



HIGH RELIABILITY AND SAFETY LEVELS  
IDEAL FOR SPECIFIC APPLICATIONS

## LV TRANSFORMERS AND REACTORS





# ABOUT ORTEA

Founded in 1969, ORTEA SpA is a leading company in manufacturing and engineering Power Quality solutions.



Fifty years in the business and ongoing technical research have made of ORTEA SpA 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.

Beside standard production, ORTEA SpA 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 ORTEA SpA products are installed and working in a large number of countries, and, thanks to strategically positioned offices and distributors, guarantee rapid and competent support.





# QUALITY CERTIFIED

The belief that product quality and Customer satisfaction are the core of a modern organisation, led to the implementation of a certified Company Managing System.



A modern Company that wants to accept the challenge of today's business scenario cannot do so without conforming to standardized organizational criteria.

Customer satisfaction, product quality and responsible occupational practices are the basis on which the Company's activities can be consolidated. ORTEA SpA understood this a long time ago: the first ISO 9001 approval dates back to 1996.

Today ORTEA SpA Integrated Managing System is approved by Lloyd's Register according to the main Standards:

- ISO9001 (Quality management systems).
- ISO14001 (Environmental management systems).
- ISO45001 (Occupational health & safety management systems).

This means that ORTEA SpA can ensure that its performance is optimized in terms of internal process management, commitment towards environmental issues and attention to health & safety at work within the frame of a single Managing System.



# ORTEA POWER QUALITY SOLUTIONS

Companies are more and more sensitive to Power Quality issues because they can cause troubles and damages to equipments and processes, up to interrupting the production cycle.

ORTEA SpA, with his brands ORTEA, ICAR and ENERSOLVE, offers a unique range of products and services for Power Quality and Energy Efficiency of low voltage electrical networks: voltage stabilisers, sag compensator, power factor correction systems, transformers and active harmonic filters.

**VOLTAGE VARIATION**

**VOLTAGE STABILISERS**



**SAGs/DIPs**

**SAG COMPENSATOR**



**EXCESSIVE REACTIVE POWER**

**POWER FACTOR CORRECTION SYSTEMS**



**UNPROTECTED LOADS**

**LV TRANSFORMERS**



**HARMONIC POLLUTION**

**ACTIVE HARMONIC FILTERS**



**WASTE OF ENERGY**

**ENERGY EFFICIENCY  
SMART DEVICES**





## EXPERIENCE

Founded in 1969, ORTEA SpA 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 Power Quality solutions.



## RELIABILITY

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



## FLEXIBILITY

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



## QUALITY

Aiming at providing for the best quality, the manufacturing process includes checks during production and detail test sessions for each equipment. The certified 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.



## RESEARCH & DEVELOPMENT

ORTEA SpA constantly collaborates with Universities and Business Partners in the research and development of new products and new technologies.



## SYNERGY

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.



## EXPERTISE

ORTEA SpA pre- and after-sales organization is able to intervene quickly, analyzing the problems and providing the correct solution.



## CUSTOMER SERVICE

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.

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# ORTEA TRANSFORMERS

Since 1969, the year ORTEA SpA was founded, transformers have been at the heart of its business. The design and production knowledge and experience gained over the years allow us to offer high-quality, optimised and reliable products.



In addition to this, one of ORTEA SpA's hallmarks has always been its extreme flexibility, which allows to ensure the quick development of dedicated solutions based on the Customer's technical specifications. All this is achieved through customised design and the guarantee of maintaining the same high levels of quality of standard products. All design, production and marketing activities are carried out at ORTEA SpA's headquarters, thus ensuring continuous control and synergy amongst the resources involved.

## Sectors of application

The use of a transformer adapts the voltage of the supply network to that required by its load by separating one from the other, with the same supply power and frequency.

For this reason, the field of application is extremely wide:



Data center power supply systems.



Telecommunication systems.



UPS systems.



Isolated by-pass lines.



Rectifiers and electro-plating.



Photovoltaic and wind power plants.



Public buildings.



General purpose.





# CONSTRUCTION FEATURES

Transformers are manufactured using a copper or aluminium winding (according to the rated power and the economic optimisation of the project or the Customer's request) and a magnetic core made of low-thickness laminations to reduce the losses.

The isolating material used for the main insulation towards the core and for the inner insulation of windings is selected according to the required insulation class.

The solidly-built assembly, locked by plates and rods, is impregnated with environment-friendly polyester resin. The impregnation and oven polymerisation processes consolidate the assembly and allow to achieve the required insulation class.

The specific aspects of an application that fall within the scope of design include the temperature class (B, F, H up to class 220°C), the presence of multiple windings, any adjustment sockets, the connection vector unit and the performance characteristics (losses, short-circuit voltage, inrush current, etc.).

The transformers can be in an open configuration (IP00) or housed in a metal enclosure with a standard protection rating of IP21.

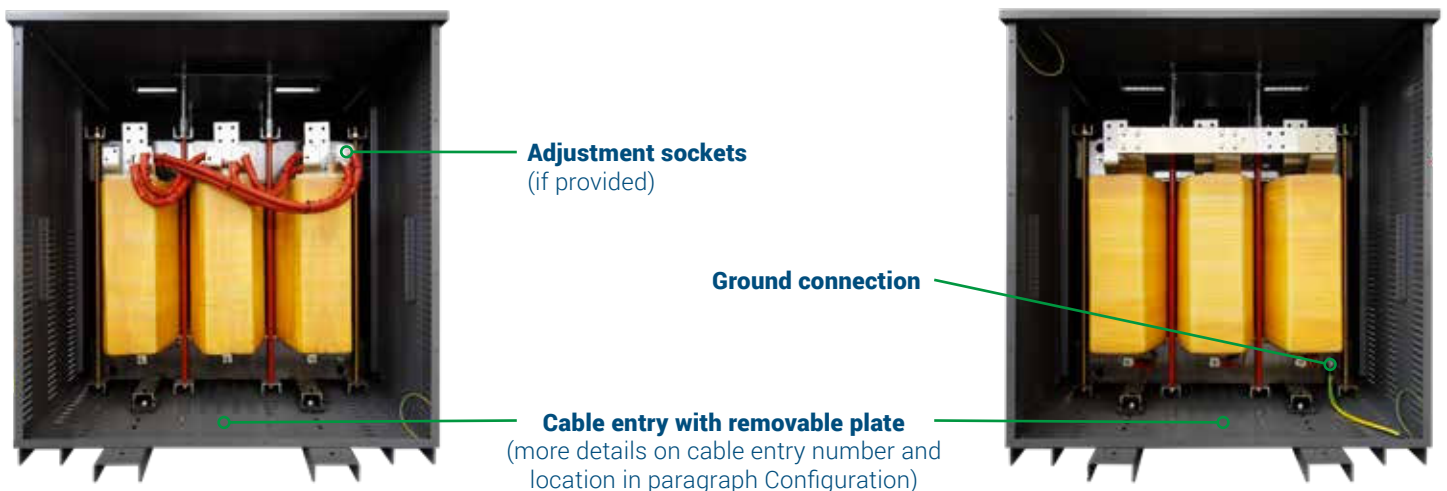
Other degrees of protection are available upon request.

The transformers are typically designed for indoor installation, but housings suitable for outdoor installation can be provided upon request.



**PRIMARY SIDE**

**SECONDARY SIDE**



The examples above are for illustrative purposes only. Adjustment sockets are optional. The position of connection terminals shown is only indicative.

Other configurations are possible as required.



## STANDARDS OF REFERENCE

The regulatory references follow an international chain that defines harmonised standards and is made up of IEC (International Electrotechnical Commission), CENELEC (European Committee for Electrotechnical Standardization) and CEI (Italian Electrotechnical Committee).

The standard technical reference provision for transformers manufactured by ORTEA SpA is the following: CEI EN IEC 60076 power transformers (divided into several parts).

When applicable, for isolating transformers reference is also made to CEI EN IEC 61558 safety of transformers, power supply units and similar (divided into several parts).

ORTEA SpA has obtained the UL approval for insulation systems in the 155°C, 180°C and 200°C classes.

## Sizing

The size of transformers can be customised according to the Customer's needs. The most suitable materials used allow to achieve high performance levels and limited losses. The optimised calculation process and the use of top-quality materials allow to meet the requirements of technical specifications.

## Time index, vector unit and connection

These are fundamental characteristics for the dimensioning of three-phase transformers.

The most common types of connection are delta/star or delta/zig-zag (both with or without accessible star centre). These connections (so-called "heteronymous connection") eliminate the third and multiple-of-three harmonics.

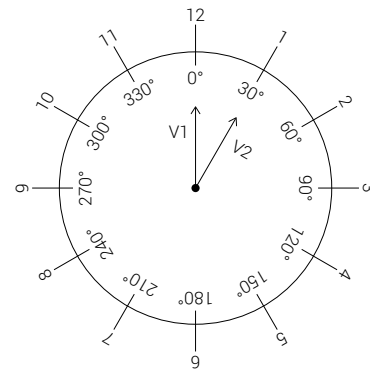
Other connections - such as star/star and delta/delta ("homonymous connections") are available upon request.

The phase shift between primary and secondary voltage is indicated by time index.

With homonymous connections, the following phase shifts are possible: 0°, 60°, 120°, 180°, 240°, 300°, i.e. every 60° starting from 0°.

With heteronymous connections, the following phase shifts are possible: 30°, 90°, 150°, 210°, 270°, 330°, i.e. every 60° starting from 30°.

These situations are expressed using the time index symbols. In other words, taking the clock face as a reference and placing the primary voltage (V1) in the 12 o'clock direction, the phase shift of the secondary voltage (V2) is identified with the time towards which it is pointed.



From the homonymous connections, the time indices 0, 2, 4, 6, 8, 10, i.e. all the even ones are obtained, while from the heteronymous connections, the odd time indices are obtained: 1, 3, 5, 7, 9, 11. The phase shift is obtained by multiplying the time indices by 30°.

Finally, the connection and phase shift between the primary and secondary in a transformer are indicated by an abbreviation consisting of two letters, followed by an integer between 0 and 11, in a set defined as a vector unit.

For instance, Dy11 means:

D = delta-connected primary winding

y = star-connected secondary winding

11 = time index, phase shift between primary and secondary 330°

Not all possible connections are actually made: among the homonymous connections, the most common are 0 and 6, while among the heteronymous connections 1, 5 and 11.

The vector unit determines how the three phases of the primary and secondary windings are connected.

Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6	Index 7	Index 8	Index 9	Index 10	Index 11

## Thermal class

The thermal class indicates the maximum allowable temperature (hot spot) for the winding of a transformer operating at an ambient temperature of 40°C and is classified into various levels by defining temperature ratings.

The following table summarises the different thermal classes available.

THERMAL CLASS (EN 60085)	THERMAL CLASS (prev. ed. of EN 60085)	MAX. WINDING TEMPERATURE (hot spot)	MAX. AVERAGE WINDING OVERTEMPERATURE (at rated current)
90	Y	90°C	45°C
105	A	105°C	60°C
120	E	120°C	75°C
130	B	130°C	80°C
155	F	155°C	100°C
<b>180</b>	<b>H</b>	<b>180°C</b>	<b>125°C</b>
200		200°C	135°C
220	N	220°C	150°C

The class supplied as standard by ORTEA SpA is highlighted in bold.

Transformers are designed according to the desired thermal class.

For the same power, a transformer with a low thermal class level must guarantee lower temperatures. This results in a limited use of the properties of the materials and leads to greater overall dimensions and weight.

Isolating materials used are different according to the required thermal and insulation class.

Normally, transformers manufactured by ORTEA SpA are in class H.

## Noise level

All transformers emit noise due to the alternating flow within the magnetic core.

If the transformer is installed near populated areas, the noise level may become a factor to be evaluated and considered.

For all transformers above 50kVA, the noise level is checked after 12 hours of no-load connection to the grid.

## K factor

In order for a load with one or more non-linear uses to be safely power-supplied, transformers must be suitably dimensioned to withstand the additional losses generated by the non-linearity of the load current and the consequent generation of harmonics.

The K factor is an index used to define the ability to power-supply a wide range of non-linear loads, whilst preventing overheating and service outage.

Each index corresponds to a certain current harmonic content. The most commonly used K-factor values are: 4, 9, 13 and 20.

The technical literature also provides some indications on the best K factor according to the specific application, if no measurement or figure is available:

- K = 1 for resistance ovens, motors, linear apps.
- K = 4 for welding machines, induction ovens, UPS with input filtering, PLC and static controls (variable speed drives are excluded).
- K = 13 for telecommunication applications, UPS without input filtering.
- K = 20 for data centre, variable speed drives.
- K > 20 for special applications, with very heavy harmonic load and high-range harmonics. In this case, it is advisable to carry out measurement campaigns using very sensitive and accurate instruments and discuss with the transformer manufacturer.

(source: Underwriters Laboratory (UL))

Please note that a K-rated transformer cannot cancel the harmonics of the systems (with the exception of the third and multiple-of-three harmonics in case of heteronomous

## VACUUM/PRESSURE IMPREGNATION SYSTEM

All ORTEA transformers are impregnated with class H polyester resin using vacuum/pressure equipment.

The polyester resin has a much higher dielectric strength and adhesion properties than any paint or other encapsulations, including oil-modified epoxies.

Polyester resin have the following characteristics:

- Low moisture absorption (non-hygroscopic).
- High dielectric strength.
- High bond strength.
- Excellent mechanical properties.
- High temperature stability.
- Excellent thermal shock properties.
- Long life at maximum transformer temperatures.

For a longer life, it is essential that integrity of dielectric properties of the transformers' material insulation is maintained.

Transformers are impregnated through a full vacuum/pressure impregnation cycle:

- Transformers are placed in a sealed tank and vacuum is drawn in.
- Resin is then injected into the chamber and the assembly is fully immersed.
- The tank is pressurised to force the impregnation material deep into the windings.
- The transformers are removed from the chamber and placed in an oven where the resin polymerisation cycle takes place.



connections), but it can bear their effects. In order to avoid or minimise the harmonic content, suitable filtering systems should be included.

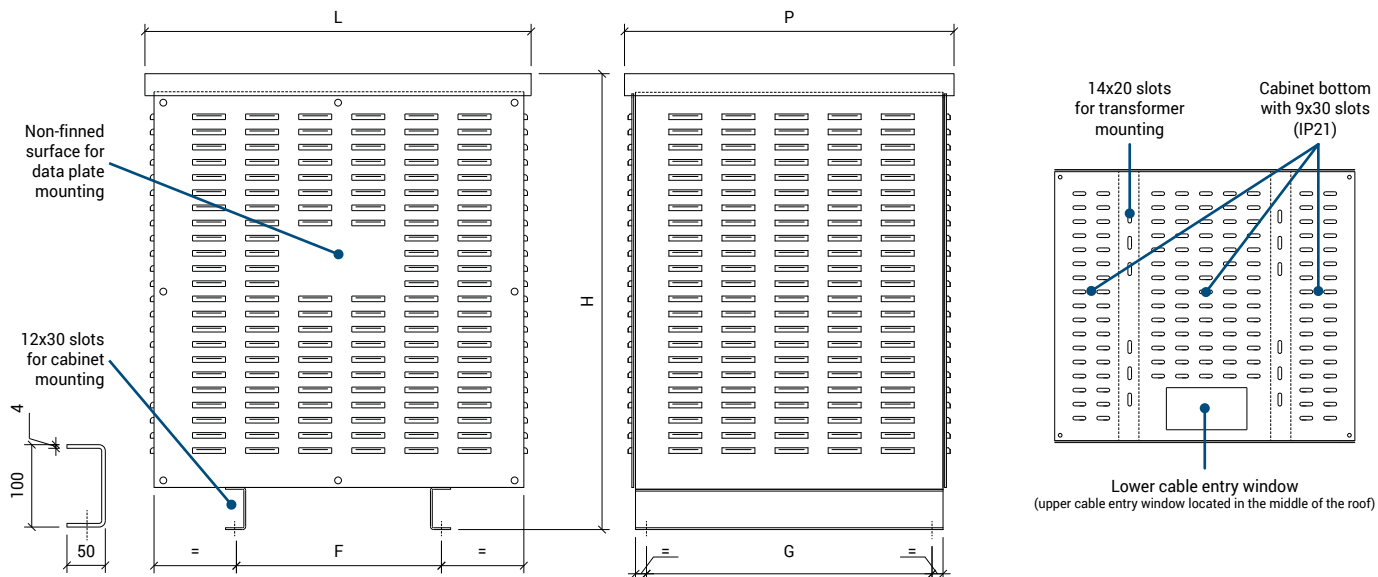
ORTEA SpA manufactures a range of standard isolating transformers having K factor 4, 13 and 20, but we can meet other specific Customers' needs.

## Configuration

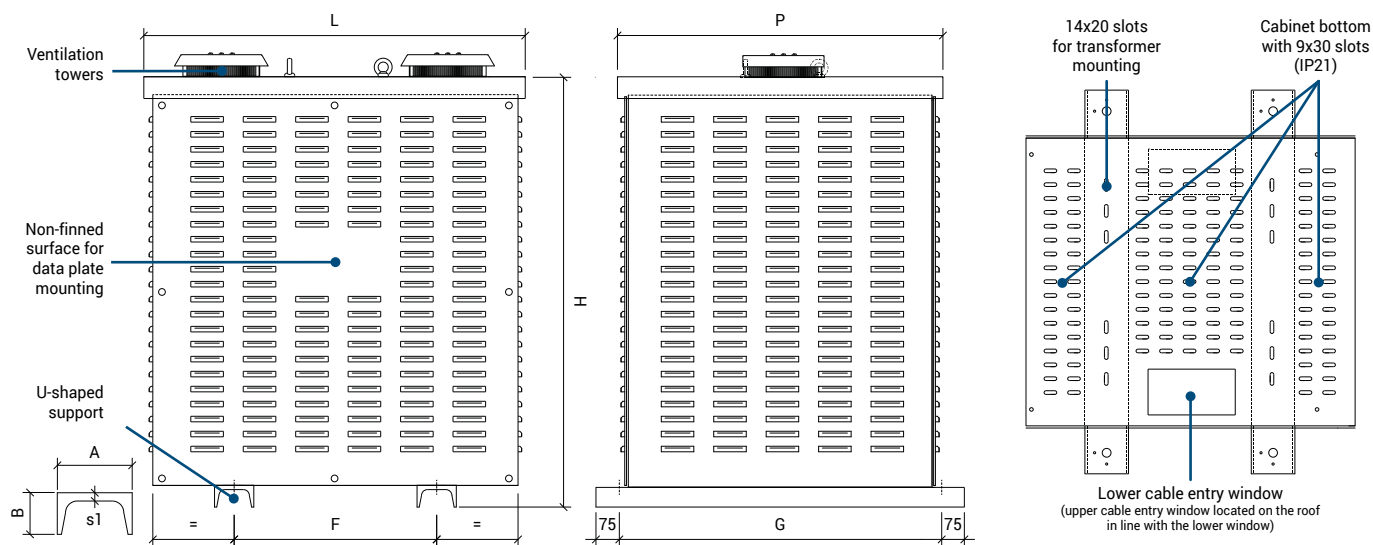
Transformers are available both in an open setup (IP00) and inside metal cabinets built upon ORTEA's specifications. In this case, the standard protection degree is IP21. However, other protection levels are available upon request.







DIMENSIONS (W x D x H) [mm]	FASTENING (F x G) [mm]	CABLE ENTRY [mm]
450 x 350 x 500	225 x 250	80 x 140
600 x 400 x 600	300 x 300	80 x 200
700 x 500 x 700	350 x 450	100 x 200



DIMENSIONS (W x D x H) [mm]	FASTENING (F x G) [mm]	CABLE ENTRY [mm]
800 x 700 x 850	400 x 550	100 x 200
900 x 800 x 950	450 x 650	100 x 250
1000 x 1000 x 1150	500 x 850	2x (100 x 250)
1200 x 1100 x 1350	600 x 950	2x (100 x 250)
1400 x 1200 x 1550	650 x 1050	2x (150 x 300)
1600 x 1300 x 1750	700 x 1150	2x (150 x 300)
1600 x 1300 x 1750	800 x 1450	2x (200 x 350)

## TESTS

In order to fully comply with the Customer's requirements and the applicable standards, the manufacturing process includes intermediate and electrical tests executed on all the items produced.

List of tests:

- Size, rated data and data plate check.
- Terminal identification check.
- Vector unit test.
- Dielectric properties test (dielectric strength at 3kV and insulation resistance).
- Transformation ratio test.
- No-load test (checking: secondary voltage, current absorbed without load, magnetic core losses).
- Load test (checking: percentage short-circuit voltage, winding losses).
- Electro-static shield connection test.
- Air and surface insulation distance test.
- Noise level check (for transformers having 50KVA + power) after 12 hours of connection to the grid without load.
- Electrical and mechanical connection test.
- Checking for the absence of foreign matter inside the coils.
- Thermal probes continuity and insulation check.



## Accessories

TYPE	PURPOSE
Electro-static shield	The shield is made up of a thin layer of conducting material having the same thickness as the windings and located between primary and secondary, that constitutes an earth-connected open coil. Its purpose is to mitigate any high-frequency disturbances in the network, that are discharged to the earth, thus preventing them from propagating. All ORTEA's isolating transformers are equipped with one or several electro-static shields.
Temperature sensors	These are thermal probes installed inside the coils, that are triggered when a given temperature is reached. They can consist of simple NO or NC contacts that provide an external signal or of thermocouples connected to a control unit to initiate alarm and protection systems.
Room temperature sensors	Thermostat placed inside a housing to operate any ventilation.
Automatic circuit breakers	They provide load protection in the event of an overload or short circuit.
Overvoltage arresters	These are devices whose function is to discharge voltage surges and lightning strikes to earth.
Insulation controllers	An instrument to monitor the integrity of the insulation.
Anti-seismic supports	For high-seismicity installations, these mounts are sized to withstand the level of acceleration specified by the user. Supplied upon request.
Customising the IP degree of protection of the housing	If required, the IP rating, which indicates the level of protection against the ingress of foreign bodies and water, can be raised from the usual IP21 to IP54.
Type of installation	Transformers are normally designed for internal installation. Upon request, it is possible to install them inside cabins designed for outdoor installation.
Customisation of housing colours	If the enclosure is to be installed together with other equipment, a specific colour can be requested.



Transformer housed inside an IP54 enclosure with circuit breakers and air conditioners.

# CHOICE OF THREE-PHASE TRANSFORMERS

A three-phase transformer is designed to transform an input voltage into the required single-phase or three-phase output voltage.

To calculate the rated power (kVA) when the voltage and current are known:

$$P \text{ [kVA]} = \sqrt{3} \times \frac{V \times I}{1000}$$

Where:

P = Rated power [kVA]

V = Rated voltage [V]

I = Rated current [A]

To select the correct type of transformer you need to determine:

1. Type of load to be power supplied	If the load consists of both single-phase and three-phase equipment, the single-phase equipment is connected to only one phase of the transformer.
2. Primary transformer voltage	It corresponds to the line input voltage (typically 400V).
3. Secondary transformer voltage	It corresponds to the voltage required by the load to be power supplied.
4. Frequency [Hz] of the load	It must be the same as the transformer's (typically 50 Hz).
5. Total power [kVA] of the load to be power supplied	This is determined by the result of the voltage supplied to the load multiplied by its current.

The total load is often a combination of individual single-phase and three-phase loads (e.g. lights, heaters, motors). You need to know the characteristics of the individual loads: active power, power factor, unbalance, etc. The total load must be evaluated taking into account the appropriate usage and contemporaneity factors.

The transformer chosen must have a kVA value equal to or greater than the required load, also taking into account any unbalance.









# ISOLATION TRANSFORMERS

These transformers are specifically designed and manufactured to guarantee the load protection. Isolation transformers usually provide a unit transformation ratio (e.g. 400/400V) and are used to uncouple the load from the power supply grid, as the primary and secondary windings are galvanically isolated.

The typical sectors of application are telecommunication systems, data centre power supply systems, trafoless UPS power supply, by-pass line protection, public building systems.

## Standard isolation transformers

Isolation transformers are always equipped with an electrostatic screen between the primary and secondary windings. The windings are made in a delta/star or delta/zig-zag configuration (with star centre available) to eliminate the third and multiple-of-three harmonics.

Isolation transformers perform various functions and, in particular, in data centre power supply systems, they can be used for the following purposes:

- Within a UPS, to act as an integral part of power conversion circuits.
- To create a locally grounded stable neutral point.
- Inside distribution units to reduce harmonic currents.
- If equipped with sockets, to allow voltage adjustment to comply with load requirements.
- To eliminate ground loops with multiple generators or network sources.

ORTEA SpA manufactures a range of standard isolating transformers having K factor 4, 13 and 20, but we can meet any specific need of the Customer.

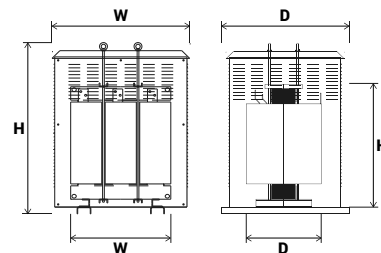


The tables in the following pages show the technical specifications of the standard K4, K13 and K20 ranges with delta/star connection (DYN11) and delta/zig-zag (DZNO). The table shows the losses with and without load, the performance and Vdc% and the corresponding size of the open setup (IP00) and the cabinet setup (IP21).

# DYN11 K4

## Technical data standard models 10-2500kVA

<b>Primary voltage</b>	400V ±10%
<b>Transformer ratio</b>	up to 1:2
<b>Connection type</b>	Delta / Star
<b>Neutral point</b>	Accessible
<b>Time index</b>	11
<b>K factor</b>	4
<b>Insulation level</b>	3kV
<b>Temperature class</b>	H
<b>Enclosure standard colour</b>	RAL7012
<b>Reference Standards</b>	IEC 60076 / IEC 61558 (when applicable)



Rated power	No-load losses	Load losses	Efficiency	Vcc	IP00		IP21	
					Dimensions	Weight	Dimensions	Weight
					WxDxH [mm]	[kg]	WxDxH [mm]	[kg]
[kVA]	[W]	[W]	[%]	[%]				
10	150	430	94,5	3,5	360 x 220 x 370	80	600 x 400 x 600	105
12	170	530	94,5	3,5	420 x 240 x 420	90	600 x 400 x 600	115
15	180	660	94,7	3,5	420 x 250 x 420	100	600 x 400 x 600	125
20	210	720	95,6	3,5	420 x 260 x 420	110	700 x 500 x 700	150
25	240	860	95,8	3,5	420 x 280 x 420	125	700 x 500 x 700	165
30	270	1000	95,9	3,5	420 x 320 x 420	145	700 x 500 x 700	185
40	350	1250	96,2	3,5 - 4,0	600 x 360 x 460	210	800 x 700 x 850	265
50	410	1480	96,4	3,5 - 4,0	600 x 390 x 460	230	800 x 700 x 850	285
63	450	1550	96,9	3,5 - 4,0	600 x 420 x 490	250	800 x 700 x 850	315
80	630	1700	97,2	3,5 - 4,0	660 x 460 x 500	300	800 x 700 x 850	355
90	680	1800	97,3	3,5 - 4,0	660 x 470 x 520	330	800 x 700 x 850	385
100	740	1900	97,4	3,5 - 4,0	660 x 470 x 560	360	900 x 800 x 950	430
110	780	2000	97,5	3,5 - 4,0	660 x 480 x 560	380	900 x 800 x 950	450
125	870	2250	97,6	3,5 - 4,0	660 x 490 x 560	410	900 x 800 x 950	480
140	920	2450	97,6	3,5 - 4,0	660 x 490 x 600	430	900 x 800 x 950	510
160	960	2800	97,7	3,5 - 4,0	660 x 510 x 620	480	1000 x 1000 x 1150	590
180	1100	2950	97,8	3,5 - 4,0	700 x 510 x 640	520	1000 x 1000 x 1150	630
200	1200	3150	97,9	3,5 - 4,0	700 x 530 x 660	580	1000 x 1000 x 1150	690
225	1290	3350	98,0	3,5 - 4,0	720 x 550 x 660	620	1000 x 1000 x 1150	730
250	1430	3600	98,0	3,5 - 4,0	760 x 570 x 680	670	1000 x 1000 x 1150	780
280	1470	3900	98,1	3,5 - 4,0	760 x 570 x 760	730	1000 x 1000 x 1150	840
315	1620	4250	98,2	3,5 - 4,0	760 x 590 x 780	780	1200 x 1100 x 1350	920
350	1730	4600	98,2	3,5 - 4,0	780 x 600 x 780	850	1200 x 1100 x 1350	1000
400	1890	5450	98,2	3,5 - 4,0	840 x 600 x 820	900	1200 x 1100 x 1350	1060
450	2100	6100	98,2	3,5 - 4,0	840 x 610 x 900	1000	1200 x 1100 x 1350	1160
500	2250	6750	98,2	3,5 - 4,0	840 x 630 x 900	1200	1200 x 1100 x 1350	1350
630	2780	7850	98,3	3,5 - 4,0	1050 x 650 x 950	1400	1400 x 1200 x 1550	1600
800	3000	9200	98,5	3,5 - 4,0	1100 x 680 x 1100	1600	1400 x 1200 x 1550	1800
1000	4050	10700	98,5	4,0 - 4,5	1100 x 750 x 1150	2000	1600 x 1300 x 1750	2250
1250	4950	12700	98,6	4,0 - 4,5	1200 x 800 x 1200	2400	1600 x 1300 x 1750	2650
1600	6200	15300	98,7	5	1400 x 850 x 1400	3200	2000 x 1600 x 2000	3600
2000	7600	18100	98,7	5	1500 x 900 x 1500	4200	2100 x 1700 x 2200	5000
2500	9000	21500	98,8	6	1700 x 950 x 1700	4500	2600 x 1700 x 2300	5500

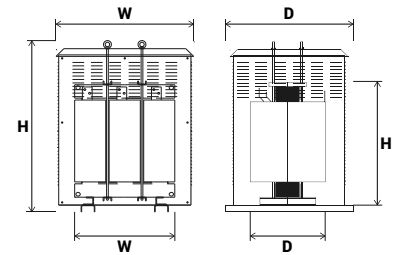
Losses on load are at 115°C with linear load, nominal voltage mains at 50Hz and nominal power.



# DYN11 K13

## Technical data standard models 8-2000kVA

<b>Primary voltage</b>	400V ±10%
<b>Transformer ratio</b>	up to 1:2
<b>Connection type</b>	Delta / Star
<b>Neutral point</b>	Accessible
<b>Time index</b>	11
<b>K factor</b>	13
<b>Insulation level</b>	3kV
<b>Temperature class</b>	H
<b>Enclosure standard colour</b>	RAL7012
<b>Reference Standards</b>	IEC 60076 / IEC 61558 (when applicable)



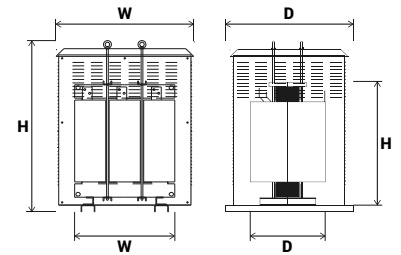
Rated power	No-load losses	Load losses	Efficiency	Vcc	IP00		IP21	
					Dimensions	Weight	Dimensions	Weight
					WxDxH [mm]	[kg]	WxDxH [mm]	[kg]
[kVA]	[W]	[W]	[%]	[%]				
8	150	290	94,8	3,5	360 x 220 x 370	80	600 x 400 x 600	105
10	170	360	95,0	3,5	420 x 240 x 420	90	600 x 400 x 600	115
12	180	450	95,0	3,5	420 x 250 x 420	100	600 x 400 x 600	125
15	210	490	95,5	3,5	420 x 260 x 420	110	700 x 500 x 700	150
20	240	580	96,1	3,5	420 x 280 x 420	125	700 x 500 x 700	165
25	270	710	96,2	3,5	420 x 320 x 420	145	700 x 500 x 700	185
30	350	850	96,2	3,5 - 4,0	600 x 360 x 460	210	800 x 700 x 850	265
40	410	1000	96,6	3,5 - 4,0	600 x 390 x 460	230	800 x 700 x 850	285
50	450	1080	97,0	3,5 - 4,0	600 x 420 x 490	250	800 x 700 x 850	315
63	630	1150	97,3	3,5 - 4,0	660 x 460 x 500	300	800 x 700 x 850	355
70	680	1210	97,4	3,5 - 4,0	660 x 470 x 520	330	800 x 700 x 850	385
80	740	1320	97,5	3,5 - 4,0	660 x 470 x 560	360	900 x 800 x 950	430
90	780	1380	97,7	3,5 - 4,0	660 x 480 x 560	380	900 x 800 x 950	450
100	870	1520	97,7	3,5 - 4,0	660 x 490 x 560	410	900 x 800 x 950	480
110	920	1640	97,7	3,5 - 4,0	660 x 490 x 600	430	900 x 800 x 950	510
125	960	1880	97,8	3,5 - 4,0	660 x 510 x 620	480	1000 x 1000 x 1150	590
140	1100	1980	97,8	3,5 - 4,0	700 x 510 x 640	520	1000 x 1000 x 1150	630
160	1200	2120	98,0	3,5 - 4,0	700 x 530 x 660	580	1000 x 1000 x 1150	690
180	1290	2280	98,1	3,5 - 4,0	720 x 550 x 660	620	1000 x 1000 x 1150	730
200	1430	2420	98,1	3,5 - 4,0	760 x 570 x 680	670	1000 x 1000 x 1150	780
225	1470	2620	98,2	3,5 - 4,0	760 x 570 x 760	730	1000 x 1000 x 1150	840
250	1620	2850	98,2	3,5 - 4,0	760 x 590 x 780	780	1200 x 1100 x 1350	920
280	1730	3180	98,3	3,5 - 4,0	780 x 600 x 780	850	1200 x 1100 x 1350	1000
315	1890	3600	98,3	3,5 - 4,0	840 x 600 x 820	900	1200 x 1100 x 1350	1060
350	2100	4100	98,3	3,5 - 4,0	840 x 610 x 900	1000	1200 x 1100 x 1350	1160
400	2250	4530	98,3	3,5 - 4,0	840 x 630 x 900	1200	1200 x 1100 x 1350	1350
500	2780	5250	98,4	3,5 - 4,0	1050 x 650 x 950	1400	1400 x 1200 x 1550	1600
630	3000	6180	98,6	3,5 - 4,0	1100 x 680 x 1100	1600	1400 x 1200 x 1550	1800
800	4050	7180	98,6	4,0 - 4,5	1100 x 750 x 1150	2000	1600 x 1300 x 1750	2250
1000	4950	8450	98,7	4,0 - 4,5	1200 x 800 x 1200	2400	1600 x 1300 x 1750	2650
1250	6200	10400	98,7	5	1400 x 850 x 1400	3200	2000 x 1600 x 2000	3600
1600	7600	12250	98,8	5	1500 x 900 x 1500	4200	2100 x 1700 x 2200	5000
2000	9000	14500	98,8	6	1700 x 950 x 1700	4500	2600 x 1700 x 2300	5500

Losses on load are at 115°C with linear load, nominal voltage mains at 50Hz and nominal power.

# DYN11 K20

## Technical data standard models 7-1800kVA

<b>Primary voltage</b>	400V ±10%
<b>Transformer ratio</b>	up to 1:2
<b>Connection type</b>	Delta / Star
<b>Neutral point</b>	Accessible
<b>Time index</b>	11
<b>K factor</b>	20
<b>Insulation level</b>	3kV
<b>Temperature class</b>	H
<b>Enclosure standard colour</b>	RAL7012
<b>Reference Standards</b>	IEC 60076 / IEC 61558 (when applicable)



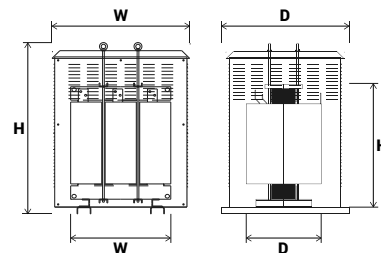
Rated power	No-load losses	Load losses	Efficiency	Vcc	IP00		IP21	
					Dimensions	Weight	Dimensions	Weight
					WxDxH [mm]	[kg]	WxDxH [mm]	[kg]
<b>7</b>	150	240	94,9	3,5	360 x 220 x 370	80	600 x 400 x 600	105
<b>9</b>	170	300	94,9	3,5	420 x 240 x 420	90	600 x 400 x 600	115
<b>10</b>	180	360	94,9	3,5	420 x 250 x 420	100	600 x 400 x 600	125
<b>14</b>	210	390	95,9	3,5	420 x 260 x 420	110	700 x 500 x 700	150
<b>18</b>	240	470	96,2	3,5	420 x 280 x 420	125	700 x 500 x 700	165
<b>22</b>	270	540	96,4	3,5	420 x 320 x 420	145	700 x 500 x 700	185
<b>28</b>	350	680	96,5	3,5 - 4,0	600 x 360 x 460	210	800 x 700 x 850	265
<b>36</b>	410	800	96,7	3,5 - 4,0	600 x 390 x 460	230	800 x 700 x 850	285
<b>45</b>	450	840	97,2	3,5 - 4,0	600 x 420 x 490	250	800 x 700 x 850	315
<b>58</b>	630	920	97,4	3,5 - 4,0	660 x 460 x 500	300	800 x 700 x 850	355
<b>63</b>	680	980	97,4	3,5 - 4,0	660 x 470 x 500	330	800 x 700 x 850	385
<b>70</b>	740	1080	97,5	3,5 - 4,0	660 x 470 x 560	360	900 x 800 x 950	430
<b>80</b>	780	1100	97,7	3,5 - 4,0	660 x 480 x 560	380	900 x 800 x 950	450
<b>90</b>	870	1230	97,7	3,5 - 4,0	660 x 490 x 560	410	900 x 800 x 950	480
<b>100</b>	920	1350	97,8	3,5 - 4,0	660 x 490 x 600	430	900 x 800 x 950	510
<b>110</b>	960	1550	97,8	3,5 - 4,0	660 x 510 x 620	480	1000 x 1000 x 1150	590
<b>125</b>	1100	1620	97,9	3,5 - 4,0	700 x 510 x 640	520	1000 x 1000 x 1150	630
<b>140</b>	1200	1710	98,0	3,5 - 4,0	700 x 530 x 660	580	1000 x 1000 x 1150	690
<b>160</b>	1290	1820	98,1	3,5 - 4,0	720 x 550 x 660	620	1000 x 1000 x 1150	730
<b>180</b>	1430	1960	98,2	3,5 - 4,0	760 x 570 x 680	670	1000 x 1000 x 1150	780
<b>200</b>	1470	2150	98,2	3,5 - 4,0	760 x 570 x 760	730	1000 x 1000 x 1150	840
<b>225</b>	1620	2320	98,3	3,5 - 4,0	760 x 590 x 780	780	1200 x 1100 x 1350	920
<b>250</b>	1730	2510	98,3	3,5 - 4,0	780 x 600 x 780	850	1200 x 1100 x 1350	1000
<b>280</b>	1890	3080	98,3	3,5 - 4,0	840 x 600 x 820	900	1200 x 1100 x 1350	1060
<b>315</b>	2100	3350	98,3	3,5 - 4,0	840 x 610 x 900	1000	1200 x 1100 x 1350	1160
<b>350</b>	2250	3720	98,3	3,5 - 4,0	840 x 630 x 900	1200	1200 x 1100 x 1350	1350
<b>450</b>	2780	4350	98,4	3,5 - 4,0	1050 x 6500 x 950	1400	1400 x 1200 x 1550	1600
<b>580</b>	3000	5100	98,6	3,5 - 4,0	1100 x 680 x 1100	1600	1400 x 1200 x 1550	1800
<b>720</b>	4050	5850	98,6	4,0 - 4,5	1100 x 750 x 1150	2000	1600 x 1300 x 1750	2250
<b>900</b>	4950	6950	98,7	4,0 - 4,5	1200 x 800 x 1200	2400	1600 x 1300 x 1750	2650
<b>1100</b>	6200	8350	98,7	5	1400 x 850 x 1400	3200	2000 x 1600 x 2000	3600
<b>1400</b>	7600	9900	98,8	5	1500 x 900 x 1500	4200	2100 x 1700 x 2200	5000
<b>1800</b>	9000	11800	98,9	6	1700 x 950 x 1700	4500	2600 x 1700 x 2300	5500

Losses on load are at 115°C with linear load, nominal voltage mains at 50Hz and nominal power.

# DZNO K4

## Technical data standard models **10-2500kVA**

<b>Primary voltage</b>	400V ±10%
<b>Transformer ratio</b>	up to 1:2
<b>Connection type</b>	Delta / Zig-zag
<b>Neutral point</b>	Accessible
<b>Time index</b>	0
<b>K factor</b>	4
<b>Insulation level</b>	3kV
<b>Temperature class</b>	H
<b>Enclosure standard colour</b>	RAL7012
<b>Reference Standards</b>	IEC 60076 / IEC 61558 (when applicable)



Rated power	No-load losses	Load losses	Efficiency	Vcc	IP00		IP21	
					Dimensions	Weight	Dimensions	Weight
					WxDxH [mm]	[kg]	WxDxH [mm]	[kg]
<b>10</b>	160	460	94,2	3,5	380 x 230 x 380	85	600 x 400 x 600	110
<b>12</b>	180	560	94,2	3,5	420 x 250 x 420	95	600 x 400 x 600	120
<b>15</b>	190	710	94,3	3,5	420 x 260 x 420	110	600 x 400 x 600	135
<b>20</b>	225	770	95,3	3,5	420 x 270 x 420	120	700 x 500 x 700	160
<b>25</b>	260	920	95,5	3,5	420 x 290 x 420	135	700 x 500 x 700	175
<b>30</b>	290	1070	95,7	3,5	420 x 340 x 440	160	700 x 500 x 700	200
<b>40</b>	375	1340	95,9	3,5 - 4,0	600 x 380 x 460	230	800 x 700 x 850	285
<b>50</b>	440	1580	96,1	3,5 - 4,0	600 x 410 x 460	250	800 x 700 x 850	305
<b>63</b>	480	1660	96,7	3,5 - 4,0	600 x 440 x 490	270	800 x 700 x 850	325
<b>80</b>	670	1820	97,0	3,5 - 4,0	660 x 470 x 530	330	800 x 700 x 850	385
<b>90</b>	730	1920	97,1	3,5 - 4,0	660 x 480 x 560	350	800 x 700 x 850	405
<b>100</b>	790	2030	97,3	3,5 - 4,0	660 x 480 x 560	380	900 x 800 x 950	450
<b>110</b>	830	2140	97,4	3,5 - 4,0	660 x 490 x 560	400	900 x 800 x 950	470
<b>125</b>	930	2400	97,4	3,5 - 4,0	660 x 490 x 600	430	900 x 800 x 950	500
<b>140</b>	980	2610	97,5	3,5 - 4,0	660 x 510 x 620	470	900 x 800 x 950	540
<b>160</b>	1030	2990	97,5	3,5 - 4,0	700 x 510 x 640	520	1000 x 1000 x 1150	630
<b>180</b>	1180	3150	97,7	3,5 - 4,0	700 x 530 x 660	560	1000 x 1000 x 1150	670
<b>200</b>	1280	3360	97,7	3,5 - 4,0	720 x 550 x 660	610	1000 x 1000 x 1150	720
<b>225</b>	1380	3580	97,8	3,5 - 4,0	760 x 570 x 680	660	1000 x 1000 x 1150	770
<b>250</b>	1530	3840	97,9	3,5 - 4,0	760 x 570 x 760	720	1000 x 1000 x 1150	830
<b>280</b>	1570	4160	98,0	3,5 - 4,0	760 x 590 x 780	790	1000 x 1000 x 1150	900
<b>315</b>	1730	4540	98,0	3,5 - 4,0	780 x 600 x 780	830	1200 x 1100 x 1350	980
<b>350</b>	1850	4910	98,1	3,5 - 4,0	840 x 600 x 820	890	1200 x 1100 x 1350	1050
<b>400</b>	2020	5810	98,1	3,5 - 4,0	840 x 610 x 900	990	1200 x 1100 x 1350	1150
<b>450</b>	2240	6500	98,1	3,5 - 4,0	840 x 630 x 900	1100	1200 x 1100 x 1350	1250
<b>500</b>	2400	7200	98,1	3,5 - 4,0	1050 x 650 x 950	1200	1200 x 1100 x 1350	1350
<b>630</b>	2970	8370	98,2	3,5 - 4,0	1100 x 680 x 1100	1450	1400 x 1200 x 1550	1650
<b>800</b>	3200	9800	98,4	3,5 - 4,0	1100 x 700 x 1150	1650	1400 x 1200 x 1550	1850
<b>1000</b>	4320	11400	98,5	4,0 - 4,5	1200 x 750 x 1200	2100	1600 x 1300 x 1750	2350
<b>1250</b>	5280	13540	98,5	4,0 - 4,5	1250 x 800 x 1250	2500	1600 x 1300 x 1750	2800
<b>1600</b>	6600	16400	98,6	5	1500 x 850 x 1400	4000	2000 x 1600 x 2000	4500
<b>2000</b>	8100	19300	98,6	5	1600 x 900 x 1500	4700	2100 x 1700 x 2200	5600
<b>2500</b>	9600	22950	98,7	6	1800 x 950 x 1800	5400	2600 x 1700 x 2300	6400

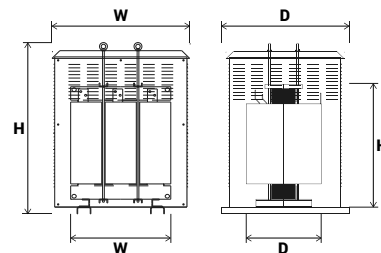
Losses on load are at 115°C with linear load, nominal voltage mains at 50Hz and nominal power.



# DZNO K13

## Technical data standard models **8-2000kVA**

<b>Primary voltage</b>	400V ±10%
<b>Transformer ratio</b>	up to 1:2
<b>Connection type</b>	Delta / Zig-zag
<b>Neutral point</b>	Accessible
<b>Time index</b>	0
<b>K factor</b>	13
<b>Insulation level</b>	3kV
<b>Temperature class</b>	H
<b>Enclosure standard colour</b>	RAL7012
<b>Reference Standards</b>	IEC 60076 / IEC 61558 (when applicable)



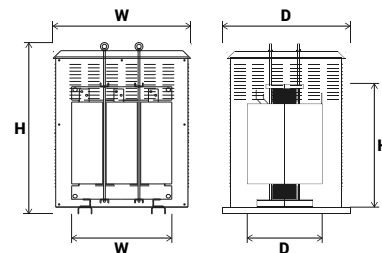
Rated power	No-load losses	Load losses	Efficiency	Vcc	IP00		IP21	
					Dimensions	Weight	Dimensions	Weight
					WxDxH [mm]	[kg]	WxDxH [mm]	[kg]
[kVA]	[W]	[W]	[%]	[%]				
8	160	310	94,5	3,5	380 x 230 x 380	85	600 x 400 x 600	110
10	180	385	94,7	3,5	420 x 250 x 420	95	600 x 400 x 600	120
12	190	480	94,7	3,5	420 x 260 x 420	110	600 x 400 x 600	135
15	225	530	95,2	3,5	420 x 270 x 420	120	700 x 500 x 700	160
20	260	620	95,8	3,5	420 x 290 x 420	135	700 x 500 x 700	175
25	290	770	95,9	3,5	420 x 340 x 440	160	700 x 500 x 700	200
30	375	900	95,9	3,5 - 4,0	600 x 380 x 460	230	800 x 700 x 850	285
40	440	1070	96,4	3,5 - 4,0	600 x 410 x 460	250	800 x 700 x 850	305
50	480	1160	96,8	3,5 - 4,0	600 x 440 x 490	270	800 x 700 x 850	325
63	670	1230	97,1	3,5 - 4,0	660 x 470 x 530	330	800 x 700 x 850	385
70	730	1290	97,2	3,5 - 4,0	660 x 480 x 560	350	800 x 700 x 850	405
80	790	1410	97,3	3,5 - 4,0	660 x 480 x 560	380	900 x 800 x 950	450
90	830	1480	97,5	3,5 - 4,0	660 x 490 x 560	400	900 x 800 x 950	470
100	930	1630	97,5	3,5 - 4,0	660 x 490 x 600	430	900 x 800 x 950	500
110	980	1750	97,6	3,5 - 4,0	660 x 510 x 620	470	900 x 800 x 950	540
125	1030	2000	97,6	3,5 - 4,0	700 x 510 x 640	520	1000 x 1000 x 1150	630
140	1180	2110	97,7	3,5 - 4,0	700 x 530 x 660	560	1000 x 1000 x 1150	670
160	1280	2260	97,8	3,5 - 4,0	720 x 550 x 660	610	1000 x 1000 x 1150	720
180	1380	2440	97,9	3,5 - 4,0	760 x 570 x 680	660	1000 x 1000 x 1150	770
200	1530	2580	98,0	3,5 - 4,0	760 x 570 x 760	720	1000 x 1000 x 1150	830
225	1570	2790	98,1	3,5 - 4,0	760 x 590 x 780	790	1000 x 1000 x 1150	900
250	1730	3040	98,1	3,5 - 4,0	780 x 600 x 780	830	1200 x 1100 x 1350	980
280	1850	3390	98,2	3,5 - 4,0	840 x 600 x 820	890	1200 x 1100 x 1350	1050
315	2020	3840	98,2	3,5 - 4,0	840 x 610 x 900	990	1200 x 1100 x 1350	1150
350	2240	4350	98,2	3,5 - 4,0	840 x 630 x 900	1100	1200 x 1100 x 1350	1250
400	2400	4830	98,2	3,5 - 4,0	1050 x 650 x 950	1200	1200 x 1100 x 1350	1350
500	2970	5600	98,3	3,5 - 4,0	1100 x 680 x 1100	1450	1400 x 1200 x 1550	1650
630	3200	6590	98,5	3,5 - 4,0	1100 x 700 x 1150	1650	1400 x 1200 x 1550	1850
800	4320	7660	98,5	4,0 - 4,5	1200 x 750 x 1200	2100	1600 x 1300 x 1750	2350
1000	5280	9000	98,6	4,0 - 4,5	1250 x 800 x 1250	2500	1600 x 1300 x 1750	2800
1250	6600	11100	98,6	5	1500 x 850 x 1400	4000	2000 x 1600 x 2000	4500
1600	8100	13100	98,7	5	1600 x 900 x 1500	4700	2100 x 1700 x 2200	5600
2000	9600	15500	98,8	6	1800 x 950 x 1800	5400	2600 x 1700 x 2300	6400

Losses on load are at 115°C with linear load, nominal voltage mains at 50Hz and nominal power.

# DZNO K20

## Technical data standard models 7-1800kVA

<b>Primary voltage</b>	400V ±10%
<b>Transformer ratio</b>	up to 1:2
<b>Connection type</b>	Delta / Zig-zag
<b>Neutral point</b>	Accessible
<b>Time index</b>	0
<b>K factor</b>	20
<b>Insulation level</b>	3kV
<b>Temperature class</b>	H
<b>Enclosure standard colour</b>	RAL7012
<b>Reference Standards</b>	IEC 60076 / IEC 61558 (when applicable)



Rated power	No-load losses	Load losses	Efficiency	Vcc	IP00		IP21	
					Dimensions	Weight	Dimensions	Weight
					WxDxH [mm]	[kg]	WxDxH [mm]	[kg]
<b>7</b>	160	260	94,3	3,5	380 x 230 x 380	85	600 x 400 x 600	110
<b>9</b>	180	330	94,6	3,5	420 x 250 x 420	95	600 x 400 x 600	120
<b>10</b>	190	385	94,6	3,5	420 x 260 x 420	110	600 x 400 x 600	135
<b>14</b>	225	420	95,6	3,5	420 x 270 x 420	120	700 x 500 x 700	160
<b>18</b>	260	510	95,9	3,5	420 x 290 x 420	135	700 x 500 x 700	175
<b>22</b>	290	580	96,2	3,5	420 x 340 x 440	160	700 x 500 x 700	200
<b>28</b>	375	730	96,2	3,5 - 4,0	600 x 380 x 460	230	800 x 700 x 850	285
<b>36</b>	440	860	96,5	3,5 - 4,0	600 x 410 x 460	250	800 x 700 x 850	305
<b>45</b>	480	900	97,0	3,5 - 4,0	600 x 440 x 490	270	800 x 700 x 850	325
<b>58</b>	670	990	97,2	3,5 - 4,0	660 x 470 x 530	330	800 x 700 x 850	385
<b>63</b>	730	1050	97,3	3,5 - 4,0	660 x 480 x 560	350	800 x 700 x 850	405
<b>70</b>	790	1160	97,3	3,5 - 4,0	660 x 480 x 560	380	900 x 800 x 950	450
<b>80</b>	830	1180	97,5	3,5 - 4,0	660 x 490 x 560	400	900 x 800 x 950	470
<b>90</b>	930	1320	97,6	3,5 - 4,0	660 x 490 x 600	430	900 x 800 x 950	500
<b>100</b>	980	1440	97,6	3,5 - 4,0	660 x 510 x 620	470	900 x 800 x 950	540
<b>110</b>	1030	1660	97,6	3,5 - 4,0	700 x 510 x 640	520	1000 x 1000 x 1150	630
<b>125</b>	1180	1730	97,7	3,5 - 4,0	700 x 530 x 660	560	1000 x 1000 x 1150	670
<b>140</b>	1280	1830	97,8	3,5 - 4,0	720 x 550 x 660	610	1000 x 1000 x 1150	720
<b>160</b>	1380	1950	98,0	3,5 - 4,0	760 x 570 x 680	660	1000 x 1000 x 1150	770
<b>180</b>	1530	2090	98,0	3,5 - 4,0	760 x 570 x 760	720	1000 x 1000 x 1150	830
<b>200</b>	1570	2290	98,1	3,5 - 4,0	760 x 590 x 780	790	1000 x 1000 x 1150	900
<b>225</b>	1730	2480	98,2	3,5 - 4,0	780 x 600 x 780	830	1200 x 1100 x 1350	980
<b>250</b>	1850	2680	98,2	3,5 - 4,0	840 x 600 x 820	890	1200 x 1100 x 1350	1050
<b>280</b>	2020	3250	98,2	3,5 - 4,0	840 x 610 x 900	990	1200 x 1100 x 1350	1150
<b>315</b>	2240	3580	98,2	3,5 - 4,0	840 x 630 x 900	1100	1200 x 1100 x 1350	1250
<b>350</b>	2400	3970	98,2	3,5 - 4,0	1050 x 650 x 950	1200	1200 x 1100 x 1350	1350
<b>450</b>	2970	4640	98,3	3,5 - 4,0	1100 x 680 x 1100	1450	1400 x 1200 x 1550	1650
<b>580</b>	3200	5440	98,5	3,5 - 4,0	1100 x 700 x 1150	1650	1400 x 1200 x 1550	1850
<b>720</b>	4320	6240	98,6	4,0 - 4,5	1200 x 750 x 1200	2100	1600 x 1300 x 1750	2350
<b>900</b>	5280	7450	98,6	4,0 - 4,5	1250 x 800 x 1250	2500	1600 x 1300 x 1750	2800
<b>1100</b>	6600	8900	98,6	5	1500 x 850 x 1400	4000	2000 x 1600 x 2000	4500
<b>1400</b>	8100	10600	98,7	5	1600 x 900 x 1500	4700	2100 x 1700 x 2200	5600
<b>1800</b>	9600	12600	98,8	6	1800 x 950 x 1800	5400	2600 x 1700 x 2300	6400

Losses on load are at 115°C with linear load, nominal voltage mains at 50Hz and nominal power.

## K-rated isolation transformers for non-linear loads

These isolation transformers are specifically designed to cope with the high level of harmonic distortion generated by non-linear loads.

Typical non-linear loads are computers, variable speed drives, inverters, welding machines.

The harmonics generated result in a higher effective value of current and therefore in an increase in Joule losses.

In order to ensure compliance with the temperature limits defined by the thermal class, the design of the transformer must take account of these harmonics.

The degree of influence of harmonic distortion is indicated by the K factor: the higher the K value, the higher the harmonic content that the transformer must withstand without damage.



K13 isolating transformer for areas at risk of earthquake.

## Isolation transformers for UPS

These transformers are used for AC/DC conversion and DC/AC rectification units that are typical of uninterruptible power supplies (UPS).

These transformers are highly customised and standard types cannot be defined, as their design is linked to that of the machine in which they are to be installed. Both the electrical parameters and the mechanical characteristics meet precise specifications drawn up by the UPS manufacturer.

Close cooperation is therefore essential for the development of the most suitable solution.

Thanks to its decade-long experience, ORTEA SpA designs and manufactures transformers that are suitable for any type of UPS system. Partnerships with the world's leading manufacturers provide evidence of the high degree of reliability achieved.

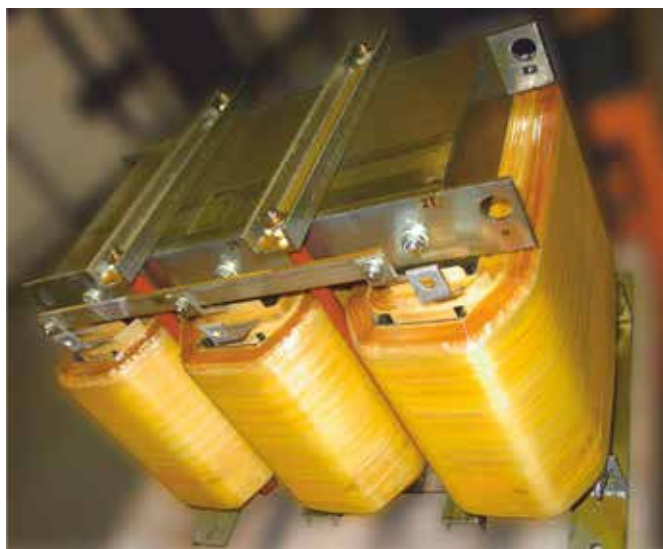


Transformer and reactance unit for 800kVA UPS on frame.

## Isolation transformers for photovoltaic systems

These are actual isolation transformers, but made in such a way as to have very high efficiency, i.e. minimised losses. This characteristic is required by the fact that photovoltaic conversion systems offer low levels of efficiency.

The use of a low-loss transformer allows to optimise the management of the system, as it increases the amount of energy transferred to the managing body, thus improving the economic performance of the system.



High efficiency 100kVA transformer for photovoltaic plant.



# TRANSFORMERS FOR RECTIFIERS

They are used for special industrial applications mainly in galvanic plants (chromium-plating, zinc-coating, etc.).

The rectifier converts alternating current to direct current.

Again, the transformer is developed specifically for the rectifier for which it is intended.

The conversion unit can have different configurations (three-phase bridge, six-phase with or without interphase coil, twelve-phase, etc.) and each one requires the sizing of a dedicated transformer.

The type of use requires high secondary currents in the thousands of amperes.

The know-how of ORTEA SpA's design engineers leads to the best possible engineering and development of output bars, that represent one of the most critical parts.



800kVA 5-column transformer for galvanic applications..

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# GENEAL-PURPOSE TRANSFORMERS

Transformers are often used just to adapt the voltage coming from the grid to the voltage required by the system or the machinery to be power supplied.

In this case, each transformer is intended for the specific use.

Thanks to their professional expertise, ORTEA SpA's design engineers process user's data to find the best solution in terms of efficiency, cost-effectiveness and performance.



2000kVA transformer within IP21 cabinet.









# ORTEA'S REACTORS

Thanks to many years of experience and close collaboration with Customers, ORTEA SpA has developed a specific knowledge that allows to manufacture reactors in the light of the various problems that may arise from the wide variety of uses in which these magnetic parts are employed.

Production processes being very versatile, we can cover a wide range of uses.

In particular, we produce for both indoor and outdoor use:

- Three-phase and single-phase reactors.
- Reactors with iron or air core.
- Detuning reactors.
- Smoothing reactors.
- Blocking reactance.
- Inrush current limiting reactors.

Our reactors are manufactured in accordance with the relevant technical standard (IEC 60076).

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# BLOCKING REACTORS

The growing use of power electronic devices is causing an increasing level of harmonic distortion in the electrical systems, which is why energy suppliers require the use of harmonic blocking reactors.



Blocking reactors, together with capacitor banks, create power factor correction and harmonic current filtering banks. This type of reactor is usually constructed with a magnetic core that can guarantee high linearity values even with large increases in current compared to the nominal value. A detuning power factor correction system prevents any amplification of harmonic currents and voltages caused by resonance between the capacitor and inductance capacitance of the electrical system. By adding a correctly sized reactor to the power capacitor, a low resonant circuit is formed (usually below the fifth current harmonic) which prevents higher order harmonics from flowing into the capacitors. ORTEA's blocking reactors are assembled with aluminium or copper coils.

## Parameters and selection

### Coupling of Capacitors and Reactors

The combination of capacitors and reactors is a complex procedure that must be carried out correctly. The scheme that ORTEA proposes on the following pages stems from its experience in the design and manufacture of automatic power factor correction systems and takes all aspects into consideration, such as:

- Voltage increase across the capacitor terminals.
- Allowable harmonic overload of reactors and capacitors.
- Effective reactive power output.

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

### Detuning frequency [ $f_0$ ]

The selection of the blocking reactor is based on the actual harmonic current spectrum. The highest and lowest harmonic current determine the detuning frequency, hence the choice of a reactor.

In more detail:

- 12.7% if the 5<sup>TH</sup> harmonic current is higher than 25%.
- 5.4% or 7% if the 5<sup>TH</sup> harmonic current is lower than 25%.

Detuning factor p	Detuning frequency $f_0$	
	f = 50Hz	f = 60Hz
5.4%	NA	258Hz
7%	189Hz	227Hz
12.7%	140Hz	NA

### Rated inductance [L]

Inductance rating of reactor, measured at rated current  $I_n$ , expressed in mH (milliHenry) 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  $\mu F$  (microFarad).

### 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

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

### Rated capacitor power [Q]

The rated capacitor output is defined as the power the capacitor can generate if supplied at rated voltage; it is important to follow the manufacturer recommendation in terms of voltage selection. This parameter also helps select the appropriate capacitor to be added in series with the reactor.

### Effective power [Qc]

The effective power of the capacitor is the power that the capacitor provides at the voltage to which it is normally subjected, which may be less than or equal to its rated voltage.

### RSS current [Irms]

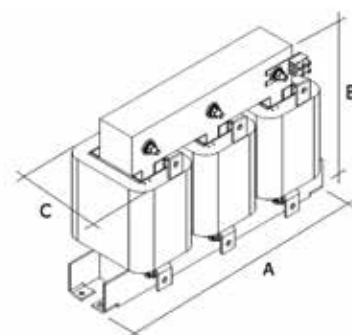
The RSS current is the square root of the sum of the squares of the rated current at industrial frequency and all current values at the frequencies specified in the rated current spectrum (IEC 60076-6).



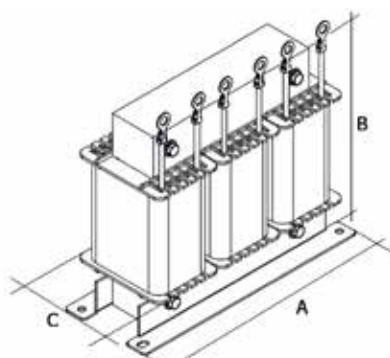
# STANDARD BLOCKING REACTORS

## Common technical characteristics

<b>Applicable standards</b>	IEC 60076-6
<b>Rated voltages</b>	230V...1.1kV
<b>Inductance tolerance</b>	±5% (average value in the three phases)
<b>Linearity</b>	$I_{lin} = 1.6...1.8 I_n$
<b>Insulation (winding-core)</b>	3 kV
<b>Temperature class</b>	F (155°C)
<b>Maximum Ambient Temperature</b>	40°C
<b>Protection class</b>	IP00 indoor mounting
<b>Humidity</b>	95%
<b>Cooling</b>	natural air
<b>Design</b>	Three phase, iron core with double air gap
<b>Winding material</b>	Aluminium foil/copper wires
<b>Impregnation</b>	Polyester resin, class H
<b>Terminals</b>	Aluminium bar with hole, or cable lugs.
<b>Temperature Switch</b>	Reactors with a current higher than 33A are provided with a separate screw terminal for the temperature switch (opening switch) which is located inside each coil
<b>Switching temperature</b>	140°C
<b>Voltage</b>	250Vac (<5A)
<b>Tolerance</b>	±5K



ALUMINIUM



COPPER

U <sub>e</sub>	f	f <sub>D</sub>	I <sub>250Hz</sub> %*
400V	50Hz	189Hz	≤25%

\* Percentage of the 5<sup>th</sup> harmonic.

Part number	Q <sub>c</sub> at 400V	L	I <sub>rms</sub>	Material	Dimensions (AxBxC)	Weight	Capacitor Part number	Q <sub>c</sub> at rated voltage	Capacitor rated voltage	Capacitance
	[kvar]	[mH]	[A]					[kvar]	[V]	[μF]
RHF5300H001	5	8.3	8	copper	205x170x65	6	6DCRTX0750H50	7.5	525	87
RHG0012H001	10	4.2	17	copper	205x181x79	7.7	6DCRTX1250G50	12.5	450	196
RHG0015H001	12.5	3.465	21	copper	240x142x100	13	6DCRTX1500G50	15	450	236
PRG0032DAB57528	20	2.2	37	aluminium	340x215x120	18	6DCRTX2500G50	25	450	393
PRG0028DAB57538	25	1.73	40	aluminium	340x215x110	17	6DCRTX3000G50	30	450	471
PRG0064DAB57527	40	1.1	75	aluminium	340x215x145	27	6DCRTX2500G50 + 6DCRTX3000H50	25+30	450+525	738
PRG0050DAB57567	50	0.786	79	aluminium	340x215x140	28	2 x 6DCRTX3000G50	60	450	942

U <sub>e</sub>	f	f <sub>D</sub>	I <sub>250Hz</sub> %*
400V	50Hz	140Hz	>25%

\* Percentage of the 5<sup>th</sup> harmonic.

Part number	Q <sub>c</sub> at 400V	L	I <sub>rms</sub>	Material	Dimensions (AxBxC)	Weight	Capacitor Part number	Q <sub>c</sub> at rated voltage	Capacitor rated voltage	Capacitance
	[kvar]	[mH]	[A]					[kvar]	[V]	[μF]
RHG001BH001	5	14.8	9	copper	205x170x78	7.4	6DCRTX0750H50	7.5	525	87
RHG0022H001	10	7.4	18	copper	205x180x113	12.8	6DCRTX1500H50	15	525	173
RHG0023H002	12.5	6.3	19	copper	205x170x113	13.5	6DCRTX2000H50	20	525	231
RHG0043H002	20	3.7	35	copper	270x215x90	21	6DCRTX3000H50	30	525	345
PRG0056DAB57235	25	2.595	43	aluminium	340x215x135	27	6DCRTX4000H50	40	525	462
PRG0076DAB57664	40	2.12	61	aluminium	340x215x135	35	2 x 6DCRTX3000H50	60	525	692
PRG0093DAB57418	50	1.57	77	aluminium	380x215x165	37	6DCRTX2500H50 + 6DCRTX5000H50	75	525	867

U <sub>e</sub>	f	f <sub>D</sub>	I <sub>300Hz</sub> %*
400V	60Hz	227Hz	≤25%

\* Percentage of the 5<sup>th</sup> harmonic.

Part number	Qc at 400V	L	I <sub>rms</sub>	Material	Dimensions (AxBxC)	Weight	Capacitor Part number	Qc at rated voltage	Capacitor rated voltage	Capacitance
	[kvar]	[mH]	[A]		[mm]	[kg]		[kvar]	[V]	[μF]
RR46015810	5	5.8	8	copper	205x167x68	5.5	6DCRTX0750K60	7.5	480	87
RR46012910	10	2.9	16	copper	205x184x68	8.6	6DCRTX1500K60	15	480	173
RHG0023H001	12.5	2.1	33	copper	205x160x113	13	6DCRTX2000K60	20	480	231
RR46011451	20	1.45	32	copper	205x184x88	9.5	6DCRTX3000K60	30	480	346
PRG0019DAB57872	25	1.22	40	aluminium	340x215x110	18	6DCRTX3000K60 + 6DCRTX0750K60	37.5	480	433
PRG0030DAB57579	40	0.73	65	aluminium	340x215x110	18	2 x 6DCRTX3000K60	60	480	692
PRG0037DAB57692	50	0.6	78	aluminium	340x215x120	21	6DCRTX4000K60 + 6DCRTX3000K60	70	480	864

U <sub>e</sub>	f	f <sub>D</sub>	I <sub>300Hz</sub> %*
400V	60Hz	258Hz	≤25%

\* Percentage of the 5<sup>th</sup> harmonic.

Part number	Qc at 400V	L	I <sub>rms</sub>	Material	Dimensions (AxBxC)	Weight	Capacitor Part number	Qc at rated voltage	Capacitor rated voltage	Capacitance
	[kvar]	[mH]	[A]		[mm]	[kg]		[kvar]	[V]	[μF]
RHG0012H001	5	4.2	17	copper	205x181x79	8	6DCRTX0750K60	7.5	480	87
RR46012401	10	2.4	18	copper	205x184x68	6	6DCRTX1500K60	15	480	173
RHG0023H001	12.5	2.1	33	copper	205x160x113	14	6DCRTX1000K60 + 6DCRTX0750K60	17.5	480	202
PRG0019DAB57872	20	1.22	40	aluminium	340x215x110	18	6DCRTX1500K60 + 6DCRTX1250K60	27.5	480	317
PRG004GDAB57571	25	1.045	66	aluminium	340x215x120	22	6DCRTX2000K60 + 6DCRTX1500K60	35	480	404
PRG0030DAB57579	40	0.6	78	aluminium	340x215x120	21	6DCRTX3000K60 + 6DCRTX2500K60	55	480	634
PRG0093DAB57626	50	0.523	133	aluminium	380x215x170	38	6DCRTX5000K60 + 6DCRTX2000K60	70	480	807

U <sub>e</sub>	f	f <sub>D</sub>	I <sub>300Hz</sub> %*
230V	60Hz	227Hz	≤25%

\* Percentage of the 5<sup>th</sup> harmonic.

Part number	Qc at 400V	L	I <sub>rms</sub>	Material	Dimensions (AxBxC)	Weight	Capacitor Part number	Qc at rated voltage	Capacitor rated voltage	Capacitance
	[kvar]	[mH]	[A]		[mm]	[kg]		[kvar]	[V]	[μF]
RR46012401	5	2.4	19	copper	205x185x90	6	6DCRTX1500D60	15	400	249
PRG0019DAB57872	10	1.22	40	aluminium	340x215x110	18	6DCRTX3000D60	30	400	497
PRG0039DAB57871	20	0.6	78	aluminium	340x215x120	21	2 x 6DCRTX3000D60	60	400	996
PRG0035DAB57693	25	0.45	88	aluminium	320x220x130	19	3 x 6DCRTX2500D60	75	400	1242
PRG0033DAB57694	40	0.273	109	aluminium	320x220x120	18.5	3 x 6DCRTX3000D60 + 6DCRTX2500D60	115	400	1908
PRG0043DAB57695	50	0.2	146	aluminium	320x220x135	21.5	4 x 6DCRTX3000D60 + 6DCRTX2500D60	145	400	2406







Companies are more and more sensitive to Power Quality issues because they can cause troubles and damages to equipments.

Our Power Quality solutions:

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**LV TRANSFORMERS**  
**PFC SYSTEMS**  
**ACTIVE HARMONIC FILTERS**  
**ENERGY EFFICIENCY SMART DEVICES**

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