA 1/3 - 24030 VILLA D'ADDA (BG) Italy
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: 2010 - 06 - 04

Registration Number: IT - 30436

René Wimmer
President of IQNET

Gianrenzo Prati
President of CISQ

IQNet partners*:
AENOR Spain AFAC AFNOR France AIB-Vinçotte International Belgique ANCE Mexico APCER Portugal CISQ Italy CQC China
CQM China CQS Czech Republic Cco Cert Croatia DQS Germany DS Denmark ELIOT Greece ICASV Brazil
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IRAM Argentina IQA Japan KQF Korea MSZT Hungary Nemko AS Norway NSAI Ireland PCBC Poland QMI Canada
Quality Austria Austria RB Russia SAI Global Australia SII Israel SIQ Slovenia SIBIM QAS International Malaysia
SQS Switzerland SRAC Romania TEST St Petersburg Russia YUQS Serbia
IQNet is represented in the USA by: AFAC AFNOR, AIB-Vinçotte International, CISQ, DQS, NSAI Inc., QMI and SAI Global
*The list of IQNet partners is valid at the time of issue of this certificate. Updated information is available under www.iqnet-certification.com



**СИСТЕМА СЕРТИФИКАЦИИ ГОСТ Р
ГОСТАНДАРТ РОССИИ**

СЕРТИФИКАТ СООТВЕТСТВИЯ

№ РОСС.ИТ.АВ28.101730
Срок действия с 15.07.2009 по 14.07.2012

1085377

ОРГАН ПО СЕРТИФИКАЦИИ пер. № РОСС RU.0001.11AB28
ПРОДУКЦИОННОЕ ОБЩЕСТВО С ОГРАНИЧЕННОЙ ОТВЕТСТВЕННОСТЬЮ "СЕРКОНС"
РФ, 115114, г. Москва, ул. Дербеневская, д. 20, стр. 16, тел. (495) 782-17-08, факс (495) 775-74-68

ПРОДУКЦИЯ Цилиндрический трехфазный силовой конденсатор серии СКТ...
Сериальный выпуск: 34 1460

СООТВЕТСТВУЕТ ТРЕБОВАНИЯМ НОРМАТИВНЫХ ДОКУМЕНТОВ
ГОСТ 12.2.007-75 (и. 1.2); ГОСТ 1282-88 (и.л. 3.4, 3.7, 3.8)

ИЗГОТОВИТЕЛЬ «ICAR SPA»
Corso Magenta 65-20123, Milano(MI), Италия

СЕРТИФИКАТ ВЫДАН «ICAR SPA»
Corso Magenta 65-20123, Milano(MI), Италия

НА ОСНОВании протокола сертификационных испытаний № 936-103 от 15.07.2009г. ЗАО "ТНБП", пер. № РОСС RU.0001.21M.144 от 21.01.2008г., адрес: Россия, 125635, г. Москва, ул. Ангарская, д. 10

ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ Сертификат системы менеджмента качества ISO 9001:2008
выдан в соответствии с требованиями ГОСТ Р ИСО 9001-2008, выданный ОС "ИМ" Система сертификации 3.

Руководитель органа Эксперт

Сертификат не применяется при обязательной сертификации



CISQ
www.cisq.it

CERTIFICATO N. 9170.ICAR
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 - 20052 MONZA (MB)
ICAR SPA
VIA NOSEA 1/3 - 24030 VILLA D'ADDA (BG)
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
Riferirsi al manuale della qualità per l'applicabilità dei requisiti della norma ISO 9001:2008
Refer to quality manual for details of applications to ISO 9001:2008 requirements

IL PRESENTE CERTIFICATO E' SOGGETTO AL RISPETTO DEL REGOLAMENTO
PER LA CERTIFICAZIONE DEI SISTEMI DI QUALITA' E DI GESTIONE DELLE AZIENDE
THE USE AND THE VALIDITY OF THE CERTIFICATE SHALL SATISFY THE REQUIREMENTS
OF THE RULES FOR THE CERTIFICATION OF COMPANY QUALITY AND MANAGEMENT SYSTEM

PRIMA EMISSIONE FIRST ISSUE	EMISSIONE CORRENTE CURRENT ISSUE	DATA SCADENZA EXPIRY DATE
1994-10-05	2010-06-04	2012-05-29

SINCERT EA 19

ICAR S.p.A. - VIA QUINTILIANO, 43 - 20138 MILANO (ITALY)

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test certification bodies - the largest
number of management system
certification in the world
IQNet is composed of more than 20
bodies and covers over 150 subsidiaries
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5. 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 harmonic) which prevents higher order harmonics to flow into capacitors.

ICAR harmonic blocking reactors are made of high-class transformer sheets and aluminium 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.

5.1 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 tables below 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_i]

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 I_n , expressed 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 is 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.

$$U_C = \frac{U_N}{\left[1 - \frac{p}{100\%}\right]}$$

where

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

examples:

Detuning factor p	Resonance frequency f_r	
	$f_N = 50 \text{ Hz}$	$f_N = 60 \text{ Hz}$
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 fed 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 [Q_c]

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

RMS Current I_{eff} [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.

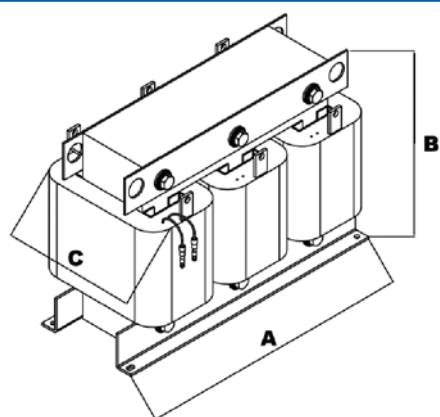
5. HARMONIC BLOCKING REACTORS



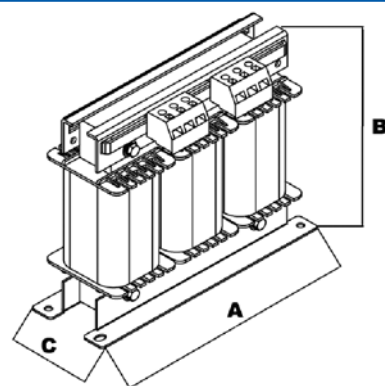
5.2 TECHNICAL DATA SHEETS AND TABLES

TECHNICAL CHARACTERISTICS

Applicable standards	CEI-EN 60289 IEC 60289
Rated voltages	230...700V
Rated frequencies	50/60 Hz
Tolerance of inductance	±5% (mean value across three phases)
Linearity	$I_{lin} = 1.6...2.0 I_n$
Insulation (winding-core)	3 kV
Temperature class	F (100°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



ALUMINIUM



COPPER

V_n = 400V - f_i = 215 Hz - f = 50 Hz - p = 5,4%

Order Code	Qc at 400V (kvar)	L (mH)	I _{rms} (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
PRG0037DAB57692	50	0,6	78	aluminium	320x220x130	20	60	450	942

V_n = 400V - f_i = 189 Hz - f = 50 Hz - p = 7%

Order Code	Qc at 400V (kvar)	L (mH)	I _{rms} (A)	Material	Dimensions (AxBxC) (mm)	Weight (Kg)	Qc at rated voltage (kvar)	Capacitor rated voltage (V)	Capacitance (μF)
46016300	5	6,3	19	copper	205x170x115	13,5	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

5. HARMONIC BLOCKING REACTORS



5.2 TECHNICAL DATA SHEETS AND TABLES

Vn = 400V - fi = 140 Hz - f = 50 Hz - p = 12,7%

Order Code	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

Vn = 380V - fi = 60 Hz - f = 227 Hz - p = 7%

Order Code	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)
46016300	5	6,3	19	copper	205x170x115	13,5	6	450	78
46012910	10	2,9	16	copper	205x184x68	8,6	12	450	157
46012600	12,5	2,6	27	copper	205x184x98	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	320x220x130	20	66	450	864

Vn = 400V - fi = 60 Hz - f = 245 Hz - p = 6%

Order Code	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	205x184x98	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
PRG0037DAB57692	40	0,6	78	aluminium	320x220x130	20	54	450	707
PRG0035DAB57693	50	0,45	88	aluminium	320x220x130	19,5	66	450	864

Vn = 230V - fi = 60 Hz - f = 227 Hz - p = 7%

Order Code	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

Vn = 230V - fi = 60 Hz - f = 252 Hz - p = 5,67%

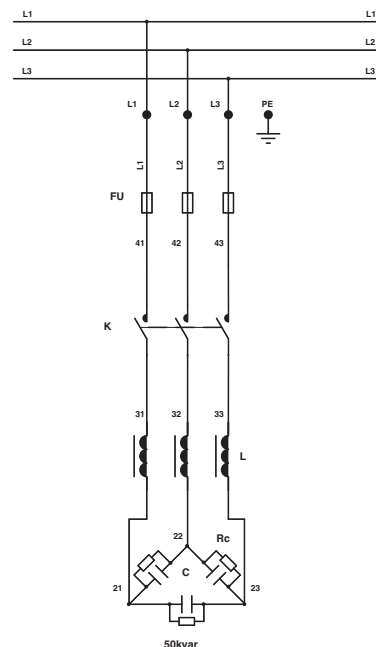
Order Code	Qc at 400V (kvar)	L (mH)	Irms (A)	Material	Dimensions (AxBxC) (mm)	Weight (Kg)	Qc at rated voltage (kvar)	Capacitor rated voltage (V)	Capacitance (μF)
460120103	5	1,6	15	copper	180x180x120	5,7	15	400	249
460120104	10	0,82	37	copper	180x180x130	8,2	30	400	497
460120105	12,5	0,66	36	copper	180x180x120	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

5. HARMONIC BLOCKING REACTORS



5.3 RECOMMENDED CONNECTING SCHEME

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



5.4 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 (including reactors) 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 every coil. These leads shall be wired in series to contactor coils to switch off in case of over load.

5.5 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

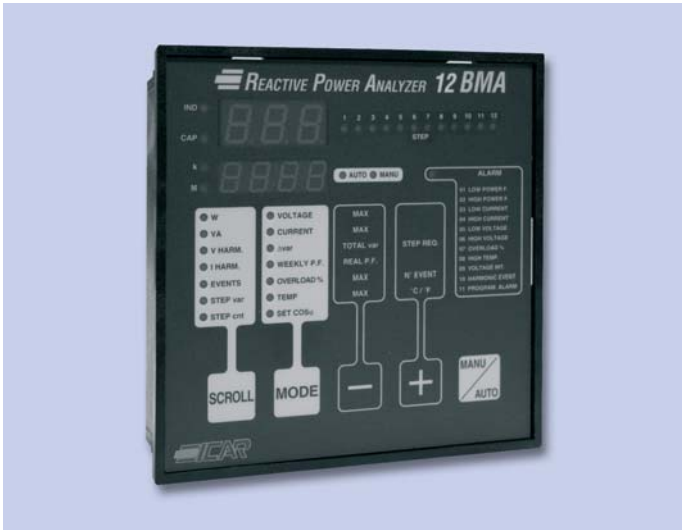
Electrical or mechanical misapplications of Harmonic Blocking Reactors capacitors may become hazardous.

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.

6. REACTIVE POWER CONTROLLERS



The reactive power controller is a basic component for the good functioning of an automatic capacitor bank: in fact it represents the “intelligent” part of the system being designed to control load conditions; upon the check results, it decides the activation of the right available capacitor banks in order to keep the power factor within the set limits.

RPC and RPA reactive power controllers proposed by ICAR and used in ICAR automatic power factor correction systems are designed to guarantee the desired power factor by optimizing the stress on capacitors batteries.

ICAR controllers offer important functions to maintain and run a power factor correction system in order to maximize the length of its life and solve the plant problems that could bring to a reduction of its working life.

Beside all RPC regulators characteristics, RPA offer more measure functions and the possibility of communication via serial output RS485.

For power factor correction systems or rather with static switching suitable for the power factor correction of plants with sudden load changes (welders, mixers, mills, etc), are available RPE special controllers.

All regulators are able to set cos phi between 0,8 inductive and 0,8 capacitive and functioning even in cogeneration plant.

6.1 GENERAL CHARACTERISTICS

ICAR power reactive controllers are managed by a microprocessor and propose many functions while keeping a simple functioning and parameterization modality either locally or by PC via serial port RS 232 of which all standard versions are equipped.

It will be possible changing all parameters to customize the functioning. Accordingly to the real characteristics of the plant that needs power factor correction, (cos phi threshold sensitivity, steps switching speed, etc).

The controller can function in automatic or manual modality. In the first case it will work in complete autonomy by switching on and off the

available capacitor banks until the desired cos phi will be reached; in the second case the operator will force the switching on and off of batteries.

The controller will supervise on the discharge times in order to prevent operations that could potentially damage the capacitors.

ICAR controllers are also equipped with the powerful AUTO SET UP function, which enables the regulator self-configuration accordingly with the real characteristics of the capacitor bank batteries; this function is particularly convenient when is needed the replacement of an existing capacitor bank controller.

6.2 MEASURE FUNCTIONS

ICAR controllers in standard edition give many measurements to verify and monitor the correct functioning and the condition of the system. On the front display are viewed

- Voltage
- Current
- Missing kvar
- Average weekly power factor
- Harmonic distortion rate % (THDI %) on capacitors
- Temperature

The regulator memorizes the greater value for each of those measures to evaluate which one created the heaviest capacitors stress on the switchboard, starting from the last reset: temperature, voltage and harmonic distortion rates have a strong impact on capacitors since, if they are constantly over the nominal value, the working life could be

drastically reduced.

The controller is also equipped for the measurement of the real reactive power supplied by the single banks and adjust the steps switching programme; this characteristic is useful for power factor correction switchboards in use since long time and therefore with old capacitors.

By connection to serial output RS232, is possible to have the use of many other information useful to evaluate the status of the system in order to schedule ordinary and extraordinary maintenance like contactors control/replacement:

- Number of manoeuvres executed by each step
- Number of working hours of each step
- Number of switchings executed by manual mode

6.3 ALARM SIGNALS

ICAR controllers, in their standard version, offer nine different alarm signals, set on the following measures:

- Under compensation
- Overcompensation
- Min current
- Max current

- Min voltage
- Max voltage
- Max THD
- Max Temperature
- Micro interruptions

6.4 LED INDICATORS

The led who are present on the controllers display, offer the following information:

- Functioning modality automatic/manual
- Status of each battery (ON/OFF)
- Cos phi determination inductive/capacitive
- Type of measure visualized on the display

6.5 CONTACTS

The controllers have the use of electric contacts for the steps switching, for the working of an eventual cooling fan and for the remote

control of alarm signals.

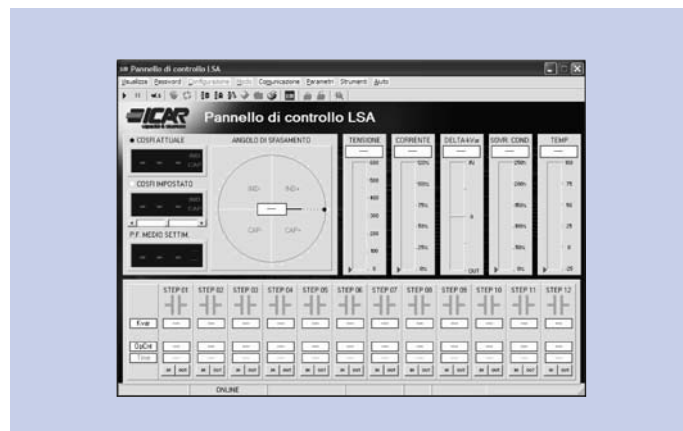
The contacts available can be programmed with NO or NC logic.

6. REACTIVE POWER CONTROLLERS



6.6 SOFTWARE

Every ICAR controller can exchange data with PC by means of RS232 netport and relevant Software. It makes quicker the controller set-up, by using stored and premade settings, and it turns easier the checking of regulator and capacitor bank parameters. All of the controller display information is repeated on the software main window and detailed step life conditions are also shown.



6.7 TECHNICAL DATA SHEETS

RPC



Generalities

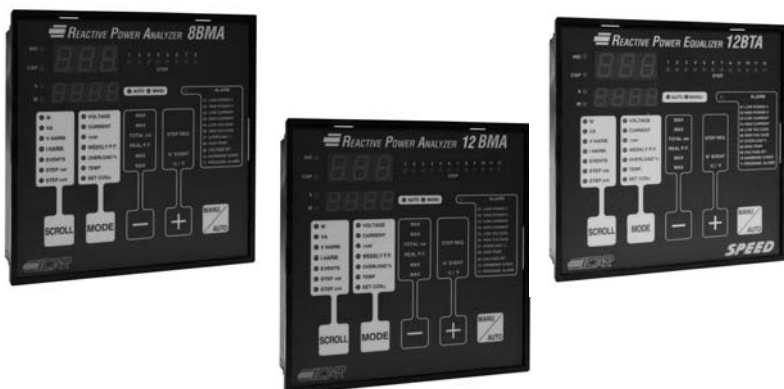
- Microprocessor Power Factor Correction relays
- IND or CAP power factor indication led
- Step indication led
- Terminal strip connection
- Relays 250Vac-5A
- Relays 415Vac -1,3A
- CEI EN 61010-1 CEI EN 50081-2 CEI EN 50082-2 Applicable standards

TYPE	RPC 5LSA	RPC 7LSA	RPC 8BSA	RPC 12BSA
CODE	A25060046413052	A25060046413070	A25060046416080	A25060046416120
AUX. SUPPLY VOLTAGE	380÷415V	380÷415V	380÷415V	380÷415V
FREQUENCY	50Hz / 60Hz	50Hz / 60Hz	50Hz / 60Hz	50Hz / 60Hz
MEASURE VOLTAGE CIRCUIT	Taken from aux. supply	Taken from aux. supply	Taken from aux. supply	Taken from aux. supply
MEASURE CURRENT CIRCUIT	5 A (1A on request)	5 A (1A on request)	5 A (1A on request)	5 A (1A on request)
BURDEN	6,2VA	6,2VA	5VA	5VA
C/K PARAMETER SET POINT	Automatic	Automatic	Automatic	Automatic
COSφ SET POINT	From 0.8 lag to 0.8 lead	From 0.8 lag to 0.8 lead	From 0.8 lag to 0.8 lead	From 0.8 lag to 0.8 lead
DISPLAY	Single	Single	Single	Single
CONNECTION TIME	5 sec. ÷ 600 sec.	5 sec. ÷ 600 sec.	5 sec. ÷ 600 sec.	5 sec. ÷ 600 sec.
OUTPUT RELAYS	5	7	8	12
ALARM RELAY	Yes	Yes	Yes	Yes
PROTECTION DEGREE	IP55	IP55	IP41	IP41
WEIGHT	0.44Kg	0.46Kg	0.74Kg	0.77Kg
WORKING TEMPERATURE	-20°C÷+60°C	-20°C÷+60°C	-20°C÷+60°C	-20°C÷+60°C
STORAGE TEMPERATURE	-30°C÷+80°C	-30°C÷+80°C	-30°C÷+80°C	-30°C÷+80°C
RS 232 SERIAL PORT	Yes	Yes	Yes	Yes
RS 485 SERIAL PORT	NO	NO	NO	NO
TEMPERATURE CONTROL	Yes	Yes	Yes	Yes
3 PHASE MULTIMETER FUNCTIONS	NO	NO	NO	NO
EXTERNAL TEMP.SENSOR INPUT	NO	NO	NO	NO
DIMENSIONS (SEE FOLLOWING PAGES)	145	145	146	146

6. REACTIVE POWER CONTROLLERS



RPA/RPE



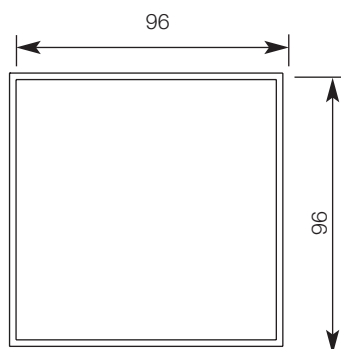
Generalities

- Microprocessor Power Factor Correction relays
- IND or CAP power factor indication led
- Insertion step indication led
- Terminal strip connection
- Relays 250Vac-5A
- Relays 415Vac –1,3A
- CEI EN 61010-1 CEI EN 50081-2 CEI EN 50082-2

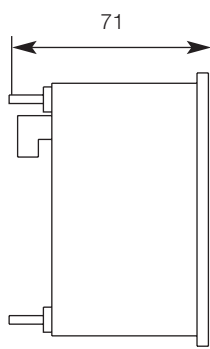
Applicable standards

TYPE	RPA 8BMA	RPA 12BMA	RPE 12BTA
CODE	A25060046416082	A25060046416126	A25060046416124
AUX. SUPPLY VOLTAGE	110V ÷127V 220V ÷240V	110V ÷127V 220V ÷240V	110V ÷127V 220V ÷240V
FREQUENCY	50Hz / 60Hz	50Hz / 60Hz	50Hz / 60Hz
MEASURE VOLTAGE CIRCUIT	100÷690V	100÷690V	100÷690V
MEASURE CURRENT CIRCUIT	5 A (1A on request)	5 A (1A on request)	5 A (1A on request)
BURDEN	9,7VA	9,7VA	9,7VA
C/K PARAMETER SET POINT	Automatic	Automatic	Automatic
COSφ SET POINT	From 0.8 lag to 0.8 lead	From 0.8 lag to 0.8 lead	From 0.8 lag to 0.8 lead
DISPLAY	Two	Two	Two
CONNECTION TIME	5 sec. ÷ 600 sec.	5 sec. ÷ 600 sec.	0 millisecc. ÷ 250 millisecc.
OUTPUT RELAYS	8	12	10 (solid state relay)
ALARM RELAY	Yes	Yes	Yes
PROTECTION DEGREE	IP41	IP41	IP41
WEIGHT	0.94Kg	0.94Kg	0.94Kg
WORKING TEMPERATURE	-20°C÷+60°C	-20°C÷+60°C	-20°C÷+60°C
STORAGE TEMPERATURE	-30°C÷+80°C	-30°C÷+80°C	-30°C÷+80°C
RS 232 SERIAL PORT	Yes	Yes	Yes
RS 485 SERIAL PORT	Yes	Yes	Yes
TEMPERATURE CONTROL	Yes	Yes	Yes
3 PHASE MULTIMETER FUNCTIONS	Yes	Yes	Yes
EXTERNAL TEMP.SENSOR INPUT	Yes	Yes	Yes
DIMENSIONS (SEE FOLLOWING PAGES)	146	146	146

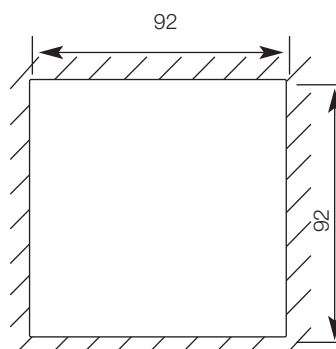
6. REACTIVE POWER CONTROLLERS



DIMENSIONI DI INGOMBRO
OVERALL DIMENSIONS

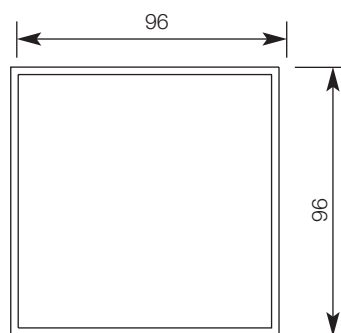


PROFONDITA'
DEPTH

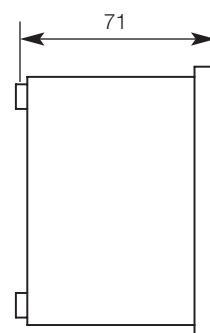


FORATURA
DRILLING

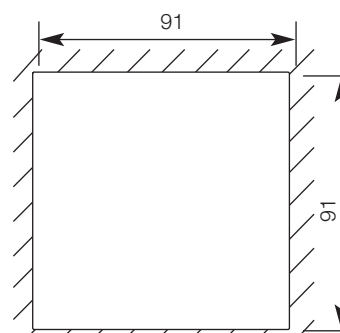
144



DIMENSIONI DI INGOMBRO
OVERALL DIMENSIONS

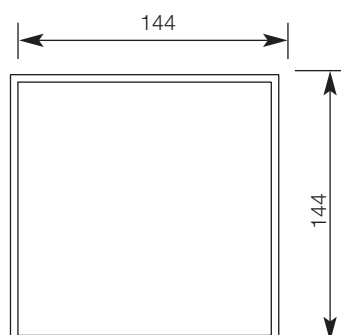


PROFONDITA'
DEPTH

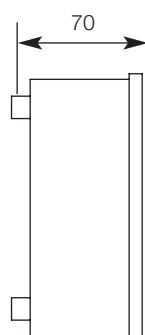


FORATURA
DRILLING

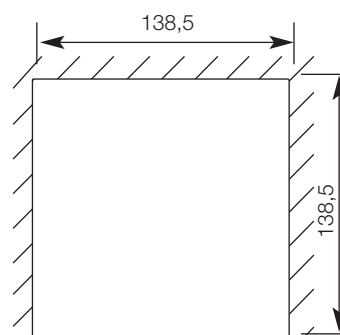
145



DIMENSIONI DI INGOMBRO
OVERALL DIMENSIONS



PROFONDITA'
DEPTH



FORATURA
DRILLING

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7. CONTROL PROTECTION MULTIMETER MCP-4



Control and protection multimeter MCP4 is utilized in the most complete power factor correction systems and in filters in addition to the reactive power controller to guarantee a more precise and reliable capacitor banks protection.

MCP4 multimeter in fact, enables monitoring voltages, currents and THD of all phases, system frequency and cabinet internal temperature; it has a relay contact for the remote carry-over of a cumulative alarm.

LED INDICATION AND DISPLAY



The LED, that are present and the display of the multimeter MCP4 give the following information

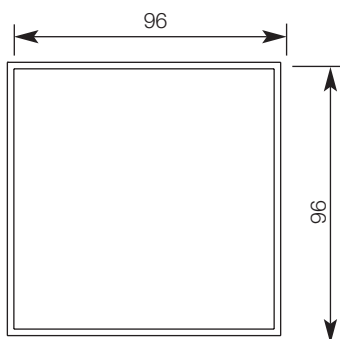
- Measure of the electric parameter indicated
- Fan status
- ON/OFF status

Generalities

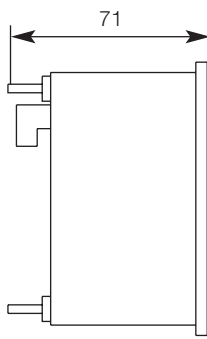
- Microprocessor device
 - Measured values: tension, current, THD%, temperature
 - Displayed value indication led
 - Fan status indication led
 - Manual reset set-up indication led
 - Alarm trip indication led
 - Terminal strip connection
 - Relays 250Vac-5A
 - CEI EN 61010-1 CEI EN 50081-2 CEI EN 50082-2
- Applicable standards

TYPE	MCP4
CODE	A25060044100010
AUX. SUPPLY	115V (230V-400V on request)
FREQUENCY	50/60Hz
MEASURE VOLTAGE CIRCUIT	80V ÷ 540V
MEASURE CURRENT CIRCUIT	5A (1A on request)
BURDEN	4VA
VOLTAGE MEASURING ACCURACY	±1%
CURRENT MEASURING ACCURACY	±1%

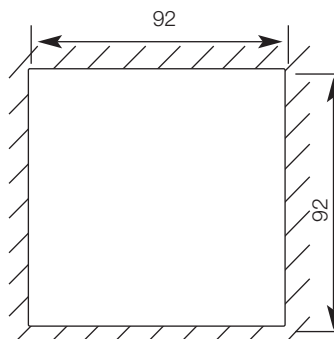
THD CURRENT MEASURING ACCURACY	±1% for I _{rms} >10% ±5% for I _{rms} <10%
TEMPERATURE MEASURING ACCURACY	±1°C
DISPLAY	Yes
ALARM RELAY	cumulative
PROTECTION DEGREE	IP40
WEIGHT	0.45Kg
WORKING TEMPERATURE	0°C ÷ +55°C
STORAGE TEMPERATURE	-20°C ÷ +70°C
RS232 SERIAL EXIT	Yes
DIMENSIONS	see below



DIMENSIONI DI INGOMBRO
OVERALL DIMENSIONS



PROFONDITA'
DEPTH



FORATURA
DRILLING

8. THYRISTOR SWITCHES



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

Thyristor switched capacitor bank 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).

Thyristor switched capacitor bank 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.

8.1 GENERAL CHARACTERISTICS

ICAR SINCHRO FAST SWITCH FEATURES are described below:

- Switching speed: 60ms
- 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. Possibility to use SFS with ICAR RPE 12BTA regulator.
2. The control technology adopted doesn't allow switching that could generate self damage.
3. Very small dimensions.
4. High temperature protection.
5. Protection from high speed switching.
6. SFS doesn't need any external supply.

8. THYRISTOR SWITCHES



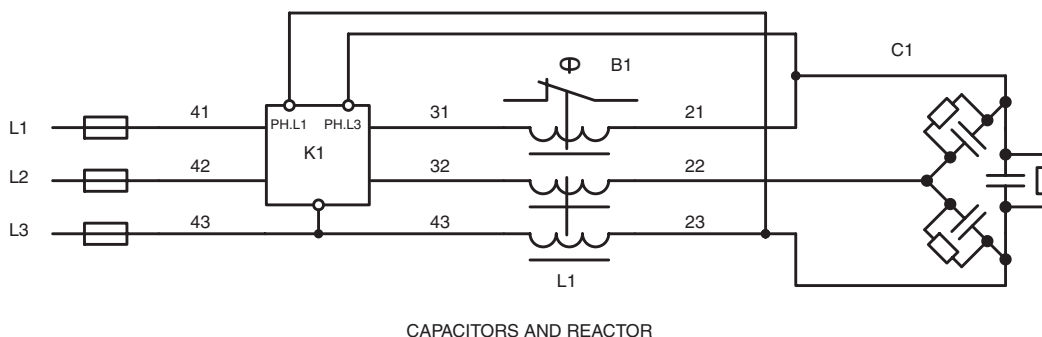
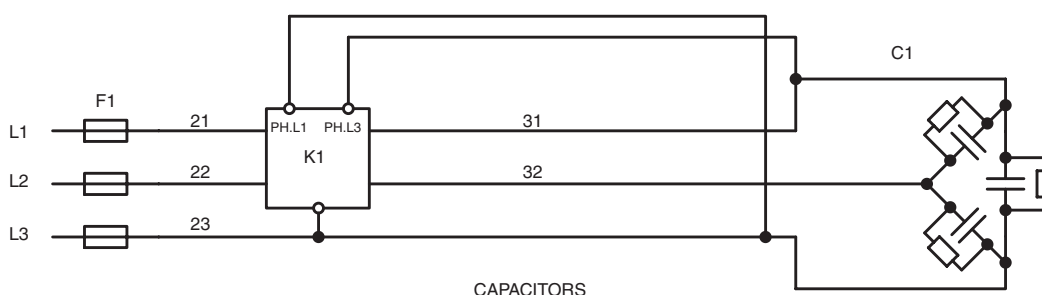
8.2 TECHNICAL DATA SHEETS AND TABLES

TECHNICAL CHARACTERISTICS

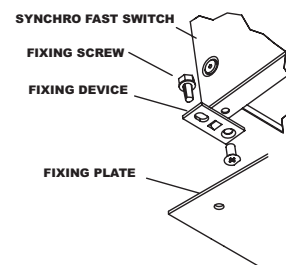
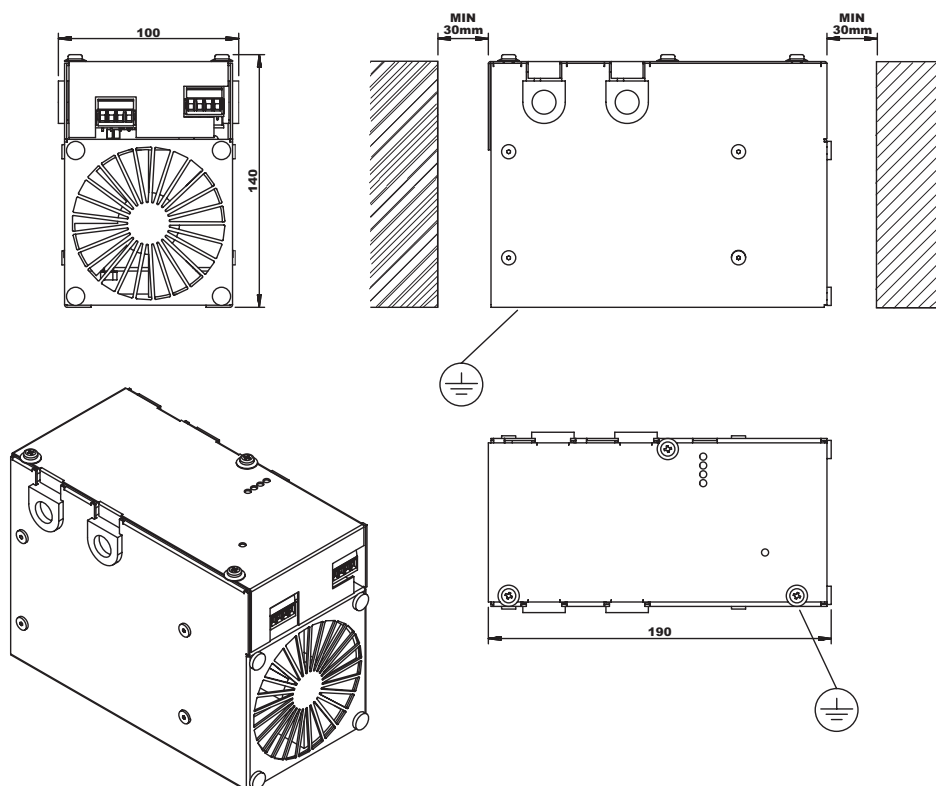
Voltage	400-415V
Frequency	50Hz (60Hz on request)
Activation	Using external contact voltage free (type SSR Bi-directional opto-mos recommended); no need for 24Vdc
Fuse (not included)	NH00 Super Fast
Duty cycle max speed	60ms ON – 60ms OFF
Power circuit	L1-L2: 25mm ² for SFS50/HS and SFS50B/HS (L3: 2,5mm ² on the main supply side only) L1-L2: 50mm ² for SFS80/HS (L3: 2,5mm ² on the main supply side only)
Operating ambient temperature	0÷50°C

Order Code	Identification	Switching Power [Capacitors]	Switching Power [Capacitors and Reactors]	Dimensions (mm) [WxHxD]	Weight (kg)
A25060043842751	SFS50/HS	60kvar	38kvar	195x140x100 (81)	3,5 Kg
A25060043842754	SFS50B/HS	-	50kvar	236x140x125 (82)	5,5 Kg
A25060043843150	SFS80/HS	100kvar	80kvar	236x140x125 (82)	5,7 Kg

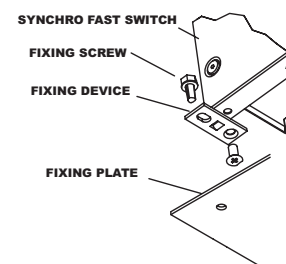
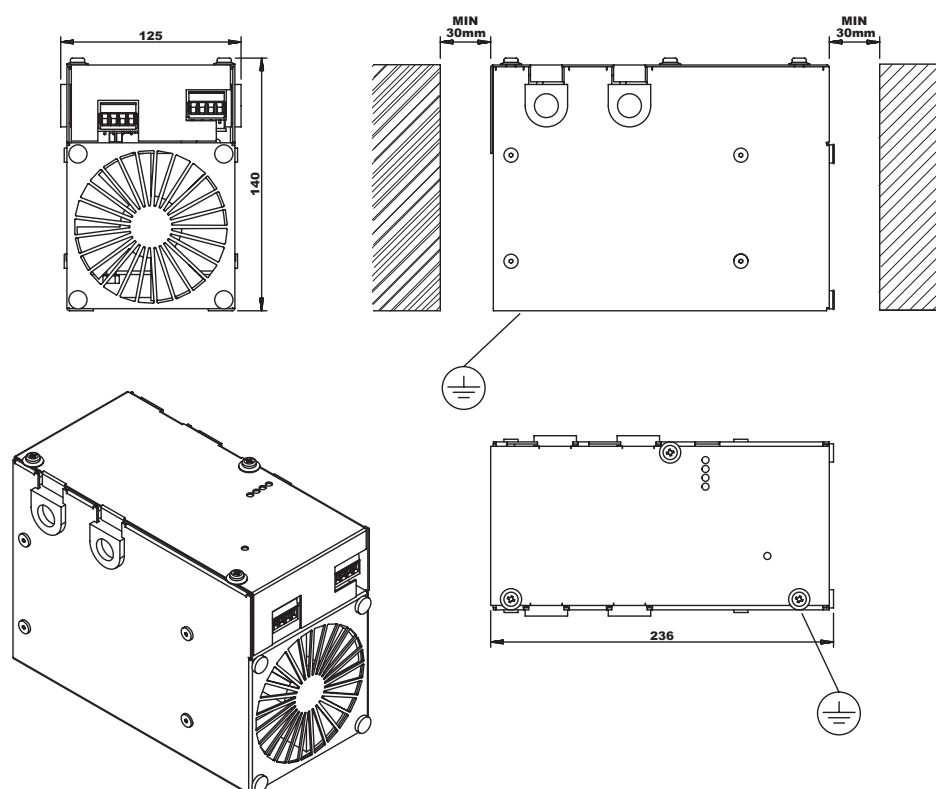
8.3 CONNECTING DIAGRAM



8. THYRISTOR SWITCHES



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9. FAST DISCHARGE DEVICE RPD 3A



9.1. 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.

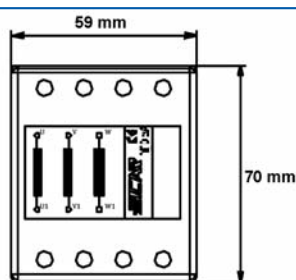
Several discharge times till residual capacitor voltage of 50V are shown in table below. They are shown for 230V and 400V capacitor rated voltage and frequency of 50 and 60 Hz.

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

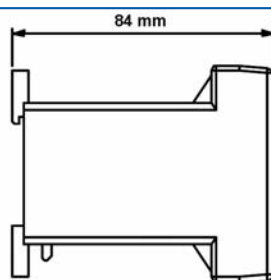
9.2. TECHNICAL CHARACTERISTICS

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

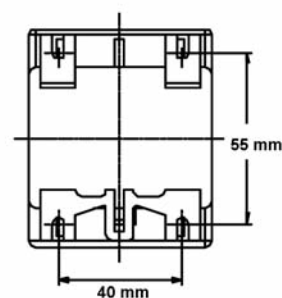
9.3. DIMENSIONS



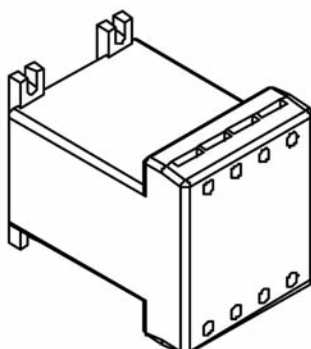
**FRONT
VIEW**



**SIDE
VIEW**



**REAR VIEW
(FIXING
DETAILS)**

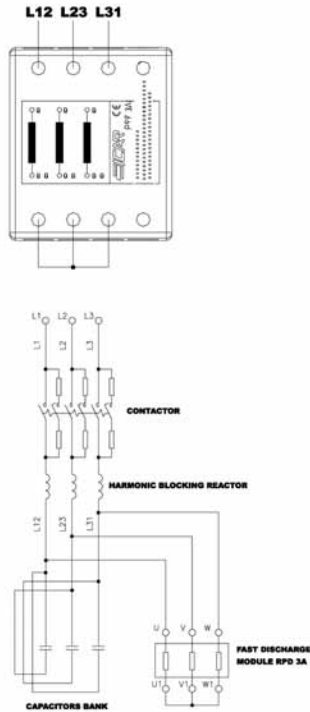


9. EUROrack TRAYS

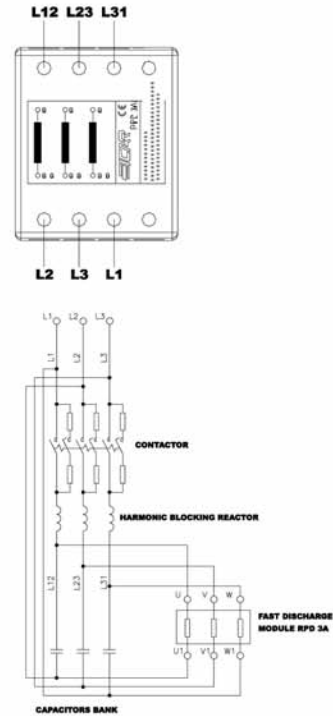


9.3. CONNECTING DIAGRAMS

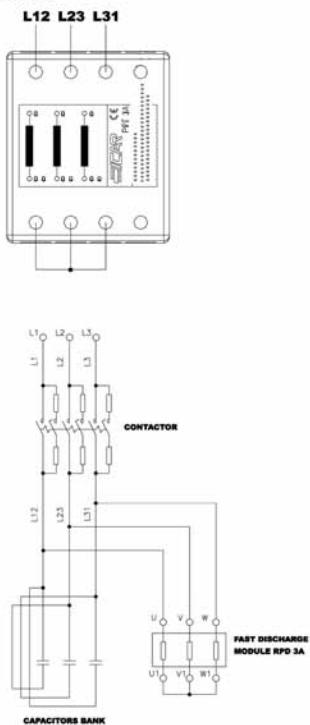
CONTACTOR OUTSIDE TO THE CAPACITORS DELTA CONNECTION (SINGLE PHASE OR THREE PHASE CAPACITORS)



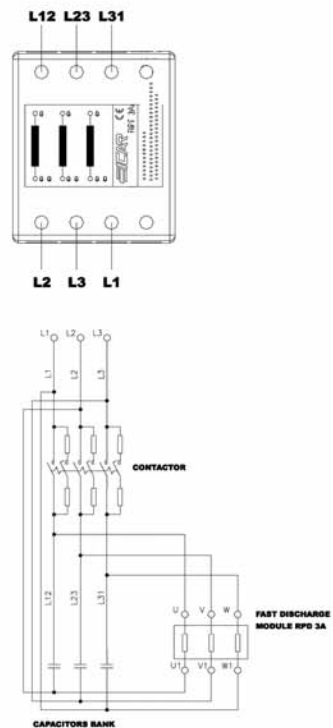
CONTACTOR INSIDE TO THE CAPACITORS DELTA CONNECTION (SINGLE PHASE CAPACITORS ONLY)



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



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



10. EUROrack TRAYS



10.1. GENERAL CHARACTERISTICS



EUORack 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.

EUORacks are sound for plants where the current Total Harmonic Distortion is as much as 100% (detuned FH30).

EUORacks are equipped with ICAR **3U±** high energy density metallised polypropylene capacitors which assure elevated performances with low losses and small dimensions.

10.2. DESIGN FEATURES

Every chassis 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
- **3U±** three phase self-healing polypropylene capacitors with 525V rated voltage (FH only).

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.

- Three-phase tinned copper bus bar system
- Discharge resistors.
- Three phase detuning chokes (FH only) with tuning frequency 215Hz-180Hz-135Hz; each coil with temperature sensor and NC switch.

All components inside these products are compliant with EU Safety Regulations

OPTION

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

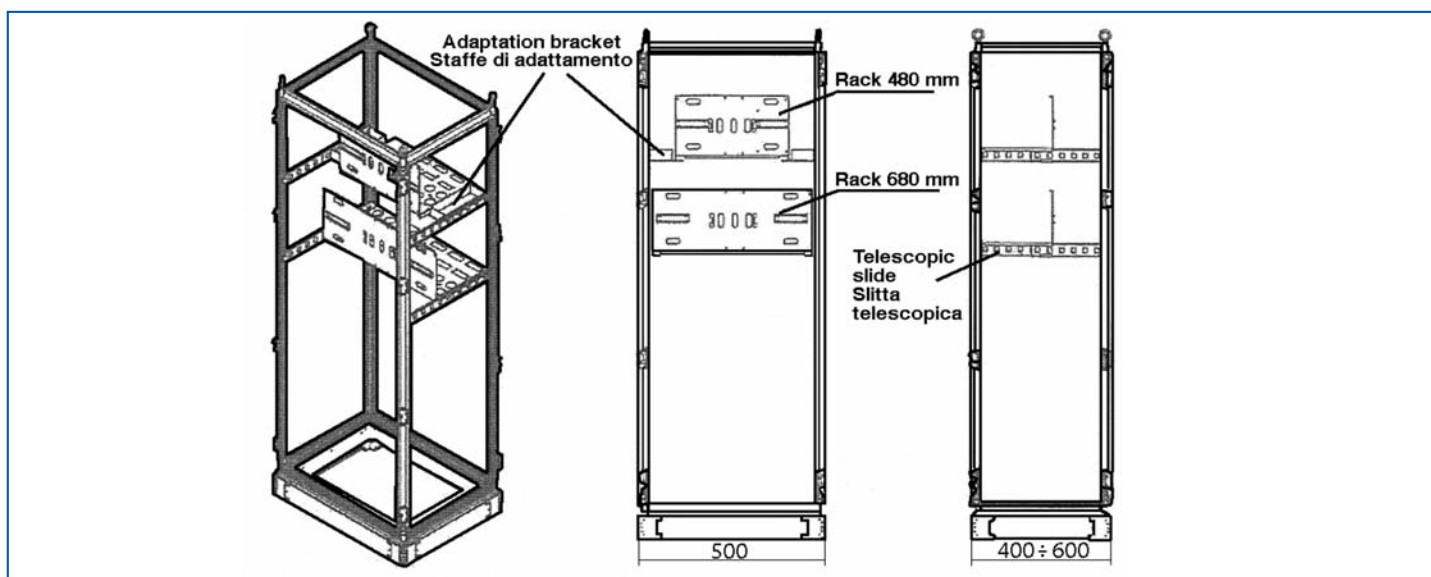
10.3 CABINET FITTING

EUORacks FH trays are easy to fit inside any standard cabinet thanks to sliding and adjustable side supports. These brackets enable EUORacks 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, both detuned and not detuned. Extensions 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.



10. EUROrack TRAYS



10.4. TECHNICAL DATA SHEETS AND SELECTION TABLES

• Rated operational voltage	$U_e = 400-415V$
• Rated frequency	50Hz
• Max current overload I_n (tray)	1.3x I_n
• Max voltage overload V_n (bank)	1.1x V_n
• Max current overload I_n (capacitors)	2x I_n
• Max voltage overload V_n (capacitors)	1,3 V_n
• Insulating voltage (bank)	690V
• Capacitors insulating level	3/15kV
• Temperature range	-25/+55°C
• Discharge resistors	on each tray
• Use	indoor
• Service	continuo/continous
• Capacitors connection	delta
• Switching devices	Capacitor duty contactors
• Total Tray losses	6 W/kvar (FH) / 2 W/kvar (HP)
• Capacitor Dielectric losses	0,2 W/kvar
• Inner surface finish	zinc passivation
• Tray Applicable standards	CEI EN 60439-1/2 CEI EN 61921-1
• Capacitor Applicable standards	CEI EN 60831-1/2

EUORack trays WITH HIGH ENERGY DENSITY METALLIZED POLYPROPYLENE CAPACITORS AND DETUNING CHOKE

U_e	Hz	THDI _R %	SERIES
400V-415V	50	≤ 20%	Detuning choke (215Hz-p=5.4%) - FH05
400V-415V	50	≤ 60%	Detuning choke (180Hz-p=7.7%) - FH20
400V-415V	50	100%	Detuning choke (135Hz-p=13.7%) - FH30

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

SERIES FH05 p=5.4%

CODE IP20	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

SERIES FH20 P=7.7%

CODE IP20	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

SERIES FH30 P=13.7%

CODE IP20 (kvar)	POWER $U_e=415V$ (kvar)	POWER $U_e=400V$ (kvar)	STEPS $U_e=400V$ (mm)	DIM IP20 WxHxD	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

10. EUROrack TRAYS



EUROrack trays WITH HIGH ENERGY DENSITY METALLIZED POLYPROPYLENE CAPACITORS

U _e	U _N	U _{MAX} ¹	Hz	THDI _R %	SERIES
400V-415V	415V	455V	50	≤ 10% ≤	HP10
400V-415V	450V	495V	50	≤ 18% ≤	HP20
400V-415V	525V	580V	50	≤ 25% ≤	HP30

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

SERIES HP10

CODE IP20	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

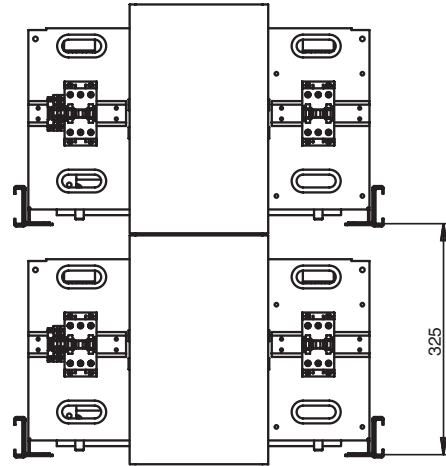
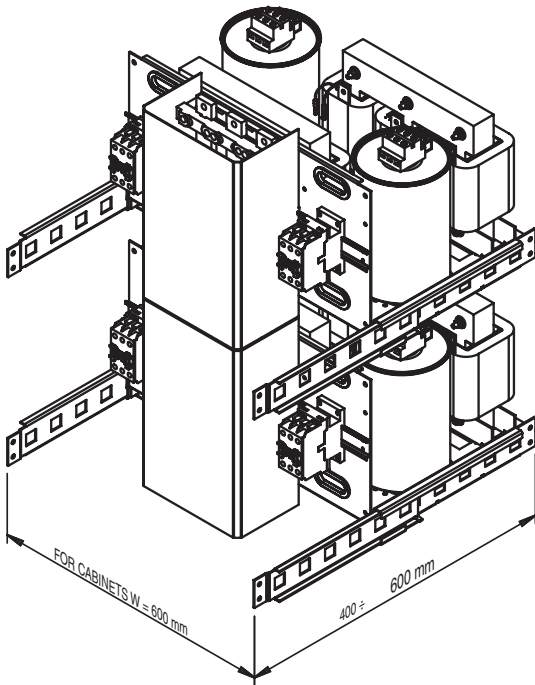
SERIES HP20

CODE IP20	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

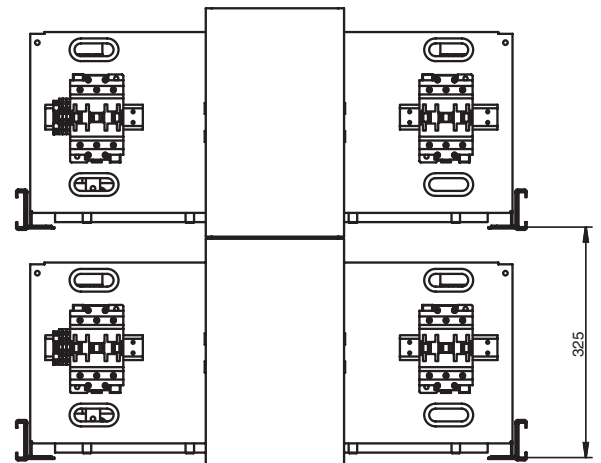
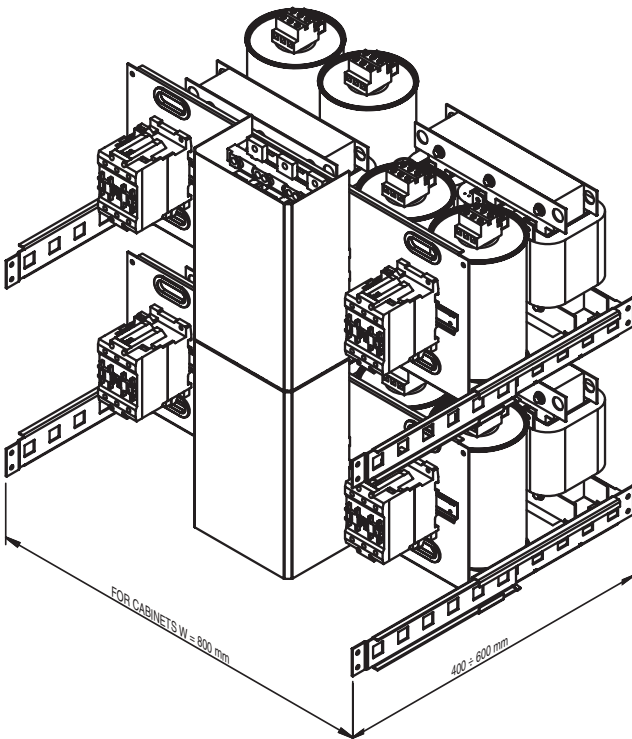
SERIES HP30

CODE IP20	POWER U _N =525V (kvar)	POWER U _e =415V (kvar)	POWER U _e =400V (kvar)	STEPS U _e =400V (kvar)	DIM IP20 WxHxD (mm)	OVERALL DRAWING
IY0SQK230050359	30	19	17.5	17.5	480x275x340	93, 95
IY0SQK260050359	60	38	35	2x17.5	480x275x340	93, 95
IY0SQK290050359	90	57	52.5	3x17.5	480x275x340	93, 95
IY0SQK312050359	120	76	70	4x17.5	480x275x340	93, 95
IY0SQK315050359	150	94	87.5	5x17.5	680x275x336	94, 96
IY0SQK318050359	180	112	105	6x17.5	680x275x336	94, 96

10. EUROrack TRAYS

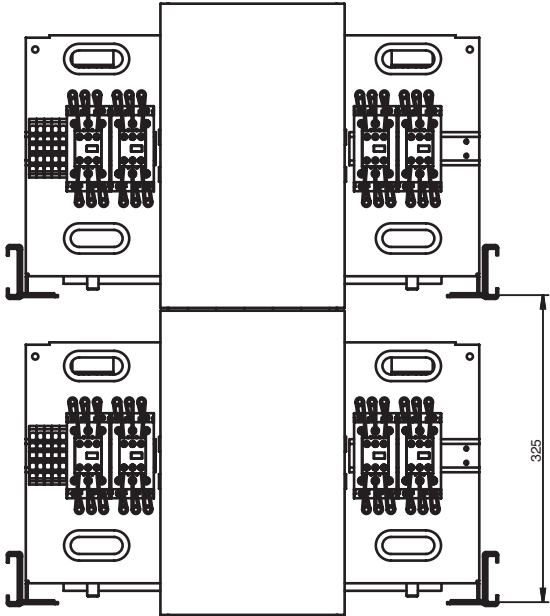
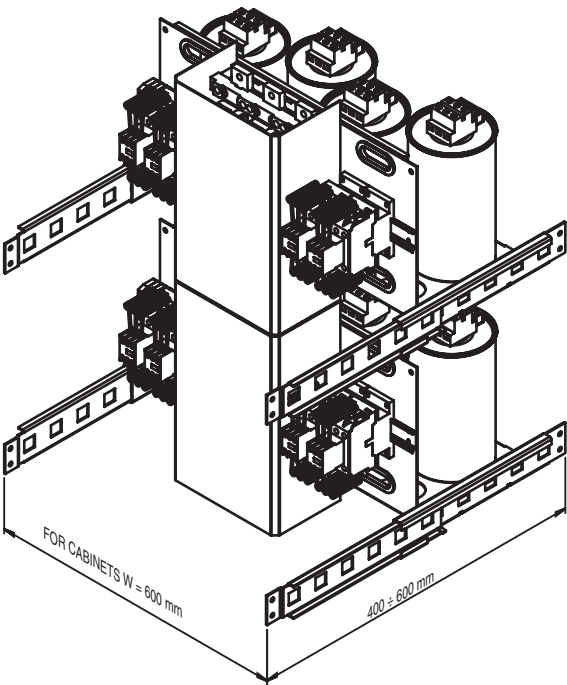


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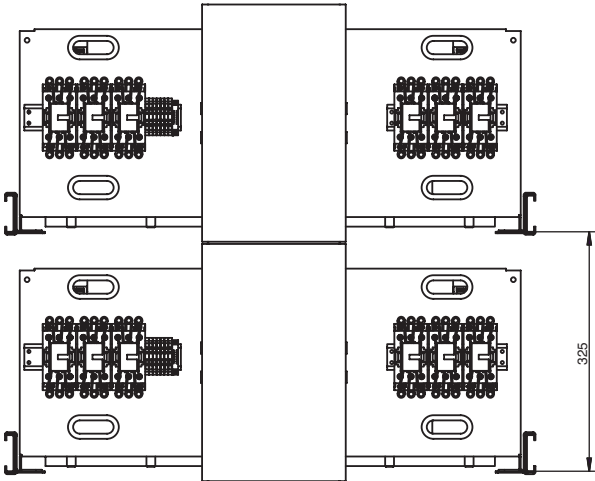
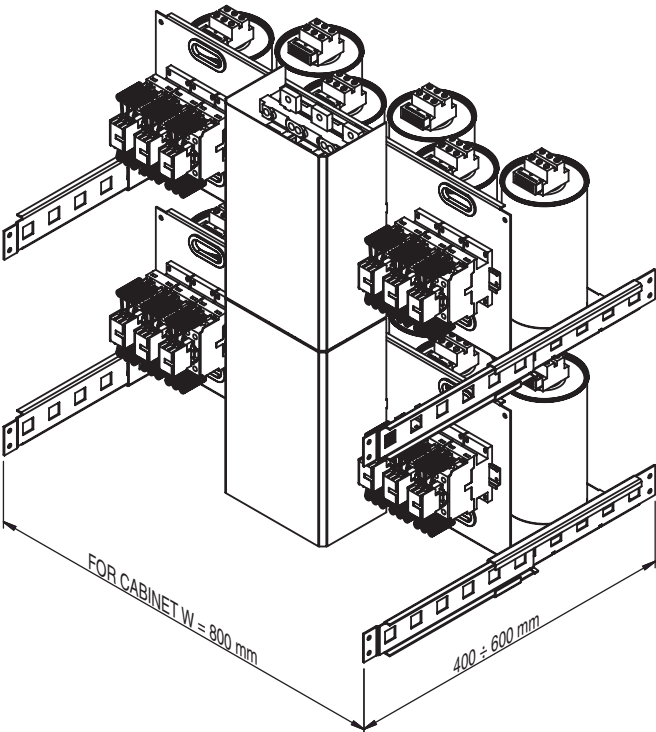


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10. EUROrack TRAYS

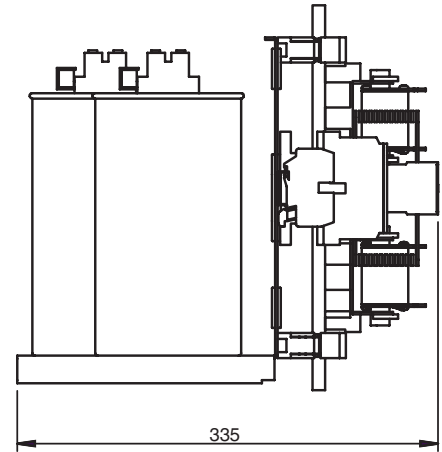
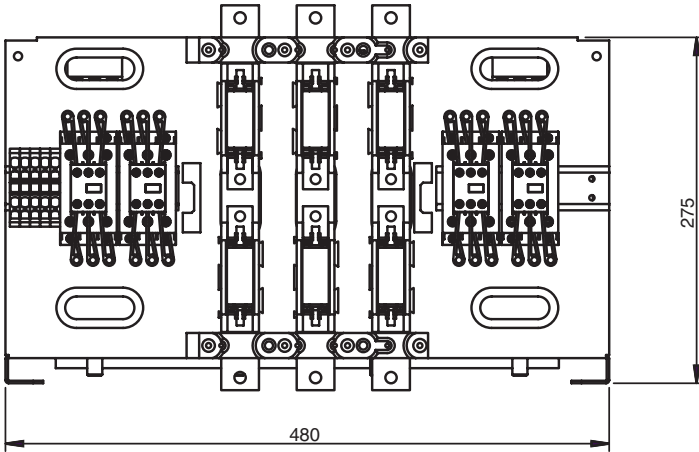


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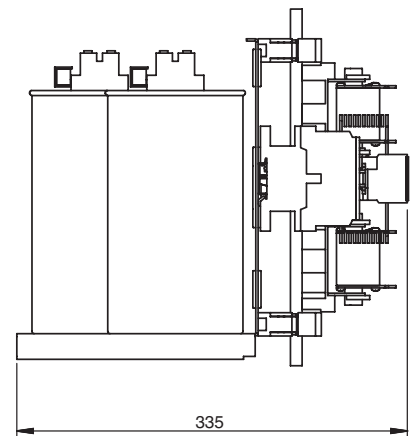
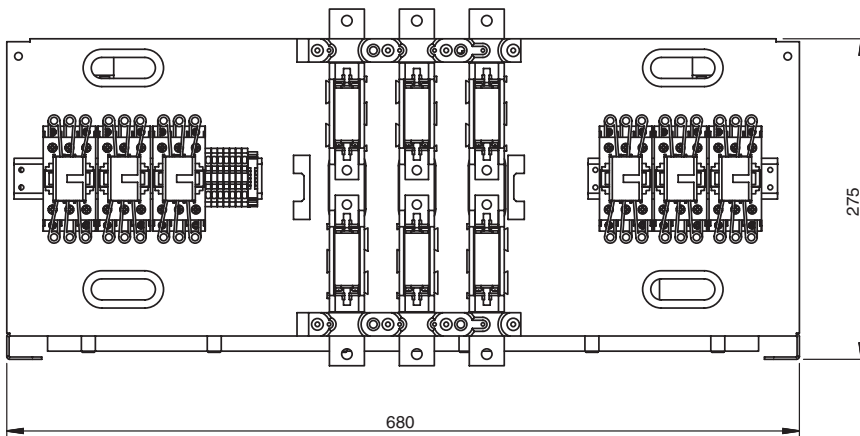


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10. EUROrack TRAYS

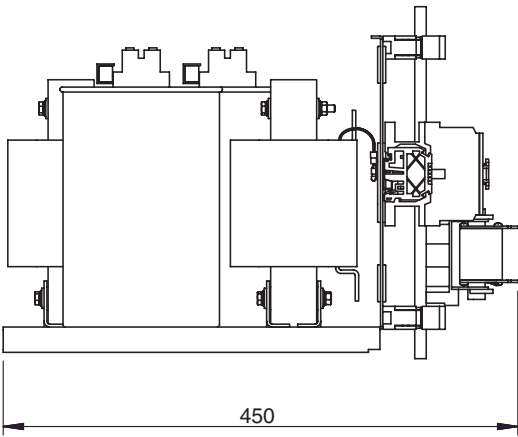
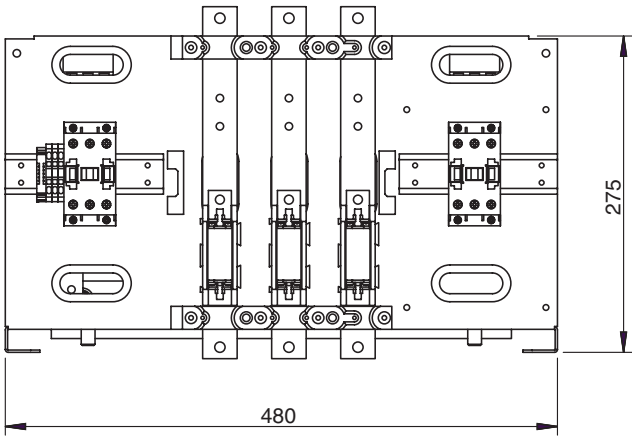


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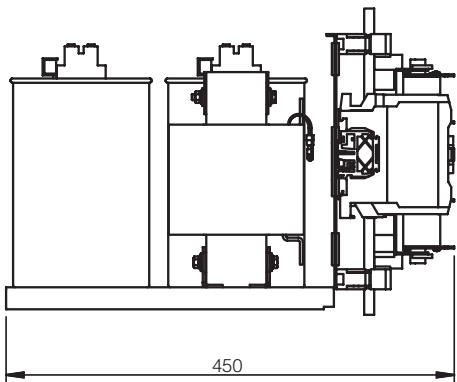
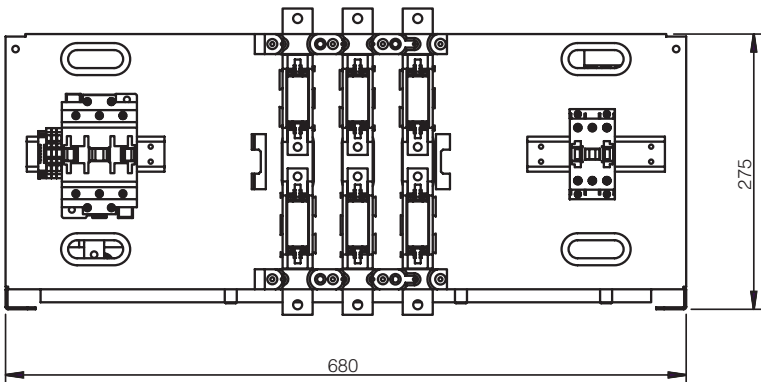


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10. EUROrack TRAYS



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