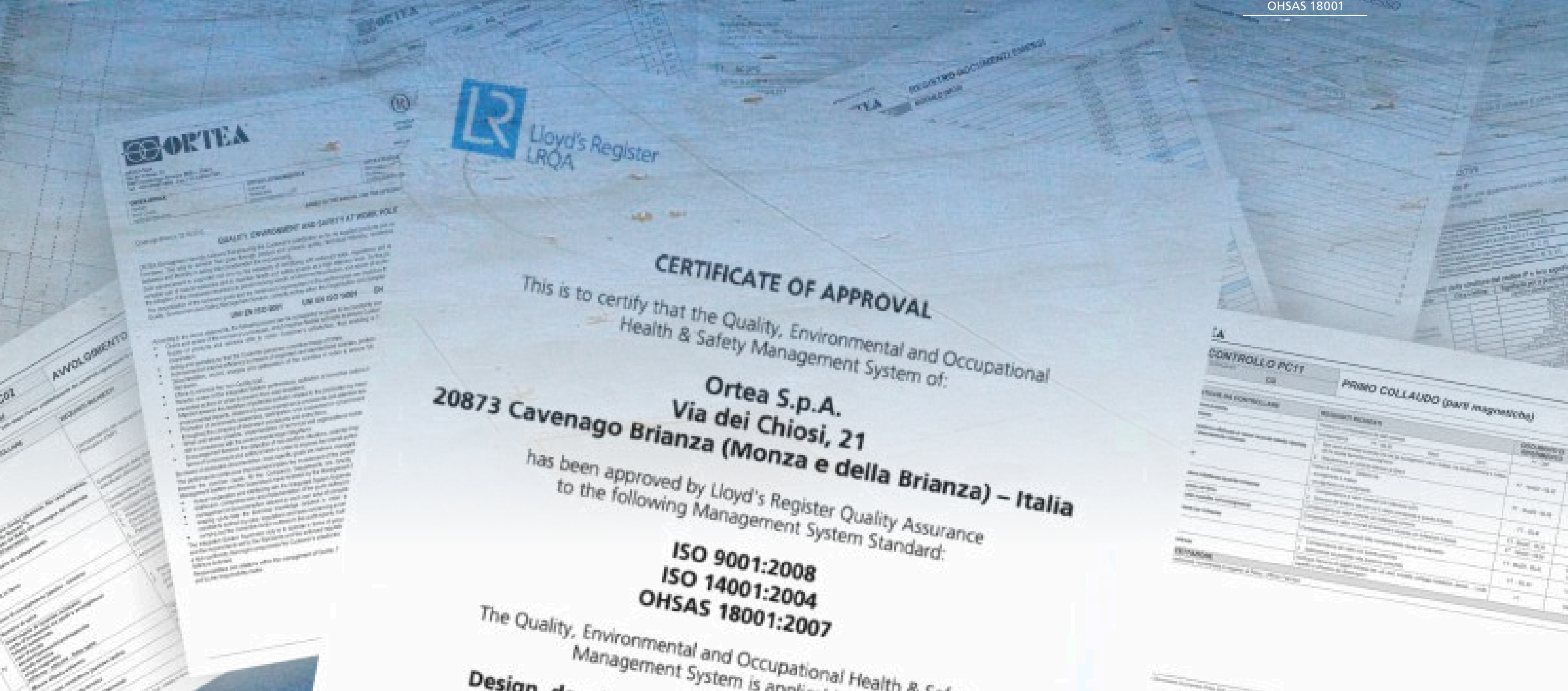
ORTEA®
ahead of time

PFC
Power Factor Correction systems

Founded in 1969, ORTEA SpA is a leading company in manufacturing and engineering voltage stabilisers and magnetic components.
Over forty years in the business and ongoing technical research have made of ORTEA a competitive and technologically advanced company. Close co-operation between design, production and marketing enables to meet the requirements of a constantly growing number of customers.
In 1996 ORTEA joined ICAR Group, made of Italian and European industrial units specialised in manufacturing capacitors and power factor correction systems.
Beside standard production, ORTEA can be extremely flexible in developing and manufacturing special equipment according to User's specification. All this thanks to the experience gained over many years of applied technological development.
Such development includes IT tools that enable the technical staff to elaborate electrical and mechanical designs for each «custom product» on a quick and cost-effective basis.

The belief that product quality and Customer satisfaction are the core of a modern organisation, led to the implementation of an ISO9001:2008 certified Company Managing System.
The achievement of the ISO14001:2004 and OHSAS18001:2007 accreditation was a natural integration in order to optimise the Company's performance, showing at the same time the commitment towards environmental and safety at work issues.

LLOYD'S REGISTER · LRQA
ISO 9001 • ISO 14001
OHSAS 18001



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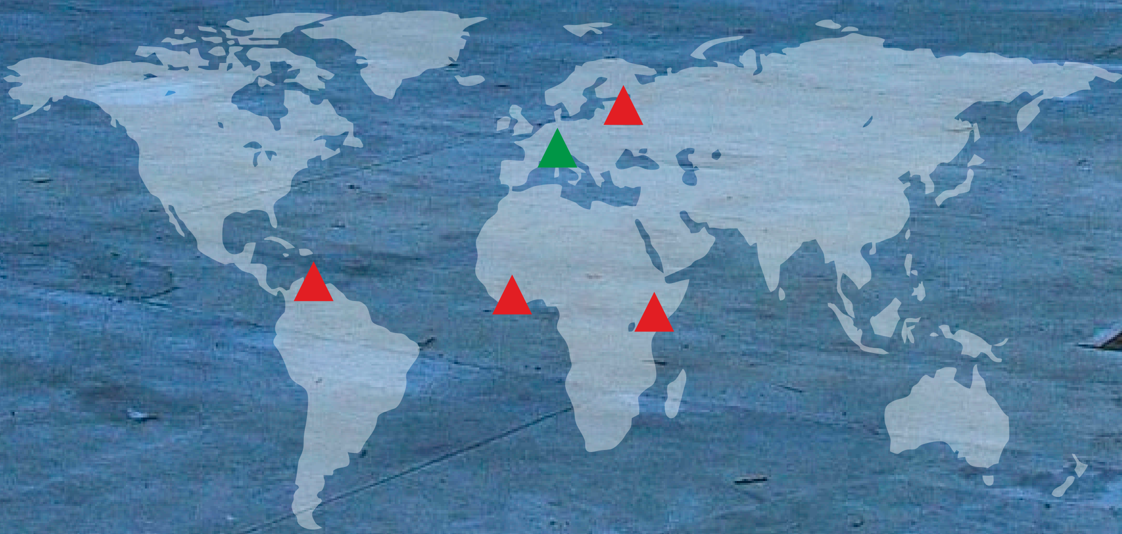
ORTEA is well established in the global market. Thanks to strategically positioned offices and distributors and efficient commercial relations, ORTEA's products are installed and working in a large number of countries.



▲ ORTEA headquarters (Italy)
▲ ORTEA branches (Russia, Ivory Coast, Kenya, Venezuela)

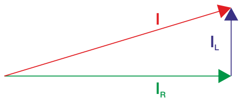
Power Factor Correction: why?

In an electric circuit, the current is:

- in phase with the voltage when the load is resistive (e.g., resistors)
- lagging when the load is inductive (e.g., motors, off-load transformers)
- leading when the load is capacitive (e.g., capacitors).

For example, the total current (I) absorbed by a motor is given by the vector sum of:

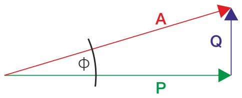
- I_R, active current due to the load resistive component
- I_L, reactive current due to the load inductive component.



$$I = \sqrt{I_R^2 + I_L^2}$$

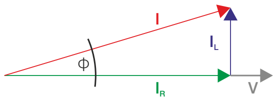
The following powers are directly associated with the above currents:

- P, active power linked to the load resistive component
- Q, reactive power linked to the load inductive component
- A, apparent power.



$$\cos\phi = \frac{P}{A}$$

The mean value of the reactive power in a wave period is nil. Therefore, the reactive power does not contribute towards the generation of mechanical work and constitutes an additional burden for the energy supplier, forcing it to oversize its generators and transmission/distribution lines.
The parameter that defines the absorption of inductive reactive power is called power factor (φ) and is represented by the ratio between active and apparent power.
Assuming there are no harmonics in the system, the power factor is equal to the cosine of the angle between the voltage vector and the current vector (cosφ).
The power factor decreases when the reactive power increases.



A system working with **low power factor** shows the following **disadvantages**:

- **High power loss** in transmission/distribution energy lines.
- **High voltage drop**.
- **Oversized design** of generating, transporting and transforming plants.

Hence the importance of solving or at least reduce the effects generated by low power factor. Capacitors are used for this purpose.

Power Factor Correction: how?

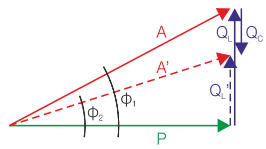
By installing a **capacitor battery**, it is possible to **reduce the reactive power** absorbed by the inductive loads connected thus **increasing the power factor**.
There are several ways to perform the power factor correction and the choice depends on daily load duty-cycle, load distribution and type of service.
The **main choice** is between **distributed** or **centralized** power factor correction.
If the correction system is distributed, the units are located in the vicinity of each load for which the power factor needs to be corrected.
If the correction system is centralized, a single automatic capacitor bank is installed upstream all the loads and immediately downstream the point where the power factor is measured (for example, inside the MV/LV distribution transformer cabin on in the main distribution switchboard).
Technically speaking, the distributed system is the solution to prefer: capacitors and load follow the same profile during daily service, which makes the power factor correction systematic and strongly linked to the affected load.
Moreover, in case of distributed configuration, both the user and the Distributing Body benefit from the reactive power reduction. In industrial plants, for example, savings are achieved in terms of tariffs but also in terms of better design of all the electric lines in the facility connecting the MV/LV cabin to the loads.
Another noticeable advantage prided by this type of correction, is that the installation is simple and not expensive. Power factor correction systems and loads are energised and de-energised at the same time, thus exploiting the same protections against overload and short-circuit.
The **daily load duty-cycle** is of critical importance when choosing the most suitable power factor correction system.
Very often, not all the loads work at the same time and some are operative only for a few hours during the day. In this case, it is clear that the distributed configuration would be too expensive due to the high number of correction systems that would need to be installed and the idle time of several units.

The distributed configuration is most efficient when the majority of the required reactive power is concentrated on few high power loads working for many hours during the day.
The centralized configuration, on the other hand, is suitable for situations where there are many diverse loads working sporadically. In this case, the bank power is much lower that the overall power that would be necessary with a distributed configuration.
It is recommended to permanently connect the correction unit only if the daily reactive power absorption is sufficiently regular, otherwise the unit must be handled in order to avoid the power factor to swap to a leading value.
Should the reactive power absorption be very changeable during the plant operating time, it is recommendable to choose an **automatic correction system** splitting the bank into several steps. The manual operation can be foreseen only when the correction unit needs to be operated only a few times during the day.

Power Factor Correction: how much?

The choice of the capacitor bank power to install (Q_C) depends directly on:

- desired cosφ2 value
- starting cosφ1 value
- installed active power.



The formula is: $\mathbf{Q_c = P \times (\tan\varphi1 - \tan\varphi2)}$
Q_C = capacitive reactive power to be installed (kvar)
P = installed active power (kW)
Q_L,Q_L' = inductive reactive power before and after the installation of the capacitor bank
A, A'= apparent power before and after the power factor correction.
Said formula can also be written as: $\mathbf{Q_c = k \times P}$
where k can be easily calculated with the table in the following page.
Example: assuming that the installed load absorbs an active power equal to 300kW with a starting power factor equal to 0,70 and that an increase to 0,97 is desired, the coefficient k can be obtained from table 1: k = 0,770. Q_C is therefore equal to: Q_C = 0,770 x 300 = 231kvar

Power Factor Correction: harmonics in electric lines

Current distortion (i.e., **harmonics**) in industrial or tertiary electric plants is generated by **non-linear loads** such as inverters, welders, rectifiers, computers, drives and so on. The distortion is represented by the number THDI%: if the current is sinusoidal, the THDI% is nil. The more the current is distorted, the higher is its THDI% value.
Their connection to the mains causes **several problems** in an electric system:

- Rotating machinery: generation of eddy torques (and consequent vibrations) that undermine the mechanical structure. The loss increase causes undesired overheating and isolation damage.
- Transformers: increase of core and winding losses, with potential winding damage. The potential presence of DC voltage or current components may saturate the magnetic core, thus increasing the magnetizing current.
- Capacitors: overheating and voltage increase, both causing a reduction of the expected life.

If periodic, the waveform of the current generated by a non-linear load can be represented as the sum of several sinusoidal waves at different frequency (the wave at 50Hz is called fundamental, whilst the ones at frequency multiple of the fundamental are called harmonics).
It is generally not recommended to correct the power factor in a system with high harmonic content without any device dealing with the harmonics.Even though capacitors able to withstand high overloading could be provided, power factor correction performed only via capacitors actually increases the harmonic disturbance and the related negative effects.
The best solution for this type of issue is the **detuned filter** obtained by connecting reactances in series to the capacitors. The **reactances** shift the system resonance frequency below the lowest existing harmonic thus protecting the capacitors and avoiding dangerous resonance phenomena.

Initial power factor	Final power factor							
	0,90	**0,91**	**0,92**	**0,93**	**0,94**	**0,95**	**0,96**	**0,97**
0,60	0,849	0,878	0,907	0,938	0,970	1,005	1,042	1,083
0,61	0,815	0,843	0,873	0,904	0,936	0,970	1,007	1,048
0,62	0,781	0,810	0,839	0,870	0,903	0,937	0,974	1,015
0,63	0,748	0,777	0,807	0,837	0,870	0,904	0,941	0,982
0,64	0,716	0,745	0,775	0,805	0,838	0,872	0,909	0,950
0,65	0,685	0,714	0,743	0,774	0,806	0,840	0,877	0,919
0,66	0,654	0,683	0,712	0,743	0,775	0,810	0,847	0,888
0,67	0,624	0,652	0,682	0,713	0,745	0,779	0,816	0,857
0,68	0,594	0,623	0,652	0,683	0,715	0,750	0,787	0,828
0,69	0,565	0,593	0,623	0,654	0,686	0,720	0,757	0,798
0,70	0,536	0,565	0,594	0,625	0,657	0,692	0,729	**0,770**
0,71	0,508	0,536	0,566	0,597	0,629	0,663	0,700	0,741
0,72	0,480	0,508	0,538	0,569	0,601	0,635	0,672	0,713
0,73	0,452	0,481	0,510	0,541	0,573	0,608	0,645	0,686
0,74	0,425	0,453	0,483	0,514	0,546	0,580	0,617	0,658
0,75	0,398	0,426	0,456	0,487	0,519	0,553	0,590	0,631
0,76	0,371	0,400	0,429	0,460	0,492	0,526	0,563	0,605
0,77	0,344	0,373	0,403	0,433	0,466	0,500	0,537	0,578
0,78	0,318	0,347	0,376	0,407	0,439	0,474	0,511	0,552
0,79	0,292	0,320	0,350	0,381	0,413	0,447	0,484	0,525
0,80	0,266	0,294	0,324	0,355	0,387	0,421	0,458	0,499
0,81	0,240	0,268	0,298	0,329	0,361	0,395	0,432	0,473
0,82	0,214	0,242	0,272	0,303	0,335	0,369	0,406	0,447
0,83	0,188	0,216	0,246	0,277	0,309	0,343	0,380	0,421
0,84	0,162	0,190	0,220	0,251	0,283	0,317	0,354	0,395
0,85	0,135	0,164	0,194	0,225	0,257	0,291	0,328	0,369
0,86	0,109	0,138	0,167	0,198	0,230	0,265	0,302	0,343
0,87	0,082	0,111	0,141	0,172	0,204	0,238	0,275	0,316
0,88	0,055	0,084	0,114	0,145	0,177	0,211	0,248	0,289
0,89	0,028	0,057	0,086	0,117	0,149	0,184	0,221	0,262
0,90	–	0,029	0,058	0,089	0,121	0,156	0,193	0,234

Power Factor Correction: conclusions

Usually, in a plant with low power factor, the payback of the installation costs is most likely achieved within a few years.

Beyond the elimination of potential penalties from the energy bills, the technical and economical benefits deriving from the installation of a power factor correction system are listed below:

– decrease of the losses in lines and transformers due to the lower absorbed current
– decrease of line voltage drop
– optimization of the plant sizing.

Used capacitors

Inside ORTEA automatic power factor correction systems there are only **three-phase polypropylene metalized high gradient capacitors** resin filled (PCB free).
The fundamental difference with respect to the standard polypropylene capacitors is how the dielectric film is metallized: if in the standard capacitors the metal layer thickness deposited on the polypropylene film surface is constant, for the «high gradient» ones the metal layer has a suitably modulated thickness.

The metallization thickness modulation greatly **improves** the capacitors (and therefore of the power factor correction systems, of which they are the a critical component) **performance** in terms of:

- Increase in power density (kvar/dm3) with a consequent power size reduction of the power factor correction systems;
- Robustness against voltage surges, for geater reliability even in systems with the presence of voltage fluctuations due to the network or maneuvers on the system;
- Improved behaviour in relation to internal short circuit withstand.

Reactive power regulators

The reactive power regulator, together with capacitors and reactors (in detuned filter cabinets) is, the **key component** of the automatic power factor correction system.
It is actually the 'intelligent' element responsible for the verification of the power factor of the load, depending on which it controls the ON/OFF switching of the capacitors batteries. By doing so, the regulator maintains the system power factor above the minimum threshold set by the Energy Authority.
The reactive power regulators RPC used in automatic ORTEA power factor correction systems are designed to **provide** for the desired power factor while **minimizing** the wear & tear of the banks of capacitors.
Accurate and reliable in their measuring and control functions, the regulators are **simple** and **intuitive** to install and use.
The **flexibility** of ORTEA regulators enables the modification of all the parameters, so that they can be customize to suit the actual characteristics of the system that needs correction (threshold power factor, step switching sensitivity, steps reconnecting time, presence of photovoltaic systems, etc.).
ORTEA regulators also offer important **features** for maintaining and managing the power factor correction bank in order to identify and solve problems which could otherwise lead to damage and life expectancy reduction.

PFC103

U_e	U_N	U_{MAX} [1]	Hz	$THDI_R\%$	$THDI_C\%$ [2]
415V	415V	455V	50	≤ 12%	≤ 50%

U_e: Rated voltage.
U_N: Capacitors rated voltage.
U_{MAX}: Capacitors admissible maximum voltage.
$THDI_R\%$: Admissible current total harmonic distortion of the plant.
$THDI_C\%$: Admissible current total harmonic distortion of the capacitors.

[1] Maximum allowed value according to IEC 60831-1 art. 20.1.
[2] Attention: in this conditions of load network harmonic amplification phenomena is possible.

Technical characteristics

Rated operational voltage	Ue = 415V
Rated frequency	50Hz
Max current overload In (cabinet)	1.3xIn
Max current overload In (capacitors)	1.3xIn (continuous) 2xIn (380s every 60m) 3xIn (150s every 60m) 4xIn (70s every 60m) 5xIn (45s every 60m)
Max voltage overload Vn (cabinet)	1.1xUe
Max voltage overload Vn (capacitors)	3xUn (for 1m)
Temperature range (cabinet)	-5/+40°C
Temperature range (capacitors)	-25/+55°C
Discharge device	On each bank
Installation	Indoor
Service	Continuous
Capacitors connection	Delta
Operation devices	Capacitors contactors (AC6b)
Total losses	ca. 2W/kvar
Inner surface finish	Zinc passivation
Applicable standards (cabinet)	IEC 61439-1/2 IEC61921
Applicable standards (capacitors)	IEC 60831-1/2

All ORTEA PFC are designed and built in compliance with the Low Voltage and Electromagnetic Compatibility European Directives with regard to the CE marking requirements. ORTEA products are built with suitable quality components and that the manufacturing process is constantly verified in accordance with the Quality Control Plans which the Company applies in compliance with the ISO 9001:2008 Standards. The commitment towards environmental issues and safety at work maters is guaranteed by the certification of the Management System according to the ISO14001:2004 and OHSAS18001:2007 Standards. In order to obtain better performance, the products described in the present document can be altered by the Company at any date and without prior notice. Technical data and descriptions do hold therefore any contractual value.

Main characteristics

Power factor correction systems indicated for the plants where the current **harmonic distorsion**, without capacitors installed has values **lower/equal than 12%**.

Use of high energy density metallized polypropylene capacitors assures elevated performances, high resistance to strong voltage overload, low losses and small dimensions.

Generalities

- Zinc-passivated metallic enclosure painted with epossidic dust paint, colour RAL 7035.
- Auxiliary transformer to separate power and auxiliary circuit parts.
- Load-break switch with door interlock.
- Contactors with damping resistors to limit capacitors' inrush current.
- Self-extinguish cable according to IEC 50267-2-1 standards.
- Microprocessor power factor correction relay.
- Three phase self-healing high energy density metallized polypropylene capacitors with rated voltage: **Un = 415V**.

All components inside this products are compliant with safety regulations requirements.

Type	Power [kvar]	Steps [no.]	Steps size [kvar]	Load-break switch [A]	Icc [kA]	Regulators	Fan [no.]	IP3X cabinet WxDxH (type) [mm]	Weight [Kg]
PFC103-100	100	8	2x12.5-25-50	250	17	RPC 5LGA	1	410x680x1200 (23)	80
PFC103-150	150	12	2x12.5-25-2x50	400	25	RPC 8BGA	2	600x600x1600 (31)	120
PFC103-200	200	16	2x12.5-25-3x50	630	25	RPC 8BGA	2	600x600x1600 (31)	135
PFC103-250	250	20	2x12.5-25-2x50-100	630	25	RPC 8BGA	3	600x600x2000 (32)	170
PFC103-300	300	24	2x12.5-25-50-75-125	800	35	RPC 8BGA	3	600x600x2000 (32)	185
PFC103-350	350	28	12.5-25-37.5-50-100-125	800	35	RPC 8BGA	2	800x600x2000 (33)	210
PFC103-400	400	32	12.5-25-37.5-75-100-150	1000	35	RPC 8BGA	2	800x600x2000 (33)	220
PFC103-450	450	36	12.5-25-37.5-75-100-200	1000	35	RPC 8BGA	2	800x600x2000 (33)	230
PFC103-500	500	20	2x25-50-2x100-200	2x630	25	RPC 8BGA	3+3	2x(600x600x2000)(2x32)	340
PFC103-600	600	24	2x25-50-100-150-250	2x800	35	RPC 8BGA	3+3	2x(600x600x2000)(2x32)	370
PFC103-700	700	28	25-50-75-100-200-250	2x800	35	RPC 8BGA	2+2	2x(800x600x2000)(2x33)	420
PFC103-800	800	32	25-50-75-150-200-300	2x1000	35	RPC 8BGA	2+2	2x(800x600x2000)(2x33)	440
PFC103-900	900	36	25-50-75-150-200-400	2x1000	35	RPC 8BGA	2+2	2x(800x600x2000)(2x33)	460
PFC103-1000	1000	28	37.5-75-112.5-150-300-375	3x800	35	RPC 8BGA	2+2+2	3x(800x600x2000)(3x33)	630

For higher powers, two or more PFC units of the same size can be connected in parallel, using the characteristic of the regulator to act as «master/slave».

PFC503

U_e	U_N	U_{MAX} [1]	Hz	$THDI_R$%	$THDI_C$% [2]
415V	525V	577V	50	≤ 27%	≤ 85%

U_e: Rated voltage.
U_N: Capacitors rated voltage.
U_{MAX}: Capacitors admissible maximum voltage.
$THDI_R$%: Admissible current total harmonic distortion of the plant.
$THDI_C$%: Admissible current total harmonic distortion of the capacitors.

[1] *Maximum allowed value according to IEC 60831-1 art. 20.1.*
[2] *Attention: in this conditions of load network harmonic amplification phenomena is possible.*

Technical characteristics

Rated operational voltage	Ue = 415V
Rated frequency	50Hz
Max current overload In (cabinet)	1.3xIn
Max current overload In (capacitors)	1.3xIn (continuous) 2xIn (380s every 60m) 3xIn (150s every 60m) 4xIn (70s every 60m) 5xIn (45s every 60m)
Max voltage overload Vn (cabinet)	1.1xUe
Max voltage overload Vn (capacitors)	3xUn (for 1m)
Temperature range (cabinet)	-5/+40°C
Temperature range (capacitors)	-25/+55°C
Discharge device	On each bank
Installation	Indoor
Service	Continuous
Capacitors connection	Delta
Operation devices	Capacitors contactors (AC6b)
Total losses	ca. 2W/kvar
Inner surface finish	Zinc passivation
Applicable standards (cabinet)	IEC 61439-1/2 IEC61921
Applicable standards (capacitors)	IEC 60831-1/2

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Main characteristics

Power factor correction systems indicated for the plants where the current **harmonic distorsion**, without capacitors installed has values **lower/equal than 27%**.
Use of high energy density metallized polypropylene capacitors assures elevated performances, high resistance to strong voltage overload, low losses and small dimensions.

Generalities

- Zinc-passivated metallic enclosure painted with epossidic dust paint, colour RAL 7035.
- Auxiliary transformer to separate power and auxiliary circuit parts.
- Load-break switch with door interlock.
- Contactors with damping resistors to limit capacitors' inrush current.
- Self-extinguish cable according to IEC 50267-2-1 standards.
- Microprocessor power factor correction relay.
- Three phase self-healing high energy density metallized polypropylene capacitors with rated voltage: **Un = 525V**.

All components inside this products are compliant with safety regulations requirements.

Type	Power [kvar]	Steps [no.]	Steps size [kvar]	Load-break switch [A]	Icc [kA]	Regulators	Fan [no.]	IP3X cabinet WxDxH (type) [mm]	Weight [Kg]
PFC503-100	100	8	2x12.5-25-50	250	17	RPC 8BGA	2	600x600x1600 (31)	85
PFC503-150	150	12	2x12.5-25-2x50	400	25	RPC 8BGA	2	600x600x1600 (31)	125
PFC503-200	200	16	2x12.5-25-3x50	630	25	RPC 8BGA	2	600x600x1600 (31)	140
PFC503-250	250	20	2x12.5-25-2x50-100	630	25	RPC 8BGA	3	600x600x2000 (32)	180
PFC503-300	300	24	2x12.5-25-50-75-125	800	35	RPC 8BGA	3	600x600x2000 (32)	195
PFC503-350	350	28	12.5-25-37.5-50-100-125	800	35	RPC 8BGA	2	800x600x2000 (33)	220
PFC503-400	400	32	12.5-25-37.5-75-100-150	1000	35	RPC 8BGA	2	800x600x2000 (33)	230
PFC503-450	450	36	12.5-25-37.5-75-100-200	1000	35	RPC 8BGA	2	800x600x2000 (33)	245
PFC503-500	500	20	2x25-50-2x100-200	2x630	25	RPC 8BGA	3+3	2x(600x600x2000)(2x32)	360
PFC503-600	600	24	2x25-50-100-150-250	2x800	35	RPC 8BGA	3+3	2x(600x600x2000)(2x32)	390
PFC503-700	700	28	25-50-75-100-200-250	2x800	35	RPC 8BGA	2+2	2x(800x600x2000)(2x33)	440
PFC503-800	800	32	25-50-75-150-200-300	2x1000	35	RPC 8BGA	2+2	2x(800x600x2000)(2x33)	460
PFC503-900	900	36	25-50-75-150-200-400	2x1000	35	RPC 8BGA	2+2	2x(800x600x2000)(2x33)	490
PFC503-1000	1000	28	37.5-75-112.5-150-300-375	3x800	35	RPC 8BGA	2+2+2	3x(800x600x2000)(3x33)	660

For higher powers, two or more PFC units of the same size can be connected in parallel, using the characteristic of the regulator to act as «master/slave».

PHF203

U_e	U_N	U_{MAX} [1]	Hz	$THDI_R$%	Detuning choke (180Hz)
415V	525V	577V	50	> 27%	100% non linear load in network

U_e: Rated voltage.
U_N: Capacitors rated voltage.
U_{MAX}: Capacitors admissible maximum voltage.
$THDI_R$%: Admissible current total harmonic distortion of the plant.

[1] Maximum allowed value according to IEC 60831-1 art. 20.1.

Technical characteristics

Rated operational voltage	Ue = 415V
Rated frequency	50Hz
Max current overload In (cabinet)	1.3xIn
Max current overload In (capacitors)	1.3xIn (continuous) 2xIn (380s every 60m) 3xIn (150s every 60m) 4xIn (70s every 60m) 5xIn (45s every 60m)
Max voltage overload Vn (cabinet)	1.1xUe
Max voltage overload Vn (capacitors)	3xUn (for 1m)
Temperature range (cabinet)	-5/+40°C
Temperature range (capacitors)	-25/+55°C
Discharge device	On each bank
Installation	Indoor
Service	Continuous
Capacitors connection	Delta
Operation devices	Capacitors contactors
Total losses	ca. 6W/kvar
Inner surface finish	Zinc passivation
Applicable standards (cabinet)	IEC 61439-1/2 IEC61921 IEC61642
Applicable standards (capacitors)	IEC 60831-1/2

LLOYD'S REGISTER LRQA
ISO 9001 • ISO 14001
OHSAS 18001

CE

All ORTEA PFC are designed and built in compliance with the Low Voltage and Electromagnetic Compatibility European Directives with regard to the CE marking requirements. ORTEA products are built with suitable quality components and that the manufacturing process is constantly verified in accordance with the Quality Control Plans which the Company applies in compliance with the ISO 9001:2008 Standards. The commitment towards environmental issues and safety at work maters is guaranteed by the certification of the Management System according to the ISO14001:2004 and OHSAS18001:2007 Standards.
In order to obtain better performance, the products described in the present document can be altered by the Company at any date and without prior notice. Technical data and descriptions do hold therefore any contractual value.

Main characteristics
Power factor correction systems indicated for the plants where the current **harmonic distorsion**, without capacitors installed has values **higher than 27%**.
Use of high energy density metallized polypropylene capacitors assures elevated performances, high resistance to strong voltage overload, low losses and small dimensions.

Generalities
– Zinc-passivated metallic enclosure painted with epossidic dust paint, colour RAL 7035.
– Auxiliary transformer to separate power and auxiliary circuit parts.
– Load-break switch with door interlock.
– Special contactors for capacitive loads.
– Self-extinguish cable according to IEC 50267-2-1 standards.
– Microprocessor power factor correction relay.
– Three phase self-healing high energy density metallized polypropylene capacitors with rated voltage: **Un = 525V**.
– Three-phase detuning chokes with **tuning frequency 180Hz**.

All components inside this products are compliant with safety regulations requirements.

Type	Power [kvar]	Steps [no.]	Steps size [kvar]	Banks [kvar]	Load-break switch [A]	Icc [kA]	Regulators	Fan [no.]	IP3X cabinet WxDxH (type) [mm]	Weight [Kg]
PHF203-100	100	8	2x12.5-25-50	25-2x50	250	17	RPC 8BGA	3	600x600x2000 (32)	200
PHF203-150	150	12	2x12.5-25-2x50	25-50-75	400	25	RPC 8BGA	2	800x600x2000 (33)	240
PHF203-200	200	8	2x25-3x50	50-2x75	630	25	RPC 8BGA	2	800x600x2000 (33)	300
PHF203-250	250	10	2x25-4x50	50-2x100	630	25	RPC 8BGA	2	800x600x2000 (33)	430
PHF203-300	300	6	6x50	3x100	800	35	RPC 8BGA	2	800x600x2000 (33)	500
PHF203-400	400	8	2x50-3x100	100-2x150	2x630	25	RPC 8BGA	2+2	2x(800x600x2000)(2x33)	600
PHF203-500	500	10	2x50-4x100	100-2x200	2x630	25	RPC 8BGA	2+2	2x(800x600x2000)(2x33)	860
PHF203-600	600	6	6x100	3x200	2x800	35	RPC 8BGA	2+2	2x(800x600x2000)(2x33)	1000
PHF203-750	750	10	2x75-4x150	3x50-6x100	3x630	25	RPC 8BGA	2+2+2	3x(800x600x2000)(3x33)	1290
PHF203-900	900	6	6x150	9x100	3x800	35	RPC 8BGA	2+2+2	3x(800x600x2000)(3x33)	1500
PHF203-1000	1000	10	2x100-4x200	4x50-8x100	4x630	25	RPC 8BGA	2+2+2+2	4x(800x600x2000)(4x33)	1720

For higher powers, two or more PFC units of the same size can be connected in parallel, using the characteristic of the regulator to act as «master/slave».

Custom products

For high rating units, beyond the 'master - slave' configuration which exploits the controller ability to connect in parallel several units, ORTEA can develop very quickly automatic power factor correction systems personalized on the Customer's specification. All this thanks to ORTEA's flexible and responsive organization.
These units are assembled inside a single industrial cabinet and are fitted with a single switch disconnect instead of the traditional switches mounted on each parallel module.
Among other characteristics, it is possible to design the unit with special step-sizes, input automatic circuit breakers, different paint colour and higher IP protection (up to IP55).


ORTEA
AUTOMATIC
POWER FACTOR CORRECTION
SYSTEM


BA
BA

Racks

Designed to suit the most common switchboard sizes, ORTEA's rack system is the ideal solution for OEM and switchboard manufacturers. The rack is:

- Compact
- Available with or without blocking reactor
- Available in a single rack from 9.4kvar to 150kvar
- Fitted with busbars sized to withstand up to 400kvar
- Easy to assemble (busbars and NH fuses incorporated in the rack support)

ORTEA racks are fitted with three-phase self-regenerating high energy-density metallised polypropylene capacitors ensuring enhanced performance, low losses and contained dimensions.
The lateral adjustable slides allow for quick and easy assembling operations inside any cabinets.
Thanks to its extensible brackets, the 480mm rack can be mounted in a 800mm cabinet thus enabling a flexible combination of sizes and total reactive power.
The busbar system can withstand a maximum reactive power equal to 400kvar (at 415V, 50Hz).
Rack can be added to the system at any time.
Each auxiliary and control component is supplied already wired to the terminal block assembled on the rack.

Standard features
Each rack is supplied complete with:

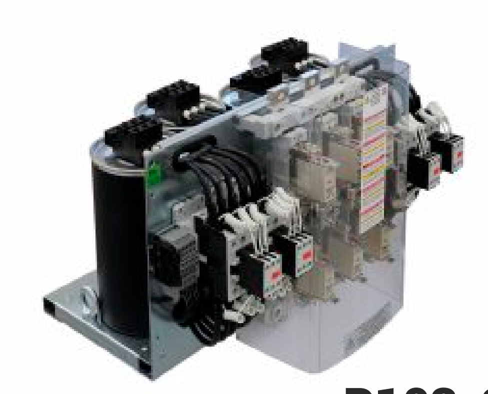
- Contactors for capacitors
- Self-extinguishing cables (EN50267-2-1)
- Three-pole NH00 fuse holder
- NH00 gG power fuses
- Three-phase self-regenerating high energy-density metallised polypropylene capacitors
- Three-phase connecting system via tinned copper bars
- Discharging resistors
- Only for the H203 type, blocking reactor with 180Hz tuning frequency

All the components conform with the safety legislative provisions.

Standard accessories (in every rack)

- Telescopic side brackets, suitable for 600-400mm deep cabinets
- Tinned copper connection bars, complete with bolts
- IP20 Plexiglass protection
- Adapting brackets for installation inside cabinet with different width (800-1000mm)

The P103 rack technical characteristics are the same as the ones valid for the PFC103 automatic power factor correction systems. The same applies for P503 racks (PFC503) and H203 (PHF203).



P103-6 (600mm)

U_e	U_N	Hz	$THDI_R$%
415V	415V	50	≤ 12%

Type	Power 415V [kvar]	Steps size 415V [kvar]	Fuses [A]	Load-break switch	Capacitors 415V [kvar]	Dimensions WxDxH [mm]	Weight [kg]
P103-6-25	25	25	3x50	BFK32A	25	480x335x275	12
P103-6-50	50	2x25	3x100	2xBFK32A	2x25	480x335x275	15
P103-6-75	75	3x25	3x50-3x100	3xBFK32A	3x25	480x335x275	19
P103-6-100	100	4x25	6x100	4xBFK32A	4x25	480x335x275	22
P103-6-100S	100	2x12,5-25-50	3x50-3x160	2xBFK12A-BFK32A-BF80K	2x12,5-3x25	480x335x275	22

P503-6 (600mm)

U_e	U_N	Hz	$THDI_R$%
415V	525V	50	≤ 27%

Type	Power 415V [kvar]	Steps size 415V [kvar]	Fuses [A]	Load-break switch	Capacitors 525V [kvar]	Dimensions WxDxH [mm]	Weight [kg]
P503-6-25	25	25	3x50	BFK32A	40	480x335x275	12
P503-6-50	50	2x25	3x100	2xBFK32A	2x40	480x335x275	15
P503-6-75	75	3x25	3x50-3x100	3xBFK32A	3x40	480x335x275	19
P503-6-100	100	4x25	6x100	4xBFK32A	4x40	480x335x275	22
P503-6-100S	100	2x12,5-25-50	3x50-3x160	2xBFK12A-BFK32A-BF80K	2x20-3x40	480x335x275	22

P103-8 (800mm)

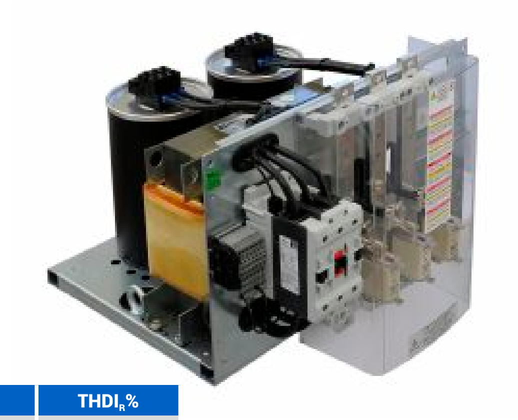
U_e	U_N	Hz	$THDI_R$%
415V	415V	50	≤ 12%

Type	Power 415V [kvar]	Steps size 415V [kvar]	Fuses [A]	Load-break switch	Capacitors 415V [kvar]	Dimensions WxDxH [mm]	Weight [kg]
P103-8-125	125	5x25	3x160-3x100	5xBFK32A	5x25	680x335x275	30
P103-8-150	150	6x25	6x160	6xBFK32A	6x25	680x335x275	33
P103-8-150S	150	2x12,5-25-2x50	6x160	2xBFK12A-BFK32A-2xBF80K	2x12,5-5x25	680x335x275	33

P503-8 (800mm)

U_e	U_N	Hz	$THDI_R$%
415V	525V	50	≤ 27%

Type	Power 415V [kvar]	Steps size 415V [kvar]	Fuses [A]	Load-break switch	Capacitors 525V [kvar]	Dimensions WxDxH [mm]	Weight [kg]
P503-8-125	125	5x25	3x160-3x100	5xBFK32A	5x40	680x335x275	30
P503-8-150	150	6x25	6x160	6xBFK32A	6x40	680x335x275	33
P503-8-150S	150	2x12,5-25-2x50	6x160	2xBFK12A-BFK32A-2xBF80K	2x20-5x40	680x335x275	33



H203-6 (600mm)

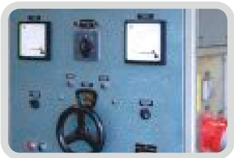
U_e	U_N	Hz	$THDI_R$%
415V	525V	50	> 27%

Type	Power 415V [kvar]	Steps size 415V [kvar]	Fuses [A]	Load-break switch	Capacitors 525V [kvar]	Dimensions WxDxH [mm]	Weight [kg]
H203-6-9	9,4	3,125-6,25	3x35	2xBF09A	5-10	480x450x275	34
H203-6-12	12,5	12,5	3x35	BF18A	20	480x450x275	22
H203-6-18	18,75	6,25-12,5	3x40	BF09A-BF18A	20-10	480x450x275	42
H203-6-25	25	2x12,5	3x63	2xBF18A	2x20	480x450x275	43
H203-6-25S	25	25	3x63	BF32A	40	480x450x275	32
H203-6-50	50	2x25	3x125	2xBF32A	2x40	480x450x275	43
H203-6-50S	50	50	3x125	BF80	2x40	480x450x275	50
H203-6-100	100	2x50	6x125	2xBF80	4x40	480x630x275	75

H203-8 (800mm)

U_e	U_N	Hz	$THDI_R$%
415V	525V	50	> 27%

Type	Power 415V [kvar]	Steps size 415V [kvar]	Fuses [A]	Load-break switch	Capacitors 525V [kvar]	Dimensions WxDxH [mm]	Weight [kg]
H203-8-75	75	25-50	3x63-3x125	BF32A-BF80	3x40	680x450x275	67
H203-8-100	100	2x50	6x125	2xBF80	4x40	680x450x275	80

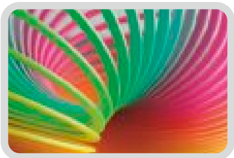


Experience.

In its **over 45 years** of business, Ortea (founded in 1969) has gained **experience** and **know-how** that enabled continuous growth and evolution. This never-ending process has allowed the Company to assume a **leading role worldwide** in designing and manufacturing voltage stabilisers.

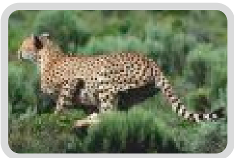
Reliability.

Thanks also to its long-established **Quality System**, ORTEA can ensure the production of **reliable** and **long lasting products**, each one of them accurately **tested**.



Flexibility.

In addition to the standard production, ORTEA's extremely flexible organization is able to develop and manufacture **cost-effective special equipment** based on the Customer's specification.

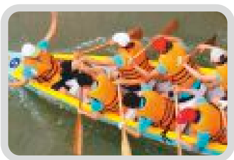


Speed.

ORTEA can manage the purchasing orders **very quickly**. Review of offer/order, design, production planning, manufacturing and strict test routines: all the **processes** have been **analysed** and **optimised** in order to eliminate idle time and shorten delivery terms.

Research & Development.

ORTEA invests a **considerable amount** in **R&D** concerning new products and technology. It is acknowledged that modern challenges in a globalised and competitive market can be won only when you're «ahead of time».



Synergy.

Co-operation between Headquarters, Subsidiaries, Distributors and Customers aimed at a careful **analysis of markets** and **demand** enable ORTEA the development of **up-to-date products**.
By working together, marketing, design, production and after-sales service allow the Company to meet the necessities set forth by an increasingly **globalised** and competitive **market**.

After-sales.

The **continuous monitoring** and **analysis** of requests and claims carried out by the after-sales service enables the **improvement** the **quality** of both **products** and **service** to the Customer.
ORTEA after-sales organization can act **quickly**, providing for precise issue analysis, supply of advise and **know-how** and , if necessary, provision of **spare parts** in order to solve any anomaly.

Quality.

Aiming at providing for the **best quality**, the manufacturing process includes checks during production and detail test sessions for each stabiliser.
The approved Integrated Managing System ensures the control of every manufacturing phase, starting from checking the components at reception and ending with the best package in relation to the transport type.
The Integrated Managing System is **ISO9001**:2008 – **ISO14001**:2004 – **OHSAS18001**:2007 approved.

Warranty terms

1.1 Warranty

The purchased equipment is under warranty against any material or workmanship defects that might occurs within the terms indicated in the following starting from the date of purchase and for all mechanical, electrical and electronic parts. During the warranty period, the Manufacturer will repair or replace any defective parts, unless said defects are due to:

- improper handling, storage and/or use:
- wear & tear resulting from normal usage;
- incompetence or negligence on the Buyer's side when installing, running and maintaining the unit;
- interventions performed by or on behalf of the Buyer without written authorization;
- failure to comply with instructions given by the Manufacturer;
- removal, alteration or forgery of the nameplate and the data indicated thereof; and
- fortuitous or force majeure events such as (but not limited to) fire, earthquake, flood, riot and revolution, war, political instability, terroristic act, strike, etc.).

Moreover, the provided warranty will immediately become null and void in case of:

- failure to comply with the payment terms;
- failure to carry out routine and / or extraordinary maintenance;
- improper use of the equipment; and
- external phenomena beyond the unit's scope and control.

In case of failure, the Buyer shall contact the Head Office where the Manufacturer will decide whether the repair can be performed on location, or if the equipment has to be shipped to the Manufacturer's facilities or to an after-sale Service Centre authorised by the Manufacturer.

If the repairing intervention can be performed at the Buyer's facility, all the expenses relevant to travelling, boarding and lodging of the Seller personnel shall be at the Buyer's charge, whilst spare parts and labour costs shall be at the Manufacturer's charge. However, the Buyer shall produce copy of the purchasing document (invoice) and report the detected anomaly prior to the intervention.

If the intervention is performed at the Manufacturer's facility, the equipment shall be duly packed and shipped back at the Buyer's expense and risk. The shipment after the repairing operations shall be under the Manufacturer's responsibility.

Unless otherwise agreed upon in writing, this warranty does not cover the replacement of the entire equipment under no circumstances whatsoever. Nothing shall be due to the Buyer for the time in which the equipment is left idle. The Buyer may not claim any compensations and/or reimbursements for expenses or indirect damages caused by the equipment failure.

Parts provided as spare parts and/or replacements are subject to the same warranty terms. Repair or replacement of a defective part does not extend the original warranty period on the product as a whole.

The competent place of jurisdiction for any disputes is in Monza (Italy).

1.2 Proper use

While the unit is functioning, the operator must be protected from any risks associated with the functioning mode. The proper / correct use of the equipment allows for full exploitation of its characteristics in complete safety. For such purpose:

- follow the instructions in the user manual;
- check the integrity of equipment and components;
- comply with instructions and warnings provided;
- check status of preservation and keep maintenance on the equipment under control;
- check the status of cables and electrical connections;
- comply with the nameplate data such as (but not limited to) power, voltage and amperage;
- use the equipment for the purpose intended by the Manufacturer;
- operate the equipment in the environmental conditions for which it was designed;
- cut off the power supply in case of inspection, repair and maintenance;
- use suitable work clothing and personal protective equipment (PPE);
- immediately report any malfunction (bad behaviour, suspicion of rupture, incorrect movement and noise beyond the standard level) to the department manager and switch off the equipment;
- comply with the recommended maintenance frequency, recording every control and comment related to the performed intervention.

1.3 Misuse / Improper use

The Manufacturer defines as «misuse / improper use» of the equipment any other than what described in the previous paragraph and in addition to that:

- modification of the operating parameters. Should it be necessary to make any modification to the equipment, the Buyer shall contact the Manufacturer;
- use of unsuitable or inadequate energy sources;
- employment of not adequately trained/skilled personnel to run the unit;
- failure to comply with the maintenance instructions or maintenance incorrectly carried out;
- use of non-original spare parts or unsuitable ones;
- modification and / or tapering with the equipment safety devices;
- performance of control operations, maintenance, or repairs without having first disconnected the energy supply;
- performance of temporary repairs or remedial measures not complying with the instructions.

WARNING. The Manufacturer declines all responsibility for damage to persons or belongings due to improper use as defined above.

1.4 Warranty terms

24 months from invoice date.

ISO 9001 • ISO 14001
OHSAS 18001

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