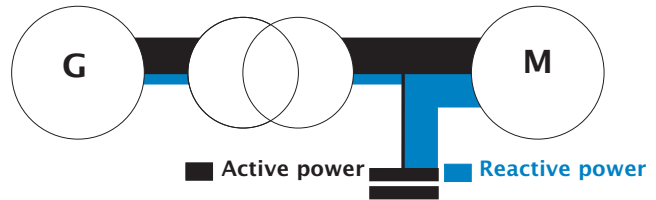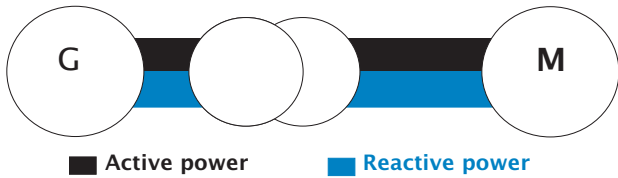# POWER FACTOR CORRECTION

The power factor correction of electrical loads is a problem common to all industrial companies using electric power. Every electric power user draws the amount active power required to carry out its tasks from the mains. every user also asks the mains to supply a certain amount of reactive power, depending on the type of machines connected to the installation. Although this reactive power is non-productive, the electricity supply companies request payment for it, by imposing asurcharge whenever contract values are exceeded. The surcharge is expressed as transport costs or debit for excessive consumption of reactive energy (penalty for low cosf) according to the specific contractual forms.

In order to avoid surcharges, a suitable power factor correction system can be installed.

A power factor correction control panel, connected in parallel with the other loads, will reduce the amount of reactive inductive power to be supplied by the electricity supply companies, thus reducing or eliminating possible surcharges for excessive reactive power absorption.

G — M
■ Active power   ■ Reactive power

G — M
■ Active power   ■ Reactive power

CALCULATION OF THE NECESSARY REACTIVE POWER.

MV/LV TRANSFORMER POWER FACTOR CORRECTION

Idle transformer losses: during idle running, i.e. overnight and during holidays, the MV/LV transformer absorbs low-cosf power and therefore needs power factor correction. The power required can be calculated from table 2, provided that the rated power of the transformer and its primary voltage are known.

CENTRALISED POWER FACTOR CORRECTION

To achieve a precise calculation of the power factor correction required for a system, the following items are needed: the maximum used power **P**, and the cosf of the system. These values may be calculated from invoices of the electric-ity supply companies by carrying out the necessary meas-urements. After establishing the cosf value desired in the system, by means of table 2 the K coefficient is determined. It is used to multiply the used kWs to calculate the power factor correction kVAr.

For example: a system using P=1000kW with cosf =0.70 requires a power factor correction to cosf =0.94. From table 2 we obtain K=0.66, and so the system requires power factor correctionto Q=1000x0.66=660kVAr at the mains voltage. A power factor correction system is properly sized when both its quantitative and qualitative aspects of the load power factor to correct have been taken into due consideration.

Therefore, knowing the following items is necessary:
1) the power factor correction rate (kVAr) to be installed to avoid surcharges, by means of the analysis of consumption.
2) the expected capacitor working conditions (environment and power mains), which must be evaluated particularly as far as the presence of harmonics in the line is concerned.

Transformer Nominal Power kVA	Capacitor Power kvar	Suggested Elcontrol model Rete 380-400V 50Hz
160	10 – 12.5	STPF 12.5-440
250	15 – 20	STPF 25-440
315	17 – 20	STPF 25-440
400	20 – 25	STPF 25-440
630	25 – 30	STPF 37.5-440
800	30 – 35	STPF 37.5-440
1000	35 – 45	STPF 50-440
1250	50 – 60	STPF 75-440
1600	60 – 80	STPF 100-440

TAB.1

k –coefficient					
Initial Cosf	kvarh/kwh	Final cosφ	Final cosφ	Final cosφ	Final cosφ
0,60	1,33	0,90	0,92	**0,94**	**0,96**
0,62	1,27	0,85	0,91	**0,97**	1,04
0,64	1,20	0,78	0,84	**0,90**	0,97
0,66	1,14	0,72	0,77	**0,84**	0,91
0,68	1,08	0,65	0,71	**0,78**	0,85
0,70	1,02	0,59	0,65	**0,72**	0,79
0,72	0,96	0,54	0,59	**0,66**	0,73
0,74	0,91	0,48	0,54	**0,60**	0,67
0,76	0,86	0,42	0,48	**0,55**	0,62
0,78	0,80	0,37	0,43	**0,49**	0,56
0,80	0,75	0,32	0,38	**0,44**	0,51
0,82	0,70	0,27	0,32	**0,39**	0,46
0,84	0,65	0,21	0,27	**0,34**	0,41
0,86	0,59	0,16	0,22	**0,28**	0,35
0,88	0,54	0,11			0,30
		0,06			0,25

TAB.2

THE PROBLEM OF HARMONICS

Harmonics are produced by the so-called non-linear loads i.e.:
● office appliances (PCs, photocopiers, etc.),
● gas discharge lamps,
● UPS,
● engines controlled by static converters,
● arc and induction furnaces.

Harmonics produce non-sinusoidal voltage and current wave-forms, as shown in the picture below.

Non-linear loads produce a distortion of the current so that it departs from the ideal sinusoidal wave form. The distorted part of the current has the following effects:

-it produces a similar distortion of the voltage, with a consequent disturbance induced on all the other electric loads connected to the same network.

-the overload of several system devices with a particular effect on the power factor capacitors.

The presence of harmonics on the network is a phenomenon of a particular importance for the correct dimensioning of power factor correction system.
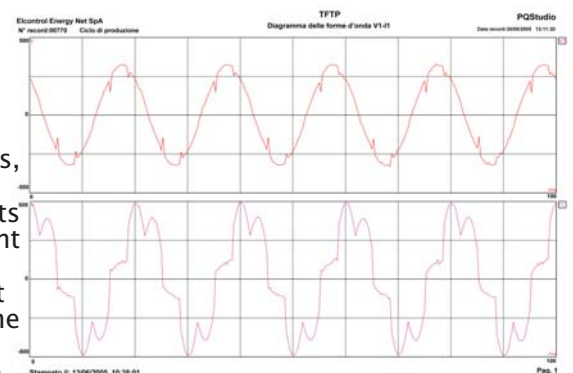
CHOOSIN A POWER FACTOR CORRECTION DEVICE ACCORDING TO THE HARMONIC LEVEL AT THE CIRCUIT.

Connecting power factor correction capacitors to power mains necessarily results in a resonant electric system, essentially produced by the mains inductance and capacitance.

The effect of this electric system will be to amplify the current and voltage harmonic components already existing in the line.This amplification will mainly concern the harmonic components whose frequency is closer to the resonance frequency of the electric system, including the mains and power factor correction capacitors.

The effect caused by this amplification (parallel resonance) is to overload the power factor correction control panel components, and above all, the capacitors and control devices, thus accelerating their ageing process.

These considerations lead to an easy reference method for determining the type of power factor correction equipment to choose from the Elcontrol Energy Net range; few, but critically important, parameters must be known.

In order to quantify the additional stress connected with harmonic amplification, to which the installed power factor correction system will be exposed, the following information must be known:

Power of the medium–to–low voltage input transformer/s [At]

Maximum THD% of the line current , at the point of installation of the power factor correction system, defined as: [THD%]

a measuring instrument is required. If harmonic measures are not available, the THD can be estimated multipling by 30 the ratio between the power of the distorted loads and the total power of the loads. Power of the power factor correction system to be used [Qr].

Once the above parameters are known the indications of the following diagram can be used to choose the most suitable power factor device. It's strongly suggested to verify the equipment for the different load conditions of the system, in order to avoid dangerous conditions when partial load is connected.

Example:
Transformer 800kVA
Power factor correction 200kVAr
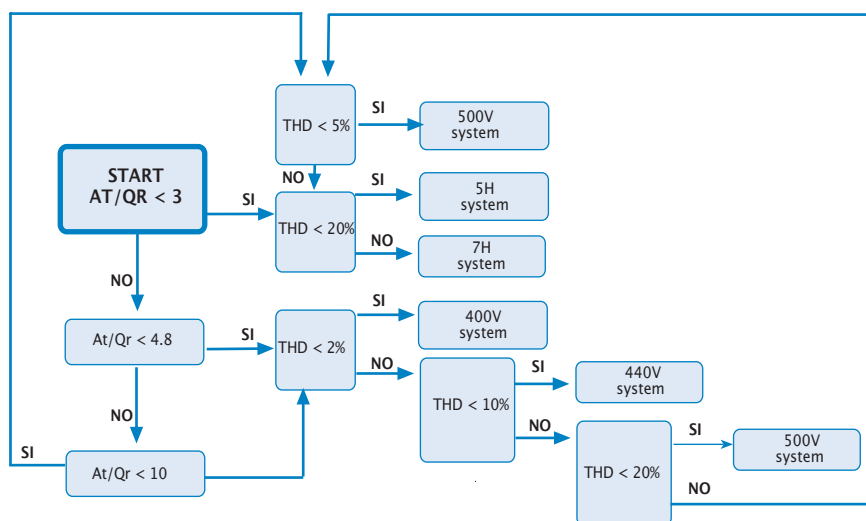Power of the distorting loads100KW
Loads total power 350KW

It results:
At/Qr=800/200=4
THD=30*100/350=8.5%
On the basis of the above diagram, the condition at rated power indicates a power factor correction system type 440V.
The condition of a half charge indicates At/QR=800/100=8

On the basis of the above diagram the condition at a half rated power indicates a power factor correction system type 5H. The final choice has to be made as a function of the real load condition to which the plant is subjected. If the load remains at rated levels for most of the working cycle the 440V system can be chosen; if the working cycle is characterised by considerable periods at half of the rated power, the 5H system is more appropriate.

PREVENTIVE ANALYSIS & MEASURES

Prior to the installation of a power factor correction system, in particular on plants with a MV/LV transformer, it is advised to perform a preliminary analysis, with the support of specific measurement instruments, for an appraisal/evaluation of the electric system. After the installation of the power factor correction system it is appropriate to perform a new measurement in order to verify the final working conditions of the network. Such indications are formalized on the EN 61921 Norm "Power capacitors – low voltage power factor correction banks".

The points measurements that are particularly useful for a correct dimensioning of the power factor correction system are shown in the alongside exemple.

1)   point of a future installation of the new power factor correction equipment.
2)   existing power factor correction supply.
3)   total load.
4)   on the power supply of non–linear loads.

Elcontrol Energy Net produces fixed and portable instrumentation of professional quality, equipped with pc software for extremely detailed analysis.
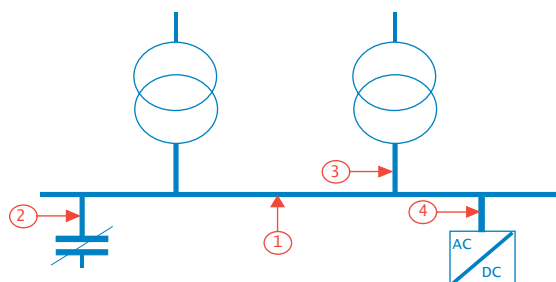
THREE-PHASE MODULAR CAPACITORS FOR LOW VOLTAGE POWER FACTOR CORRECTION MCTN SERIES

The **MCTN** series three-phase capacitors are obtained by assembling single-phase capacitors. They are made with self-healing metallic polypropylene and impregnated with a non-toxic, biodegradable resin (NO PCB). Each element is contained by a casing with an over-pressure protection device, triggered in case of non-recoverable failure. Each capacitor is fitted with a discharge resistor to reduce the residual capacitor voltage to less than 75V in 3 minutes, as per CEI EN 60831 standards. MCTN capacitors are fitted with induction coils to limit the current peaks generated when power is applied to the capacitor.

The enclosure is in plastic material (V2 class according to UL94) with integrated plastic support.
MCTN series three-phase capacitors are fitted with a plastic cover on the input terminals to prevent against unwanted contacts (protection degree IP40). By connecting several MCTN in parallel (up to a maximum of 75A corresponding 50kvar at 400V), higher power three-phase capacitor banks can be obtained; to do this, is available, with dedicated ordering code, a kit of copper bars to connect the capacitors in parallel (each bars kit connect two MCTN).

General Features

Rated frequency: 50Hz(60Hz)
Maximun voltage: 1.1Vn for 8h/24h
Maximum current: 1.3In
Dielectric loss: <0.5W/kvar
Temperature Class: -25/D
Reference standard: CEI EN60831/1-2

Type	Codice	Power at 50Hz [kVAr]	Rated voltage [V]	Rated current[A]	Capacitance -5 +10%[uF]	Dimensions lxpxh [mm]
MCTN 5-230	2WD40	5	230	12.5	3x100	230x79x213
MCTN 5-415	2WD41	5	415	6.9	3x61	230x79x213
MCTN 10-415	2WD42	10	415	13.9	3x61	230x79x213
MCTN 12.5-415	2WD43	12.5	415	17.4	3x77	230x79x213
MCTN 5-450	2WD44	5	450	6.4	3x26	230x79x213
MCTN 10-450	2WD45	10	450	12.8	3x52	230x79x213
MCTN 12.5-450	2WD46	12.5	450	16.0	3x65	230x79x213
MCTN 5-550	2WD47	5	550	5.2	3x17	230x79x213
MCTN 10-550	2WD48	10	550	10.5	3x34	230x79x213
MCTN 12.5-550	2WD49	12.5	550	13.1	3x43	230x79x213
KIT PARALLELO	2WD50					

FIXED POWER FACTOR CORRECTION EQUIPMENT, WITH TRIPOLE LOAD BREAKER, FUSES AND IP30 METAL CABINET. SERIES STPF SUITABLE FOR POWER FACTOR CORRECTION OF MT/BT WITH 380-400V /50HZ OUTPUT.

STPF equipment is designed for 400V 50Hz network but use 440V capacitors, to assure an long life of the system in every working condition. The capacitors used in STPF are able to work with an high overcurrent, to work correctly in presence of harmonics.

The STPF series is equipped with a general tripole load breaker with rotary manoeuvre and door blocking device, fuses with high power of interruption, unipolar flexible N07VK-type conductors, metal cabinet for m wall-mounting, (colour RAL7032 and protection degree IP30).

Type	Codice	Power at 440/400V [kVAr]	Current [A]	Dimensions [mm]	Weight [kg]	Three-phase load breaker	Supply cables cross-section (*)
STPF 12.5-440	2WD0M	12.5/10	15	340x250x440	10	63A	4mmq
STPF 25-440	2WD0N	25/20	30	340x250x440	13	63A	10mmq
STPF 37.5-440	2WD0P	37.5/30	45	400x270x620	18	125A	16mmq
STPF 50-440	2WD0Q	50/40	60	400x270x620	20	125A	25mmq
STPF 75-440	2WD0R	75/60	90	400x270x1045	30	250A	50mmq
STPF 100-440	2WD0S	100/80	120	400x270x1045	33	250A	70mmq
STPF 125-440	2WD0T	125/100	150	400x270x1045	36	250A	95mmq

Type	Codice	Power at 425/400V [kVAr]	Current [A]	Dimensions [mm]	Weight [kg]	Three-phase load breaker	Supply cables cross-section (*)
STPF 5H 12.5-425	2WD7R	12.5/11	16	340x250x440	15	63A	4mmq
STPF5H 25-425	2WD7S	25/22	32	340x250x440	23	63A	10mmq
STPF5H 37.5-425	2WD7T	37.5/33	48	400x270x620	33	125A	16mmq
STPF5H 50-425	2WD7U	50/44	64	400x270x104	40	250A	25mmq
STPF5H 75-425	2WD7V	75/66	96	5	60	250A	50mmq

(*) The indicated section refers to one phase and is calculated for an unipolar conductor FG7 cross in air at 30°C. The exact section has to be calculated by considering the actual mounting conditions of the cables, as indicated by the norms.

PFR96 - POWER FACTOR CORRECTION REGULATORS

PFR96 Power Factor Regulator contained in 96x96mm casing, controls the reactive power by commanding the activation/deactivation of capacitor banks. The operation logic is optimised in order to minimise time and number of switching cycles and rotate active bank, thus guaranteeing equal use of the capacitor banks. **Alphanumeric back-lit LCD** display for visualization of measurement values, state of banks and alarm conditions. Available measure are the values of voltage and current, active and reactive power, **THD of voltage and current**, internal temperature, number of operations and hours of operation for each bank.

Automatic Manual operation.
Cumulative no alarm contacts (5A-250V) for: harmonic voltage overload, harmonic current overload, excessive peak voltage, excessive rms voltage, over temperature, insufficient power factor correction. Immediate release protection against voltage dips during >10ms and <50%Un.
Delay time between steps programmable from 5 to 300 sec.
Specific functions model **PFR96 PLUS: RS485** communication port, additional ct input for measurement of the current drawn capacitor banks. This measurement allows a close control of the reactive power, the current drawn by the capacitor banks and its harmonic distortion; on this parameter it is possible to activate an alarm.

Type	Codice	Series 215-250V 50/60Hz.
PFR96-6R2	2WE01	6 Relays
PFR96PLUS-6R2	2WE02	6 Relays RS485 capacitor load analysis
PFR96PLUS-12R2	2WE03	12 Relays RS485 capacitor load analysis
PFR96PLUS-6RS2	2WE04	6 Static relays (zero crossing) RS485 capacitor load analysis
PFR96PLUS-12RS2	2WE05	12 Static relays (zero crossing) RS485 capacitor load analysis

Type	Codice	Series 380-440V 50/60Hz.
PFR96-6R4	2WE06	6 Relays
PFR96PLUS-6R4	2WE07	6 Relays RS485 capacitor load analysis
PFR96PLUS-12R4	2WE08	12 Relays RS485 capacitor load analysis
PFR96PLUS-6RS4	2WE09	6 Static relays (zero crossing) RS485 capacitor load analysis
PFR96PLUS-12RS4	2WE0A	12 Static relays (zero crossing) RS485 capacitor load analysis

AUTOMATIC POWER FACTOR CORRECTION EQUIPMENTS

Automatic power factor correction equipment, in metal enclosure IP30, equipped with 400V capacitors, suitable for a harmonic content up to 20% of the current drawn by the capacitors, suitable for power factor correction of 380-400V / 50Hz networks and medium harmonic content.

Type	Codice	Power (400V) [kvar]	Current [A]	Bank [kvar]	Steps [n°xkvar]	Dimensions [mm]	Weight Kg	Regulators	Three-phase load breaker	Supply cables cross-section(*)
STP10-400	2WCIA	10	14	2x2.5+1x5	4x2.5	340x250x440	10	PFR96 6R4	63A	4mmq
STP12.5-400	2WCIC	12.5	18	1x2.5+2x5	5x2.5	340x250x440	11	PFR96 6R4	63A	4mmq
STP17.5-400	2WCIE	17.5	25	1x2.5+1x5+1x10	7x2.5	340x250x440	12	PFR96 6R4	63A	4mmq
STP20-400	2WD7W	20	29	2x5+1x10	4x5	340x250x440	12	PFR96 6R4	63A	16mmq
STP25-400	2WCIG	25	36	1x5+2x10	5x5	340x250x440	13	PFR96 6R4	63A	16mmq
STP30-400	2WD7X	30	43	1x5+1x10+1x15	6x5	400x270x620	15	PFR96 6R4	125A	25mmq
STP35-400	2WCII	35	50	1x5+1x10+1x20	7x5	400x270x620	17	PFR96 6R4	125A	25mmq
STP37.5-400	2WCIP	37.5	54	1x2.5+1x5+1x10+	15x2.5	400x270x620	19	PFR96 6R4	125A	35mmq
STP40-400	2WCIK	40	58	1x20	4x10	400x270x620	20	PFR96 6R4	125A	35mmq
STP45-400	2WD7Y	45	65	1x5+2x10+1x15	9x5	400x270x620	21	PFR96 6R4	125A	35mmq
STP50-400	2WCIM	50	72	2x10+1x20	5x10	400x270x620	21	PFR96 6R4	125A	35mmq
STP62.5-400	2WCWN	62.5	90	1x10+2x20	5x12.5	400x250x1045	30	PFR96 6R4	250A	35mmq
STP75-400	2WCWO	75	108	1x12.5+2x25	6x12.5	400x250x1045	32	PFR96 6R4	250A	50mmq
STP87.5-400	2WCWP	87.5	126	2x12.5+2x25	7x12.5	400x250x1045	36	PFR96 6R4	250A	50mmq
STP100-400	2WCWQ	100	144	1x12.5+3x25	8x12.5	400x250x1045	38	PFR96 6R4	250A	70mmq
STP125-400	2WCWS	125	180	2x12.5+3x25	5x25	400x250x1045	40	PFR96 6R4	250A	95mmq
QR150-400	2WF06	150	216	5x25	6x25	700x370x1370	90	PFR96 6R4	500A	120mmq
QR175-400	2WF0C	175	252	2x25+1x50	7x25	700x370x1370	95	PFR96 6R4	500A	2x70mmq
QR200-400	2WF01	200	289	1x25+3x50	8x25	700x370x1370	100	PFR96 6R4	500A	2x70mmq
QR225-400	2WF0Q	225	325	2x25+3x50	9x25	700x370x1370	102	PFR96 6R4	500A	2x70mmq
QR250-400	2WF0W	250	361	1x25+4x50	5x50	700x370x1370	105	PFR96 6RA	500A	2x95mmq
ARCM275-400	2WG06	275	397	1x25+5x50	11x25	600x600x1500	143	PFR96PLUS 12R4	630A	2X120mmq
ARCM300-400	2WG0C	300	434	5x50	6x50	600x600x1500	180	PFR96PLUS 12R4	630A	2x120mmq
ARCM350-400	2WG0Q	350	506	6x50	7x50	600x600x1500	210	PFR96PLUS 12R4	800A	2x150mmq
ARCM400-400	2WG13	400	578	7x50	8x50	600x600x1500	230	PFR96PLUS 12R4	800A	2x185mmq
ARCM450-400	2WG19	450	650	6x50+1x100	9x50	600x600x2000	275	PFR96PLUS 12R4	1000A	2x240mmq
ARCM500-400	2WG1F	500	722	5x50+2x100	10x50	600x600x2000	290	PFR96PLUS 12R4	1000A	2x240mmq
ARCM600-400	2WG1T	600	867	4x50+3x100	6x100	1200x600x2000	485	PFR96PLUS 12R4	1600A	4x120mmq
ARCM700-400	2WG26	700	1010	6x100	7x100	1200x600x2000	525	PFR96PLUS 12R4	1600A	4x150mmq
ARCM800-400	2WG21	800	1155	7x100	8x100	1200x600x2000	555	PFR96PLUS 12R4	1600A	4x185mmq
ARCM900-400	2WG2Q	900	1300	6x100+1x200	9x100	1200x600x2000	570	PFR96PLUS 12R4	2000A	4x240mmq
ARCM1000-400	2WG2W	1000	1443	6x100+2x200	10x100	1200x600x2000	585	PFR96PLUS-12R4	2000A	4x300mmq

(*) The indicated section refers to one phase and is calculated for an unipolar conductor FG7 cross in air at 30°C.
   The exact section has to be calculated by considering the actual mounting conditions of the cables, as indicated by the norms.

Type STP
Power
up10 at 125 Kvar
400V e 440V

Type QR
Power
up 150 at 250 Kvar
400V e 440V

Type ARCM
Power
up 300 at 1000 Kvar
at 400V
and
up 279 at 1250 Kvar
at 440V

Automatic power factor correction equipment, in metal enclosure IP30, equipped with 440V capacitors, suitable for a harmonic content up to 40% of the current drawn by the capacitors, suitable for power factor correction of 380-400V / 50Hz networks and medium harmonic content.

Type	Codice	Power (400V) [kvar]	Current [A]	Bank [kvar]	Steps [n°xkvar]	Dimensions [mm]	Weight Kg	Regulators	Three-phase load breaker	Supply cables cross-section(*)
STP10-440	2WCIB	10/8	11	2x2.5+1x5	4x2.5	340x250x440	10	PFR96 6R4	63A	4mmq
STP12.5-440	2WCID	12.5/10	14	1x2.5+2x5	5x2.5	340x250x440	11	PFR96 6R4	63A	4mmq
STP17.5-440	2WCIF	17.5/15	21	1x2.5+1x5+1x10	7x2.5	340x250x440	12	PFR96 6R4	63A	4mmq
STP20-440	2WD7Z	20/16,5	24	2x5+1x10	4x5	340x250x440	12	PFR96 6R4	63A	10mmq
STP25-440	2WCIH	25/20	29	1x5+2x10	5x5	340x250x440	13	PFR96 6R4	63A	10mmq
STP30-440	2WD80	30/25	36	1x5+1x10+1x15	6x5	400x270x620	15	PFR96 6R4	125A	16mmq
STP35-440	2WCIJ	35/29	42	1x5+1x10+1x20	7x5	400x270x620	17	PFR96 6R4	125A	16mmq
STP37.5-440	2WCIQ	37.5/31	44	1x2.5+1x5+1x10+1x20	15x2.5	400x270x620	19	PFR96 6R4	125A	16mmq
STP40-440	2WCIL	40/33	47	2x10+1x20	4x10	400x270x620	20	PFR96 6R4	125A	16mmq
STP45-440	2WD81	45/37	54	1x5+2x10+1x20	9x5	400x270x620	21	PFR96 6R4	125A	25mmq
STP50-440	2WCIN	50/41	59	1x10+2x20	5x10	400x270x620	21	PFR96 6R4	125A	25mmq
STP62.5-440	2WCWT	62.5/52	75	1x12.5+2x25	5x12.5	400x250x1045	30	PFR96 6R4	250A	35mmq
STP75-440	2WCWU	75/62	89	2x12.5+2x25	6x12.5	400x250x1045	32	PFR96 6R4	250A	50mmq
STP87.5-440	2WCWV	87.5/72	104	1x12.5+3x25	7x12.5	400x250x1045	36	PFR96 6R4	250A	50mmq
STP100-440	2WCWW	100/82	118	2x12.5+3x25	8x12.5	400x250x1045	38	PFR96 6R4	250A	70mmq
STP125-440	2WCWY	125/103	149	5x25	5x25	400x250x1045	40	PFR96 6R4	250A	95mmq
QR150-440	2WF13	150/125	179	2x25+1x50	6x25	700x370x1370	90	PFR96 6R4	500A	120mmq
QR175-440	2WF19	175/145	209	1x25+3x50	7x25	700x370x1370	95	PFR96 6R4	500A	2x70mmq
QR200-440	2WF1F	200/165	239	2x25+3x50	8x25	700x370x1370	100	PFR96 6R4	500A	2x70mmq
QR225-440	2WF1N	225/185	269	1x25+4x50	9x25	700x370x1370	102	PFR96 6R4	500A	2x70mmq
QR250-440	2WF1T	250/205	298	5x50	5x50	700x370x1370	105	PFR96 6R4	500A	2x95mmq
ARCM279-440	2WG33	279/230	333	1x31+4x62.5	9x31	600x600x1500	149	PFR96PLUS 12R4	630A	2x95mmq
ARCM312.5-440	2WG39	312.5/260	373	5x62.5	5x62.5	600x600x1500	165	PFR96PLUS 12R4	630A	2x95mmq
ARCM375-440	2WG3N	375/310	447	6x62.5	6x62.5	600x600x1500	193	PFR96PLUS 12R4	630A	2x120mmq
ARCM437.5-440	2WG3Z	437.5/360	522	7x62.5	7x62.5	600x600x1500	210	PFR96PLUS 12R4	800A	2x150mmq
ARCM500-440	2WG4C	500/410	596	6x62.5+1x125	8x62.5	600x600x1500	230	PFR96PLUS 12R4	800A	2x185mmq
ARCM562.5-440	2WG4I	562.5/465	671	5x62.5+2x125	9x62.5	600x600x2000	280	PFR96PLUS 12R4	1000A	2x240mmq
ARCM625-440	2WG4Q	625/515	746	4x62.5+3x125	10x62.5	600x600x2000	300	PFR96PLUS 12R4	1000A	2x240mmq
ARCM750-440	2WG53	750/620	895	6x125	6x125	1200x600x2000	490	PFR96PLUS 12R4	1600A	4x120mmq
ARCM875-440	2WG5F	875/720	1044	7x125	7x125	1200x600x2000	535	PFR96PLUS 12R4	1600A	4x150mmq
ARCM1000-440	2WG5T	1000/825	1193	6x125+1x250	8x125	1200x600x2000	565	PFR96PLUS 12R4	1600A	4x185mmq

(*) The indicated section refers to one phase and is calculated for an unipolar conductor FG7 cross in air at 30°C.
The exact section has to be calculated by considering the actual mounting conditions of the cables, as indicated by the norms.

Automatic power factor correction equipment, in metal enclosure IP30, equipped with 500V capacitors, suitable for a harmonic content up to 60% of the current drawn by the capacitors, suitable for power factor correction of 380-400V / 50Hz networks and medium harmonic content.

Type	Codice	Power (400V) [kvar]	Current [A]	Bank [kvar]	Steps [n°xkvar]	Dimensions [mm]	Weight Kg	Regulators	Three-phase load breaker	Supply cables cross-section(*)
STP60-500	2WD0Y	60/38	55	1x12+2x24	5x12	400x250x1045	30	PFR96 6R4	250A	16mmq
STP72-500	2WD0Z	72/46	66	2x12+2x24	6x12	400x250x1045	32	PFR96 6R4	250A	25mmq
STP84-500	2WD11	84/54	77	1x12+3x24	7x12	400x250x1045	36	PFR96 6R4	250A	25mmq
STP96-500	2WD12	96/61	88	2x12+3x24	8x12	400x250x1045	38	PFR96 6R4	250A	35mmq
STP120-500	2WD13	120/76	110	5x24	5x24	400x250x1045	40	PFR96 6R4	250A	50mmq
QR144-500	2WF1Z	144/95	135	2x24+1x48	6x24	700x370x1370	90	PFR96 6R4	500A	70mmq
QR168-500	2WF26	168/110	158	1x24+3x48	7x24	700x370x1370	95	PFR96 6R4	500A	70mmq
QR192-500	2WF2C	192/125	181	2x24+3x48	8x24	700x370x1370	100	PFR96 6R4	500A	95mmq
QR216-500	2WF2I	219/140	203	1x24+4x48	9x24	700x370x1370	102	PFR96 6R4	500A	120mmq
QR240-500	2WF2Q	240/155	226	5x48	5x48	700x370x1370	105	PFR96 6R4	500A	120mmq
ARCM252-500	2WH06	252/161	233	1x36+3x72	7x36	600x600x1500	130	PFR96PLUS 12R4	630A	150mmq
ARCM288-500	2WH0C	288/184	266	2x36+3x72	8x36	600x600x1500	138	PFR96PLUS 12R4	630A	185mmq
ARCM324-500	2WH0I	324/207	300	1x36+4x72	9x36	600x600x1500	149	PFR96PLUS 12R4	630A	185mmq
ARCM360-500	2WH0Q	360/230	333	5x72	5x72	600x600x1500	165	PFR96PLUS 12R4	630A	240mmq
ARCM432-500	2WH13	432/276	400	6x72	6x72	600x600x1500	193	PFR96PLUS 12R4	630A	2x120mmq
ARCM504-500	2WH1F	504/322	466	7x72	7x72	600x600x1500	210	PFR96PLUS 12R4	800A	2x150mmq
ARCM576-500	2WH1T	576/368	533	6x72+1x144	8x72	600x600x1500	230	PFR96PLUS 12R4	800A	2x185mmq
ARCM648-500	2WH1Z	648/414	600	5x72+2x144	9x72	600x600x2000	280	PFR96PLUS 12R4	1000A	2x185mmq
ARCM720-500	2WH26	720/460	666	4x72+3x144	10x72	600x600x2000	300	PFR96PLUS 12R4	1000A	2x240mmq
ARCM864-500	2WH21	864/553	800	6x144	6x144	1200x600x2000	490	PFR96PLUS 12R4	1600A	4x120mmq
ARCM1008-500	2WH2W	1008/645	932	7x144	7x144	1200x600x2000	535	PFR96PLUS 12R4	1600A	4x150mmq

(*) The indicated section refers to one phase and is calculated for an unipolar conductor FG7 cross in air at 30°C.
The exact section has to be calculated by considering the actual mounting conditions of the cables, as indicated by the norms.

Automatic power correction equipment, in metal enclosure IP30, equipped with 440V capacitors and anti-resonance reactors, suitable for 380-400V/50Hz networks with medium harmonic content (up to 20%), and high risk of resonance.

Type	Codice	Power (400V) [kvar]	Current [A]	Bank [kvar]	Steps [n°xkvar]	Dimensions [mm]	Weight Kg	Regulators	Three-phase load breaker	Supply cables cross-section(*)
ARCM5H62.5-425	2WL0C	62,5/55	80	1x12,5+2x25	5x12,5	600x600x1500	144	PFR96 6R4	630A	50mmq
ARCM5H75-425	2WL0I	75/66,5	96	2x12,5+2x25	6x12,5	600x600x1500	150	PFR96 6R4	630A	50mmq
ARCM5H87.5-425	2WL0Q	87,5/77,5	112	1x12,5+3x25	7x12,5	600x600x1500	157	PFR96 6R4	630A	70mmq
ARCM5H100-425	2WL0W	100/89	128	2x12,5+3x25	8x12,5	600x600x1500	164	PFR96 6R4	630A	70mmq
ARCM5H125-425	2WL19	125/111	160	5x25	5x25	600x600x1500	177	PFR96 6R4	630A	95mmq
ARCM5H150-425	2WL1N	150/133	192	2x37,5+1x75	4x37.5	600x600x1500	190	PFR96 6R4	630A	95mmq
ARCM5H187.5-425	2WL1T	187.5/165	240	1x37.5+2x75	5x37.5	600x600x1500	210	PFR96 6R4	630A	150mmq
ARCM5H225-425	2WL1Z	225/200	288	2x37.5+2x75	6x37.5	600x600x1500	240	PFR96 6R4	630A	185mmq
ARCM5H262.5-425	2WL26	262.5/235	336	1x37.5+3x75	7x37.5	600x600x1500	260	PFR96 6R4	630A	240mmq
ARCM5H300-425	2WL2C	300/265	384	4x75	4x75	600x600x1500	280	PFR96 6R4	630A	2x95mmq
ARCM5H337.5-425	2WL2I	337.5/300	432	1x37.5+4x75	9x37.5	600x600x2000	338	PFR96 6R4	630A	2x120mmq
ARCM5H375-425	2WL2Q	375/335	480	5x75	5x75	600x600x2000	380	PFR96 6R4	800A	2x150mmq
ARCM5H450-425	2WL2W	450/400	576	6x75	6x75	1200x600x2000	525	PFR96PLUS 12R4	800A	2x185mmq
ARCM5H525-425	2WL39	525/465	672	7x75	7x75	1200x600x2000	575	PFR96PLUS 12R4	1000A	2x240mmq
ARCM5H600-425	2WL3N	600/530	768	6x75+1x150	8x75	1200x600x2000	650	PFR96PLUS 12R4	1600A	4x95mmq
ARCM5H675-425	2WL3T	675/600	864	5x75+2x150	9x75	1200x600x2000	730	PFR96PLUS 12R4	1600A	4x120mmq
ARCM5H750-425	2WL3Z	750/665	960	4x75+3x150	10x75	1200x600x2000	845	PFR96PLUS 12R4	1600A	4x150mmq
ARCM5H900-425	2WL46	900/800	1152	6x150	6x150	1800x600x2000	995	PFR96PLUS 12R4	1600A	4x185mmq
ARCM5H1050-425	2WL4C	1050/930	1344	7x150	7x150	1800x600x2000	1150	PFR96PLUS 12R4	2000A	4x240mmq

*(*) The indicated section refers to one phase and is calculated for an unipolar conductor FG7 cross in air at 30°C.
The exact section has to be calculated by considering the actual mounting conditions of the cables, as indicated by the norms.*

Automatic power correction equipment, in metal enclosure IP30, equipped with 500V capacitors and filter reactors, suitable for 380-400V/50Hz networks with high harmonic content (over 20%), and high risk of resonance.

Type	Codice	Power (400V) [kvar]	Current [A]	Bank [kvar]	Steps [n°xkvar]	Dimensions [mm]	Weight Kg	Regulators	Three-phase load breaker	Supply cables cross-section(*)
ARCM7H100-400	2WM0W	100	144	2x25+1x50	4x25	600x600x1500	190	PFR96 6R4	630A	70mmq
ARCM7H125-400	2WM13	125	181	1x25+2x50	5x25	600x600x1500	200	PFR96 6R4	630A	95mmq
ARCM7H150-400	2WM19	150	216	2x25+2x50	6x25	600x600x1500	230	PFR96 6R4	630A	120mmq
ARCM7H175-400	2WM1F	175	253	1x25+3x50	7x25	600x600x1500	250	PFR96 6R4	630A	150mmq
ARCM7H200-400	2WM1N	200	289	4x50	4x50	600x600x1500	275	PFR96 6R4	630A	185mmq
ARCM7H225-400	2WM1T	225	325	1x25+4x50	9x25	600x600x2000	330	PFR96 6R4	630A	240mmq
ARCM7H250-400	2WM1Z	250	361	5x50	5x50	600x600x2000	365	PFR96 6R4	630A	2x95mmq
ARCM7H300-400	2WM2C	300	433	6x50	6x50	1200x600x2000	515	PFR96PLUS 12R4	630A	2x150mmq
ARCM7H350-400	2WM2I	350	506	7x50	7x50	1200x600x2000	560	PFR96PLUS 12R4	800A	2x150mmq
ARCM7H400-400	2WM2Q	400	578	6x50+1x100	8x50	1200x600x2000	630	PFR96PLUS 12R4	800A	2x185mmq
ARCM7H450-400	2WM2W	450	650	5x50+2x100	9x50	1200x600x2000	720	PFR96PLUS 12R4	1000A	2x240mmq
ARCM7H500-400	2WM33	500	722	4x50+3x100	10x50	1200x600x2000	820	PFR96PLUS 12R4	1000A	2x240mmq
ARCM7H600-400	2WM3F	600	867	6x100	6x100	1800x600x2000	960	PFR96PLUS 12R4	1600A	4x120mmq
ARCM7H700-400	2WM3T	700	1011	7x100	7x100	1800x600x2000	1120	PFR96PLUS 12R4	1600A	4x150mmq

*(*) The indicated section refers to one phase and is calculated for an unipolar conductor FG7 cross in air at 30°C.
The exact section has to be calculated by considering the actual mounting conditions of the cables, as indicated by the norms.*

POWER FACTOR CORRECTION BANKS

The capacitors banks,are realized with **MCE** capacitors. In the 5H and 7H models, the capacitors are coupled to three-phase antiresonance reactors. Each bank is switched by special contactors, characterized by high number of operation. The power circuit is protected by fuse with high breaking capacity (100kA). Power factor correction banks complete with protection fuses, control contactors and busbars are placed in modular racks, removable from the front.

NOTE FOR CORRECT SELECTION

ARCM serie equipments is designed for 400V 50Hz network. The capacitors used are 440V for ARCM5H, and 500V on for ARCM7H.
By referring to harmonics on network, the 400V series is able to work in network with lowTHD, 440V for network wih moderated THD, and 500V with mean THD, always without resonance condition. In case of risk of resonance is necessary to use the models with antiresonance reactors.

EXPANSION RACK FOR ARCM

Type and performance table

Type	Codice	Power [kvar]	Current [A]	Bank power (V)	Dimensions [mm]	Weght [kg]
MR100-400	2WC2S	100	144	400	495x550x280	17
MR125-440	2WD2E	125	149	440	495x550x280	25
MR144-500	2WD2F	144	130	500	495x550x280	25
MR5H75-425	2WD2T	75	96	425	495x550x280	26
MR7H50-400	2WC31	50	72	400	495x550x280	26