



Ecodesign Transformers

Energizing the World since 1979

Sustainability

ECO DESIGN TRANSFORMERS FOR SUSTAINABLE ENERGY



sustainable
efficient
new
solar
nuclear
future
environment
technology
pollution
renewable
energy
power
green
world
development
clean
energy
pollution
global
environment
fre

Table of content

Energy 20 20 20	4
The standards	6
Our proposal	7
Technical Details	10
Installed worldwide	17
A world of reliability	18
Special Design	19
Metal enclosures	20
Our Accessories	22
Description and Characteristics	24
Main Features	25
Certified Quality	26
E-C-F Classes	27
Beyond the standards	28

Energy

20 20 20

Tesar transforms the Wind, the Sun and the Water in renewable Energy.

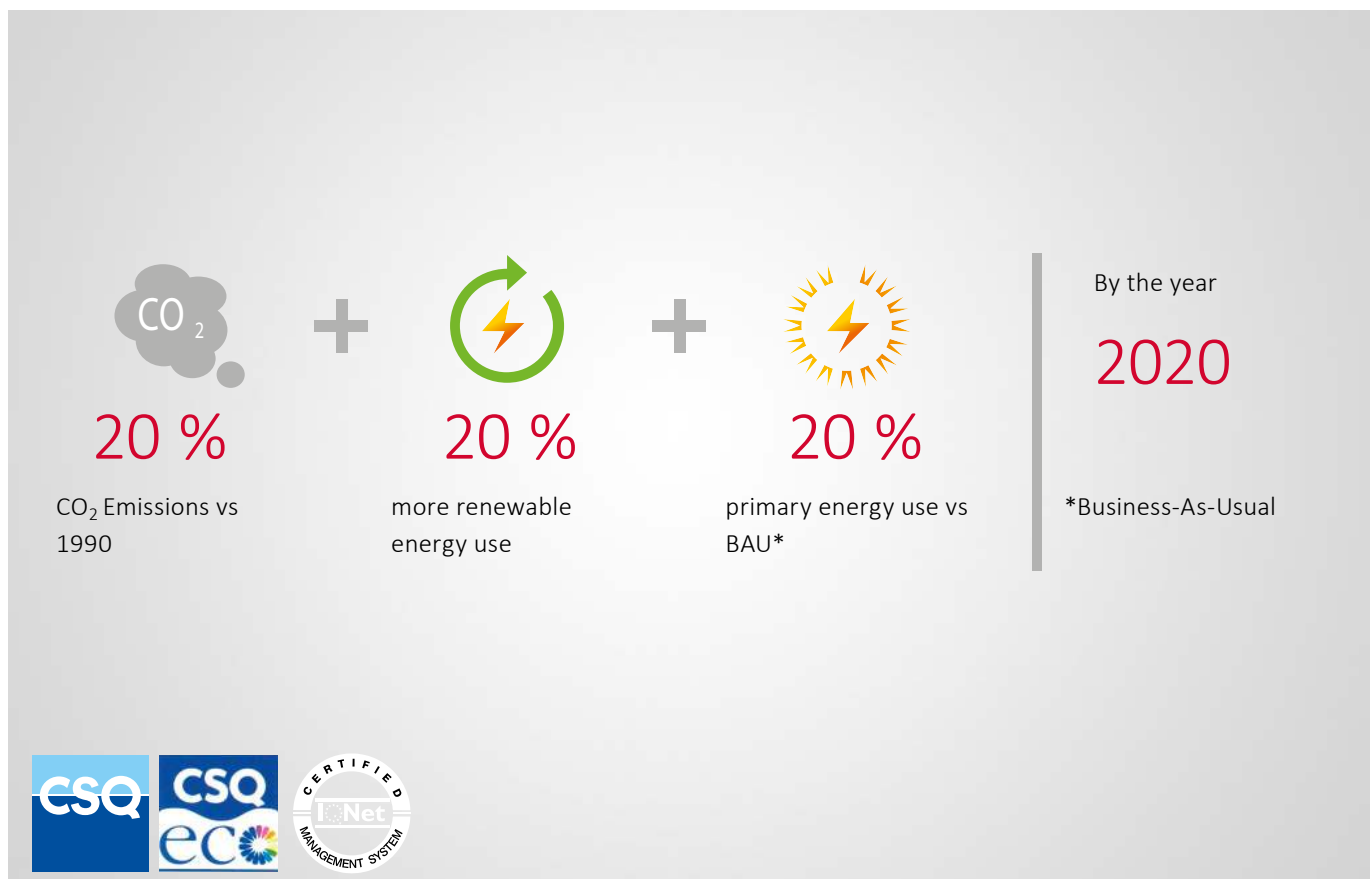
After the Kyoto Protocol, EU focused on an ambitious goal: the so called climate energy package 20-20-20, that is briefly to reduce the greenhouse gas emission by 20%. To rise up to 20% the energy produced by renewable sources and to finally reach the target 20% to get energy savings: all within 2020.

In the transformer field, the reduction of losses involves major benefits for the environment, linked to lower greenhouse gas emissions.

Based on this simple assumption, the European Commission published a new directive 548/2014, for imposing an Ecodesign Transformer and all the European manufacturers must comply.

The new directive will be applied in two steps, the first starting from July 2015, and the second in July 2021. According to a study by the European Commission, it is estimated that more than 2.5% of all the energy consumed by EU countries is wasted through transformer losses.

They target an ambitious goal that is to decrease the total yearly losses of all the transformers installed by 3.7 MT of gas emissions per year, within 2025. As a consequence, Tesar is aim to always supply a sustainable transformer to fully comply with the ecodesign regulations. It is to be kept in mind, from an economical view point, that the standard definition of the life cycle cost of a product is the sum of its purchase price and operating costs over its lifetime.



Energy saving transformers by Tesar

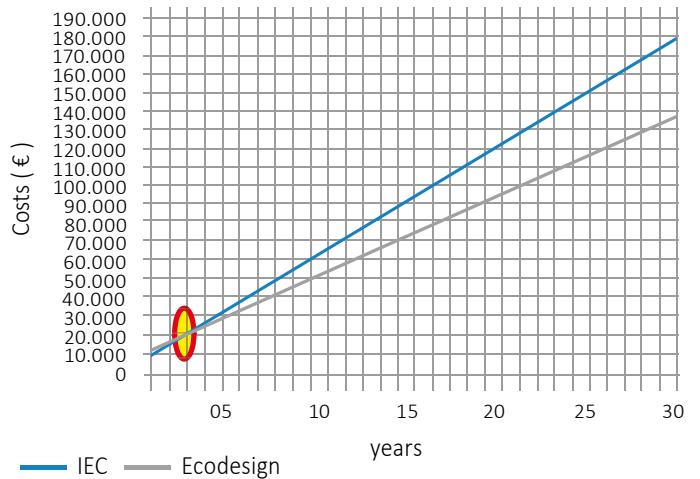
Consequently, a transformer with reduced losses has a higher purchase cost, whilst transformers designed to the minimum cost of manufacture, result in increased losses and operating costs overtime.

Considering that transformers are energized 24/7, 365 days a year and have very long lifetimes of typically 30 years energy consumption is a dominant factor.

This means that higher purchase costs are repaid via savings over the product's lifetime. Since the purchase price is only a marginal part of the total cost of the machine, whilst the operating cost (mainly related to the losses) accounts for over 80% of the total cost.

Considering a 1000kVA power transformer, comparing an Ecodesign to a traditional one, the higher cost of purchase of the first, is recovered in only two years! The cost saving in 30 years is around 45.000 Euro with considerable advantages also for the environmental impact, with a reduction of greenhouse emissions of about 5 tons every year!

	Advanced	Ecodesign
Rated Power (kVA)	1000	1000
No-load losses (W)	2300	1550
Load Losses @ 120°C (W)	10800	9000
Purchase Costs €	10500	13500
No-load operation (no-load losses)		
Hours / Days	24	24
Days / Years	365	365
Load operation (load losses)		
Hours / Days	8	8
Days / Years	220	220
Power factor	80 %	80%
Average Cost of Energy (€ / kWh)	0.175	0.175
Losses Cost in a year (€ / year)	5.655	4.150



Ecodesign Transformer compared to IEC Standards

Energy savings in a year (kWh / year)	8.598
Operating cost savings in a year (€ / year)	1.505
Average working life of transformers (year)	30
Operating cost savings in 30 years (€)	45.137
Pay back (years)	2
CO ₂ average emission factor (gCO ₂ /kWh)	540
CO ₂ emission saving in a year (t/year)	5

The standards

State of the art

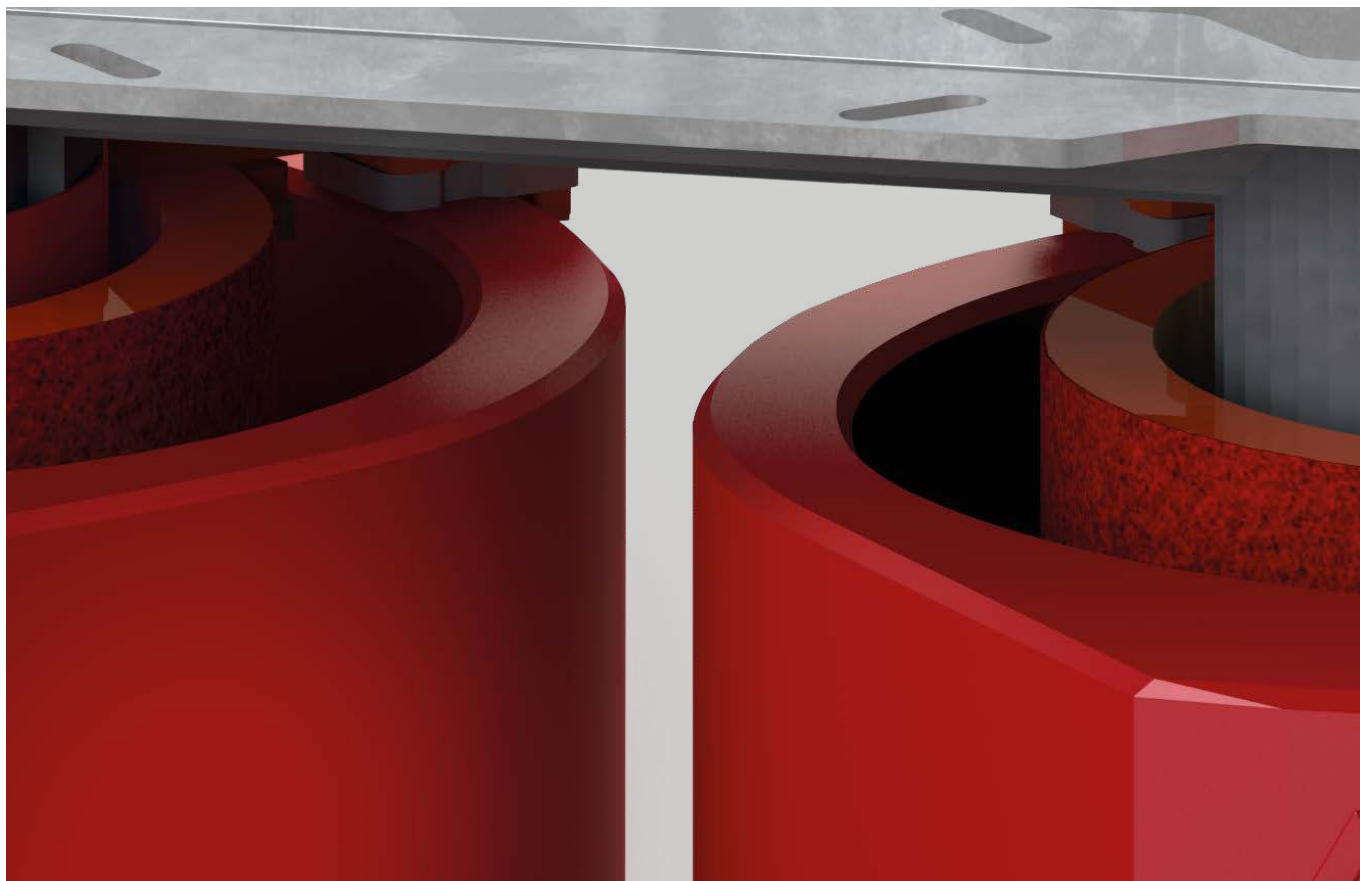
Tesar transformers are above average.

During the years, a lot of standards have taken care of the efficiency level of dry type transformers: from HD 538; in 2004 it published the international standard IEC 60076-11, which represented the first real guide for dry type transformers, and contains, amongst others, the milestone pertinent to climatic, ambient and fire classes (E-C-F). In September 2015, the standard EN 50588-1, is published and now upto 2018, will substitute all the previous revisions: it is applied both to oil filled as well as to cast resin transformers at 50Hz. With a maximum rated insulation level of 36kV and rated power from 5kVA upto 40MVA.

This standard acknowledges the regulation UE 548/2014 dated 21.May 2014, which established the new minimum require-

ment for the efficiency of a transformer, if installed after 1. July 2015.

The standards foresee the maximum value of the no-load and load losses for transformers up to the rated power of 3150kVA. For the largest rated power, this standard introduces the peak efficiency index (PEI), in order to choose the better combination of the losses according to the utilization of the transformer.



Our proposal

Italian Quality

Tesar transformers for different needs.

Ecodesign transformer

The transformer is fulfilling the ecodesign directive of EU and the EN 50588-1. The transformer allows a reduction in energy consumption and as a consequence a reduction in greenhouse emissions. This is our Top Model.

Advanced transformer

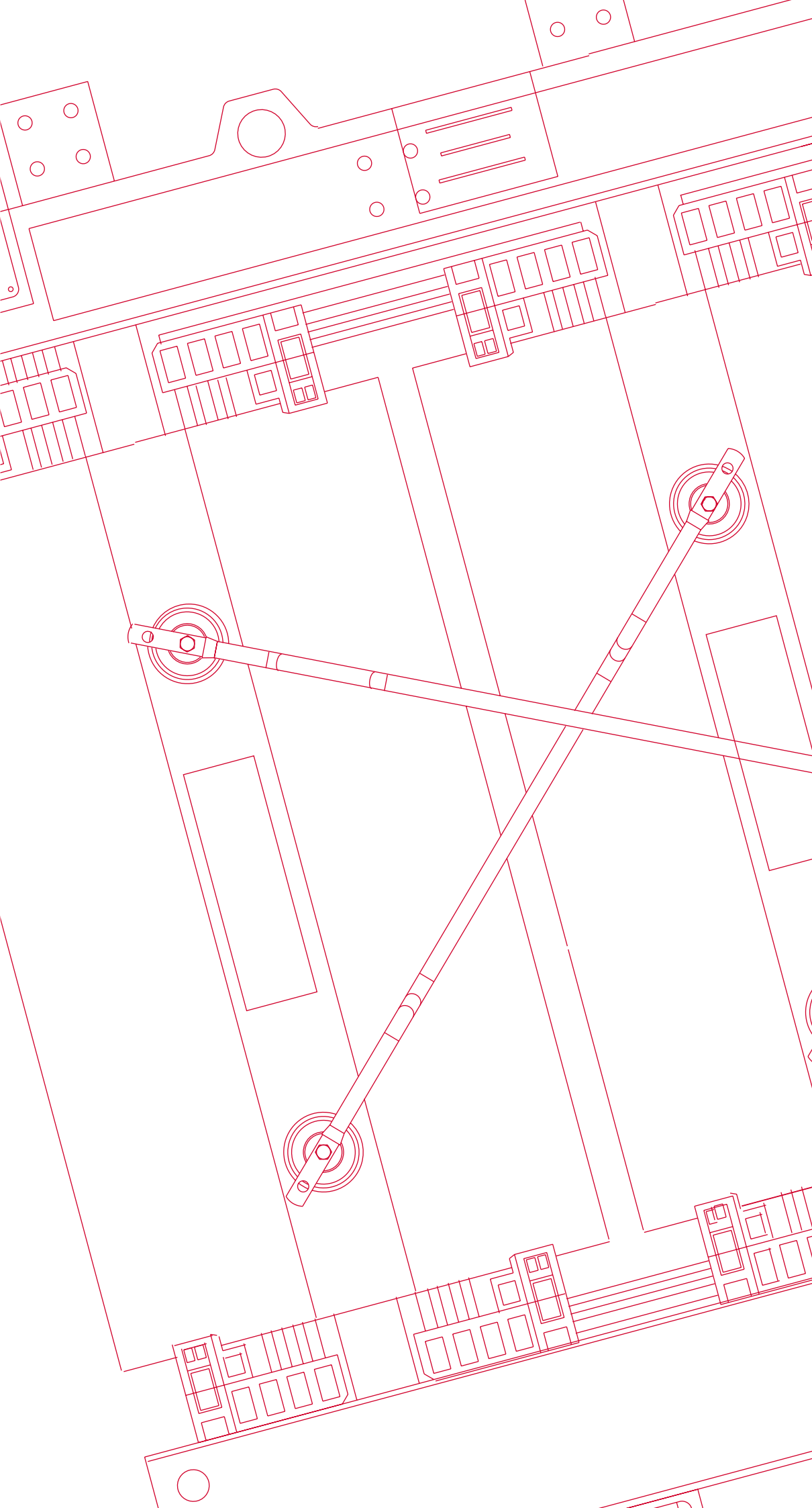
Developed thanks to 35 years of Tesar experience in the field of cast resin transformers. It's able to be installed in every site and location without any limitation. The transformer can be customized to the client specific requirements

Basic Transformer

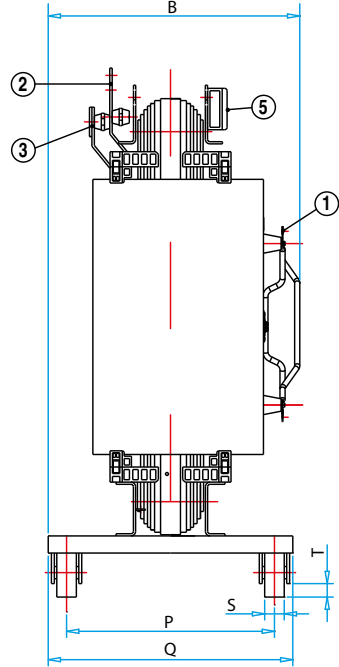
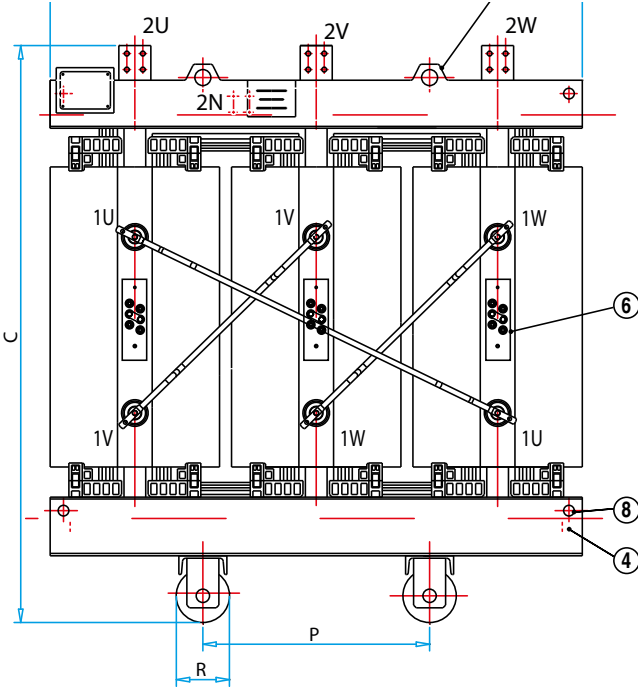
This transformer, with a maximum rated power of 2500kVA, has its strength point in its lighter weight, if compared to the advanced model, of the same characteristics. Thanks to these features, it represents the best compromise where restriction or, limitation of weight and dimensions are required.



Different variations available



Technical Details

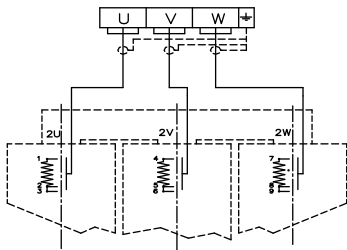


- 1 High Voltage terminal
- 2 Low Voltage terminal
- 3 Neutral terminal

- 4 Grounding clamp
- 5 Connections box
- 6 Tap changer

- 7 Lifting eyes
- 8 Tow hooks

Schema connection PT 100 ohm

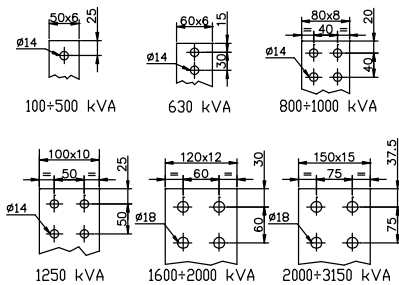


Tap changer

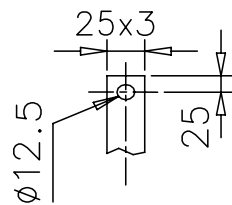


VARIAZIONI-TURIS VARIAZ. HT	POSIZIONI - POSITION POSITION
+5%	6-5
+2.5%	5-7
0	7-4
-2.5%	4-8
-5%	8-3

Low voltage terminal



High voltage terminal



Technical Data

Standards	IEC 60076
Installation	Indoor
Altitude	< 1000 m
Type of cooling	AN
Winding material	AL / AL
Ambient temperature	40° C
Temperature rise	100 / 100 K

Rated Power	Series	Po	Pcc 75°C	Pcc 120°C	Vcc 75°C	Io	Efficiency	
							cosφ 1 load 100%	cosφ 1 load 75%
kVA		W	W	W	%	%	%	%
100	Advanced	440	1700	1955	4	2,3	97,66	97,99
	Ecodesign	280	1850	2050	6	2,3	97,72	98,12
160	Basic	550	4000	4600	6	2	96,88	97,45
	Advanced	610	2300	2650	4	2	98,00	98,28
250	Ecodesign	400	2600	2900	6	2	97,98	98,34
	Basic	800	4400	5060	6	1,8	97,71	98,09
315	Advanced	820	3000	3450	4	1,8	98,32	98,55
	Ecodesign	520	3400	3800	6	1,8	98,30	98,60
400	Basic	950	4800	5520	6	1,7	97,99	98,31
	Advanced	1000	3800	4400	4	1,7	98,31	98,55
500	Ecodesign	630	3950	4400	6	1,7	98,43	98,70
	Basic	1100	5300	6100	6	1,5	98,23	98,51
630	Advanced	1150	4300	4950	4	1,5	98,50	98,71
	Ecodesign	750	4950	5500	6	1,5	98,46	98,73
800	Basic	1400	6600	7600	6	1,4	98,23	98,51
	Advanced	1400	5400	6200	4	1,4	98,50	98,71
1000	Ecodesign	900	5750	6400	6	1,4	98,56	98,81
	Basic	1550	7500	8600	6	1,3	98,41	98,67
1250	Advanced	1500	6400	7350	4	1,3	98,61	98,82
	Ecodesign	1100	6850	7600	6	1,3	98,64	98,88
1600	Basic	1800	9200	10600	6	1,1	98,47	98,72
	Advanced	1800	8200	9400	6	1,1	98,62	98,83
2000	Ecodesign	1300	7200	8000	6	1,1	98,85	99,04
	Basic	2100	10700	12300	6	1	98,58	98,81
2500	Advanced	2000	8800	10100	6	1	98,80	98,99
	Ecodesign	1550	8100	9000	6	1	98,96	99,13
3150	Basic	2600	12500	14400	6	0,9	98,66	98,87
	Advanced	2400	11000	12650	6	0,9	98,81	99,00
4000	Ecodesign	1800	9900	11000	6	0,9	98,99	99,16
	Basic	2950	15000	17300	6	0,9	98,75	98,95
5000	Advanced	2800	12700	14600	6	0,9	98,92	99,09
	Ecodesign	2200	11700	13000	6	0,9	99,06	99,21
6300	Basic	3700	19000	21800	6	0,8	98,74	98,95
	Advanced	3800	15600	18000	6	0,8	98,92	99,08
8000	Ecodesign	2600	14400	16000	6	0,8	99,08	99,23
	Basic	4400	22500	25900	6	0,7	98,80	99,00
10000	Advanced	4300	19000	21800	6	0,7	98,97	99,12
	Ecodesign	3100	17100	19000	6	0,7	99,12	99,27
12500	Advanced	5500	21000	24150	8	0,6	99,07	99,20
	Ecodesign	3800	19800	22000	8	0,6	99,19	99,32

Different design (i.e. ambient temperatures and different conducting material) are available on request

Primary voltage	up to 12kV
Tappings	+/- 2x2,5%
Secondary voltage	400 V
Vector Group	Dyn11-Dyn5
Frequency	50 Hz
Insulation class	F/F
Protection degree	IP00

12kV

Voltage Drop		LpA	LwA	A	B	C	P	Q	R	S	T	Weight	Box Type
cosφ 1 last 100%	cosφ 0,9 last 100%												
%	%	dB	dB	mm	mm	mm	mm	mm	mm	mm	mm	kg	
2,03	3,54	48	61	1100	680	1190	520	620	125	40	35	550	25
2,23	4,56	39	51	1100	750	1200	520	620	125	40	35	580	25
3,05	5,29	54	67	1100	710	1190	520	620	125	40	35	650	25
1,74	3,28	54	67	1100	690	1240	520	620	125	40	35	800	25
1,99	4,35	42	54	1200	770	1250	520	620	125	40	35	750	25
2,20	4,54	54	67	1100	690	1240	520	620	125	40	35	800	25
1,46	3,03	54	67	1240	725	1265	520	620	125	40	35	1050	25
1,70	4,10	45	57	1270	790	1400	520	620	125	40	35	1070	25
1,93	4,30	56	70	1240	730	1205	520	620	125	40	35	1000	28
1,48	3,05	56	70	1240	735	1360	520	620	125	40	35	1170	28
1,58	3,99	46	59	1300	790	1500	520	620	125	40	35	1200	28
1,70	4,10	57	71	1240	815	1355	670	770	125	40	35	1150	28
1,32	2,90	57	71	1240	795	1505	670	770	125	40	35	1300	28
1,55	3,97	47	60	1340	860	1600	670	770	125	40	35	1370	28
1,70	4,10	57	71	1290	815	1475	670	770	125	40	35	1350	28
1,32	2,91	57	71	1290	810	1495	670	770	125	40	35	1500	28
1,46	3,88	48	61	1350	880	1600	670	770	125	40	35	1500	28
1,55	3,96	58	72	1290	815	1680	670	770	125	40	35	1550	28
1,25	2,84	58	72	1290	810	1710	670	770	125	40	35	1750	28
1,39	3,82	49	62	1400	880	1700	670	770	125	40	35	1750	28
1,50	3,92	59	73	1430	835	1715	670	770	125	40	35	1800	28
1,35	3,79	59	73	1430	835	1775	670	770	125	40	35	1950	28
1,18	3,64	50	64	1450	890	1850	670	770	125	40	35	2250	28
1,41	3,84	60	74	1430	950	1765	820	1000	125	40	35	2100	28
1,19	3,65	60	74	1500	1000	1875	820	1000	125	40	35	2300	28
1,08	3,55	51	65	1500	1020	1950	820	1000	125	40	35	2750	40
1,33	3,77	62	76	1500	975	1770	820	1000	125	40	35	2500	40
1,19	3,65	62	76	1500	1000	1975	820	1000	125	40	35	2600	40
1,06	3,53	53	67	1650	1040	2000	820	1000	125	40	35	3250	40
1,26	3,71	62	76	1600	970	2130	820	1000	200	70	50	3100	40
1,09	3,56	62	76	1680	970	2215	820	1000	200	70	50	3300	40
0,99	3,47	54	68	1650	1040	2350	820	1000	200	70	50	3850	50
1,27	3,72	63	78	1680	1085	2260	1070	1200	200	70	50	3900	50
1,08	3,55	63	78	1770	1095	2370	1070	1200	200	70	50	4150	51
0,98	3,46	55	70	1800	1200	2300	1070	1200	200	70	50	4550	50
1,22	3,67	65	80	1830	1100	2335	1070	1200	200	70	50	4700	51
1,05	3,53	65	80	1940	1140	2425	1070	1200	200	70	50	4900	51
0,94	3,43	56	71	1950	1200	2400	1070	1200	200	70	50	5400	51
1,09	4,41	66	81	2100	1145	2430	1070	1200	200	70	50	5900	51
1,02	4,35	58	74	2150	1200	2450	1070	1200	200	70	50	6400	51

We reserve the right to change the technical data without advising

Technical Data

Standards	IEC 60076
Installation	Indoor
Altitude	< 1000 m
Type of cooling	AN
Winding material	AL / AL
Ambient temperature	40° C
Temperature rise	100 / 100 K

Rated Power	Series	Po	Pcc 75°C	Pcc 120°C	Vcc 75°C	Io	Efficiency	
							cosφ 1 load 100%	cosφ 1 load 75%
kVA		W	W	W	%	%	%	%
100	Advanced	480	1700	1955	6	2,3	97,62	97,94
	Ecodesign	280	1850	2050	6	2,3	97,72	98,12
160	Basic	550	4000	4600	6	2,0	96,88	97,45
	Advanced	650	2400	2760	6	2,0	97,91	98,20
250	Ecodesign	400	2600	2900	6	2,0	97,98	98,34
	Basic	800	4400	5060	6	1,8	97,71	98,09
315	Advanced	880	3300	3800	6	1,8	98,16	98,42
	Ecodesign	520	3400	3800	6	1,8	98,30	98,60
400	Basic	950	4800	5520	6	1,7	97,99	98,31
	Advanced	1030	4000	4600	6	1,7	98,24	98,49
500	Ecodesign	630	3950	4400	6	1,7	98,43	98,70
	Basic	1100	5300	6100	6	1,5	98,23	98,51
630	Advanced	1250	4800	5500	6	1,5	98,34	98,57
	Ecodesign	750	4950	5500	6	1,5	98,46	98,73
800	Basic	1400	6600	7600	6	1,4	98,23	98,51
	Advanced	1400	5900	6780	6	1,4	98,39	98,63
1000	Ecodesign	900	5750	6400	6	1,4	98,56	98,81
	Basic	1550	7500	8600	6	1,3	98,41	98,67
1250	Advanced	1650	6800	7800	6	1,3	98,52	98,74
	Ecodesign	1100	6850	7600	6	1,3	98,64	98,88
1600	Basic	1800	9200	10600	6	1,1	98,47	98,72
	Advanced	2000	8000	9200	6	1,1	98,62	98,82
2000	Ecodesign	1300	7200	8000	6	1,1	98,85	99,04
	Basic	2100	10700	12300	6	1,0	98,58	98,81
2500	Advanced	2400	9400	10800	6	1,0	98,70	98,88
	Ecodesign	1550	8100	9000	6	1,0	98,96	99,13
3150	Basic	2600	12500	14400	6	0,9	98,66	98,87
	Advanced	2800	11500	13100	6	0,9	98,74	98,93
4000	Ecodesign	1800	9900	11000	6	0,9	98,99	99,16
	Basic	2950	15000	17300	6	0,9	98,75	98,95
5000	Advanced	3500	13500	15520	6	0,9	98,83	98,99
	Ecodesign	2200	11700	13000	6	0,9	99,06	99,21
6300	Basic	3700	19000	21800	6	0,8	98,74	98,95
	Advanced	4400	16000	18400	6	0,8	98,87	99,03
8000	Ecodesign	2600	14400	16000	6	0,8	99,08	99,23
	Basic	4400	22500	25900	6	0,7	98,80	99,00
10000	Advanced	5000	19000	21800	6	0,7	98,94	99,09
	Ecodesign	3100	17100	19000	6	0,7	99,12	99,27
12500	Advanced	6000	20500	23575	8	0,6	99,07	99,19
	Ecodesign	3800	19800	22000	8	0,6	99,19	99,32

Different design (i.e. ambient temperatures and different conducting material) are available on request

Primary voltage	up to 17.5kV
Tappings	+/- 2x2,5%
Secondary voltage	400 V
Vector Group	Dyn11-Dyn5
Frequency	50 Hz
Insulation class	F/F
Protection degree	IP00

17,5kV

Voltage Drop		LpA	LwA	A	B	C	P	Q	R	S	T	Weight	Box Type
cosφ 1 last 100%	cosφ 0,9 last 100%												
%	%	dB	dB	mm	mm	mm	mm	mm	mm	mm	mm	kg	
2,13	4,48	48	61	1200	690	1240	520	620	125	40	35	550	25
2,23	4,56	39	51	1130	750	1250	520	620	125	40	35	600	25
3,05	5,29	54	67	1100	710	1190	520	620	125	40	35	650	25
1,90	4,28	54	67	1240	720	1190	520	620	125	40	35	780	25
1,99	4,35	42	54	1270	770	1250	520	620	125	40	35	800	25
2,20	4,54	54	67	1100	690	1240	520	620	125	40	35	800	25
1,70	4,10	54	67	1240	745	1210	520	620	125	40	35	1000	25
1,70	4,10	45	57	1270	790	1420	520	620	125	40	35	1100	25
1,93	4,30	56	70	1240	730	1205	520	620	125	40	35	1000	28
1,64	4,04	56	70	1240	735	1455	520	620	125	40	35	1100	28
1,58	3,99	46	59	1340	790	1530	520	620	125	40	35	1250	28
1,70	4,10	57	71	1240	815	1355	670	770	125	40	35	1150	28
1,55	3,97	57	71	1290	810	1475	670	770	125	40	35	1280	28
1,55	3,97	47	60	1340	860	1630	670	770	125	40	35	1400	28
1,70	4,10	57	71	1290	815	1475	670	770	125	40	35	1350	28
1,54	3,95	57	71	1290	810	1600	670	770	125	40	35	1450	28
1,46	3,88	48	61	1400	880	1640	670	770	125	40	35	1600	28
1,55	3,96	58	72	1290	815	1680	670	770	125	40	35	1550	28
1,42	3,85	58	72	1290	825	1710	670	770	125	40	35	1650	28
1,39	3,82	49	62	1400	880	1760	670	770	125	40	35	1800	28
1,50	3,92	59	73	1430	835	1715	670	770	125	40	35	1800	28
1,33	3,77	59	73	1430	835	1775	670	770	125	40	35	1960	28
1,18	3,64	50	64	1490	890	1880	670	770	125	40	35	2350	28
1,41	3,84	60	74	1430	950	1765	820	1000	125	40	35	2100	28
1,26	3,71	60	74	1500	1000	1875	820	1000	125	40	35	2350	40
1,08	3,55	51	65	1630	1020	1950	820	1000	125	40	35	3000	40
1,33	3,77	62	76	1500	975	1770	820	1000	125	40	35	2500	40
1,23	3,68	62	76	1500	1000	1975	820	1000	125	40	35	2650	40
1,06	3,53	53	67	1670	1040	2080	820	1000	125	40	35	3400	40
1,26	3,71	62	76	1600	970	2130	820	1000	200	70	50	3100	40
1,15	3,61	62	76	1680	970	2215	820	1000	200	70	50	3350	41
0,99	3,47	54	68	1700	1040	2380	820	1000	200	70	50	4050	50
1,27	3,72	63	78	1680	1085	2260	1070	1200	200	70	50	3900	50
1,10	3,57	63	78	1770	1095	2370	1070	1200	200	70	50	4180	51
0,98	3,46	55	70	1840	1200	2420	1070	1200	200	70	50	4750	51
1,22	3,67	65	80	1830	1100	2335	1070	1200	200	70	50	4700	51
1,05	3,53	65	80	1940	1140	2415	1070	1200	200	70	50	4900	51
0,94	3,43	56	71	1960	1200	2470	1070	1200	200	70	50	5600	51
1,07	4,40	66	81	2100	1155	2430	1070	1200	200	70	50	6000	51
1,02	4,35	58	74	2150	1200	2530	1070	1200	200	70	50	6600	51

We reserve the right to change the technical data without advising

Technical Data

Standards	IEC 60076
Installation	Indoor
Altitude	< 1000 m
Type of cooling	AN
Winding material	AL / AL
Ambient temperature	40° C
Temperature rise	100 / 100 K

Rated Power	Series	Po	Pcc 75°C	Pcc 120°C	Vcc 75°C	Io	Efficiency	
							cosφ 1 load 100%	cosφ 1 load 75%
kVA		W	W	W	%	%	%	%
100	Advanced	480	1700	1955	6	2,3	97,62	97,94
	Ecodesign	280	1850	2050	6	2,3	97,72	98,12
160	Basic	700	4000	4600	6	2,0	96,79	97,33
	Advanced	650	2500	2850	6	2,0	97,86	98,16
250	Ecodesign	400	2600	2900	6	2,0	97,98	98,34
	Basic	960	4400	5060	6	1,8	97,65	98,01
315	Advanced	880	3300	3800	6	1,8	98,16	98,42
	Ecodesign	520	3400	3800	6	1,8	98,30	98,60
400	Basic	1100	4700	5405	6	1,7	97,98	98,28
	Advanced	1030	4000	4600	6	1,7	98,24	98,49
500	Ecodesign	630	3950	4400	6	1,7	98,43	98,70
	Basic	1350	5400	6210	6	1,5	98,15	98,41
630	Advanced	1200	4800	5500	6	1,5	98,35	98,59
	Ecodesign	750	4950	5500	6	1,5	98,46	98,73
800	Basic	1600	6600	7600	6	1,4	98,19	98,46
	Advanced	1400	5900	6780	6	1,4	98,39	98,63
1000	Ecodesign	900	5750	6400	6	1,4	98,56	98,81
	Basic	1900	7900	9085	6	1,3	98,29	98,54
1250	Advanced	1650	6800	7800	6	1,3	98,52	98,74
	Ecodesign	1100	6850	7600	6	1,3	98,64	98,88
1600	Basic	2300	9500	10925	6	1,1	98,37	98,61
	Advanced	2000	8000	9200	6	1,1	98,62	98,82
2000	Ecodesign	1300	7200	8000	6	1,1	98,85	99,04
	Basic	2600	11000	12650	6	1,0	98,50	98,72
2500	Advanced	2300	9400	10800	6	1,0	98,71	98,90
	Ecodesign	1550	8100	9000	6	1,0	98,96	99,13
3150	Basic	2900	13000	14950	6	0,9	98,59	98,81
	Advanced	2700	11500	13100	6	0,9	98,75	98,94
4000	Ecodesign	1800	9900	11000	6	0,9	98,99	99,16
	Basic	3500	16500	18975	6	0,9	98,61	98,83
5000	Advanced	3100	14000	15800	6	0,9	98,83	99,01
	Ecodesign	2200	11700	13000	6	0,9	99,06	99,21
6300	Basic	4100	20500	23575	6	0,8	98,64	98,86
	Advanced	4000	16000	18000	6	0,8	98,91	99,07
8000	Ecodesign	2600	14400	16000	6	0,8	99,08	99,23
	Basic	5200	25000	28750	6	0,7	98,66	98,87
10000	Advanced	5000	19000	21850	6	0,7	98,94	99,09
	Ecodesign	3100	17100	19000	6	0,7	99,12	99,27
12500	Advanced	5600	21000	24150	8	0,6	99,06	99,19
	Ecodesign	3800	19800	22000	8	0,6	99,19	99,32

Different design (i.e. ambient temperatures and different conducting material) are available on request

Primary voltage	up to 24kV
Tappings	+/- 2x2,5%
Secondary voltage	400 V
Vector Group	Dyn11-Dyn5
Frequency	50 Hz
Insulation class	F/F
Protection degree	IP00

24kV

Voltage Drop		LpA	LwA	A	B	C	P	Q	R	S	T	Weight	Box Type
cosφ 1 last 100%	cosφ 0,9 last 100%												
%	%	dB	dB	mm	mm	mm	mm	mm	mm	mm	mm	kg	
2,13	4,48	48	61	1200	760	1240	520	620	125	40	35	580	25
2,23	4,56	39	51	1130	750	1250	520	620	125	40	35	650	25
3,05	5,29	54	67	1100	710	1240	520	620	125	40	35	700	25
1,96	4,33	51	64	1240	750	1250	520	620	125	40	35	800	25
1,99	4,35	42	54	1270	770	1250	520	620	125	40	35	850	25
2,20	4,54	54	67	1240	755	1310	520	620	125	40	35	950	25
1,70	4,10	54	67	1290	775	1410	520	620	125	40	35	1050	25
1,70	4,10	45	57	1270	790	1420	520	620	125	40	35	1150	25
1,90	4,27	56	70	1290	775	1325	520	620	125	40	35	1050	28
1,64	4,04	56	70	1290	770	1525	520	620	125	40	35	1200	28
1,58	3,99	46	59	1340	790	1530	520	620	125	40	35	1300	28
1,73	4,12	57	71	1320	850	1405	670	770	125	40	35	1250	28
1,55	3,97	57	71	1320	845	1565	670	770	125	40	35	1300	28
1,55	3,97	47	60	1340	860	1630	670	770	125	40	35	1450	28
1,70	4,10	57	71	1320	850	1505	670	770	125	40	35	1400	28
1,54	3,95	57	71	1430	850	1620	670	770	125	40	35	1550	28
1,46	3,88	48	61	1400	880	1640	670	770	125	40	35	1650	28
1,62	4,03	58	72	1430	870	1600	670	770	125	40	35	1650	28
1,42	3,85	58	72	1430	885	1760	670	770	125	40	35	1800	28
1,39	3,82	49	62	1400	880	1760	670	770	125	40	35	1850	28
1,55	3,96	59	73	1430	870	1765	670	770	125	40	35	1900	28
1,33	3,77	59	73	1500	890	1810	670	770	125	40	35	2150	28
1,18	3,64	50	64	1490	890	1880	670	770	125	40	35	2400	28
1,44	3,87	60	74	1500	1000	1950	820	1000	125	40	35	2300	40
1,26	3,71	60	74	1500	1000	1960	820	1000	125	40	35	2500	40
1,08	3,55	51	65	1630	1020	1950	820	1000	125	40	35	3050	40
1,38	3,81	62	76	1500	1000	1975	820	1000	125	40	35	2650	40
1,23	3,68	62	76	1600	1000	1975	820	1000	125	40	35	2850	40
1,06	3,53	53	67	1670	1040	2080	820	1000	125	40	35	3500	40
1,37	3,80	62	76	1680	1030	2210	820	1000	200	70	50	3300	51
1,17	3,63	62	76	1680	1025	2265	820	1000	200	70	50	3450	51
0,99	3,47	54	68	1700	1040	2380	820	1000	200	70	50	4150	51
1,36	3,80	63	78	1770	1135	2370	1070	1200	200	70	50	4100	51
1,08	3,55	63	78	1830	1140	2420	1070	1200	200	70	50	4250	51
0,98	3,46	55	70	1840	1200	2420	1070	1200	200	70	50	4850	51
1,33	3,77	65	80	1940	1165	2465	1070	1200	200	70	50	4850	70
1,05	3,53	65	80	1940	1170	2470	1070	1200	200	70	50	5000	70
0,94	3,43	56	71	1960	1200	2470	1070	1200	200	70	50	5700	70
1,09	4,41	66	81	2160	1200	2510	1070	1200	200	70	50	6300	70
1,02	4,35	58	74	2150	1200	2530	1070	1200	200	70	50	6700	70

We reserve the right to change the technical data without advising

Technical Data

Standards	IEC 60076
Installation	Indoor
Altitude	< 1000 m
Type of cooling	AN
Winding material	AL / AL
Ambient temperature	40° C
Temperature rise	100 / 100 K

Rated Power	Series	Po	Pcc 75°C	Pcc 120°C	Vcc 75°C	Io	Efficiency	
							cosφ 1 load 100%	cosφ 1 load 75%
kVA		W	W	W	%	%	%	%
160	Advanced	1000	2900	3340	6	2	97,36	97,66
	Ecodesign	460	2880	3190	6	2	97,77	98,16
250	Advanced	1300	4000	4600	6	1,8	97,69	97,97
	Ecodesign	600	3770	4180	6	1,8	98,12	98,45
315	Advanced	1500	4600	5290	6	1,7	97,89	98,14
	Ecodesign	730	4370	4840	6	1,7	98,26	98,56
400	Advanced	1650	5000	5750	6	1,5	98,18	98,40
	Ecodesign	870	5460	6050	6	1,5	98,30	98,60
500	Advanced	1950	6000	6900	6	1,4	98,26	98,47
	Ecodesign	1040	6350	7040	6	1,4	98,41	98,68
630	Advanced	2200	7000	8050	6	1,3	98,40	98,60
	Ecodesign	1270	7540	8360	6	1,3	98,49	98,75
800	Advanced	2700	8200	9430	6	1,1	98,51	98,68
	Ecodesign	1500	7930	8800	6	1,1	98,73	98,94
1000	Advanced	3300	10500	12075	7	1	98,49	98,67
	Ecodesign	1790	8920	9900	7	1	98,84	99,03
1250	Advanced	3700	13000	14950	8	1	98,53	98,72
	Ecodesign	2070	10910	12100	8	0,9	98,88	99,06
1600	Advanced	4200	15000	17250	8	0,9	98,68	98,85
	Ecodesign	2530	12890	14300	8	0,9	98,96	99,13
2000	Advanced	5000	18500	21275	8	0,8	98,70	98,88
	Ecodesign	2990	15860	17600	8	0,8	98,98	99,15
2500	Advanced	5800	22000	25300	8	0,7	98,77	98,94
	Ecodesign	3570	18830	20900	8	0,7	99,03	99,19
3150	Advanced	6800	24000	27600	8	0,6	98,92	99,06
	Ecodesign	4370	21810	24200	8	0,6	99,10	99,24

Different design (i.e. ambient temperatures and different conducting material) are available on request

Primary voltage	up to 36kV
Tappings	+/- 2x2,5%
Secondary voltage	400 V
Vector Group	Dyn11-Dyn5
Frequency	50 Hz
Insulation class	F/F
Protection degree	IP00

36kV

Voltage Drop		LpA	LwA	A	B	C	P	Q	R	S	T	Weight	Box Type
cosφ 1 last 100%	cosφ 0,9 last 100%												
%	%	dB	dB	mm	mm	mm	mm	mm	mm	mm	mm	kg	
2,27	4,59	51	64	1500	800	1550	520	620	125	40	35	1120	50
2,17	4,51	42	54	1600	850	1600	520	620	125	40	35	2900	50
2,02	4,38	54	67	1550	850	1600	520	620	125	40	35	1350	50
1,85	4,23	45	57	1625	900	1750	520	620	125	40	35	3050	50
1,86	4,24	56	70	1600	850	1700	520	620	125	40	35	1600	50
1,72	4,11	46	59	1650	900	1850	520	620	125	40	35	3150	50
1,62	4,02	57	71	1650	900	1820	670	770	125	40	35	1900	60
1,69	4,09	47	60	1700	950	1950	670	770	125	40	35	3300	60
1,56	3,97	57	71	1700	900	1850	670	770	125	40	35	2100	60
1,59	4,00	48	61	1725	975	2100	670	770	125	40	35	3450	60
1,46	3,88	58	72	1730	950	2000	670	770	125	40	35	2450	60
1,51	3,93	49	62	1750	1000	2150	670	770	125	40	35	3650	60
1,36	3,80	59	73	1750	1000	2100	670	770	125	40	35	2850	60
1,28	3,73	50	64	1875	1050	2300	670	770	125	40	35	3800	61
1,45	4,30	60	74	1800	1100	2350	820	1000	125	40	35	3200	61
1,23	4,11	51	65	1950	1050	2450	820	1000	200	70	50	4350	70
1,52	4,79	62	76	1850	1100	2400	820	1000	125	40	35	3400	61
1,29	4,59	53	67	2000	1100	2600	820	1000	200	70	50	5000	70
1,40	4,68	62	76	2000	1100	2450	820	1000	200	70	50	4450	70
1,21	4,52	54	68	2050	1100	2650	820	1000	200	70	50	5450	70
1,38	4,67	63	78	2150	1250	2600	1070	1200	200	70	50	5400	70
1,20	4,51	55	70	2200	1200	2650	1070	1200	200	70	50	6250	70
1,33	4,63	65	80	2200	1250	2700	1070	1200	200	70	50	6300	70
1,16	4,47	56	71	2300	1200	2750	1070	1200	200	70	50	6500	90
1,20	4,51	66	81	2450	1250	2700	1070	1200	200	70	50	7650	90
1,09	4,41	58	74	2350	1200	2800	1070	1200	200	70	50	7400	90

We reserve the right to change the technical data without advising

A world of reliability

over 100.000 Installations

Tesar stands for innovation and first-rate quality since 1979.

More than 100.000 units running worldwide: this is the business card of Tesar. Since 1979, Tesar is in the market with its own Design, Quality and R&D, improving continuously. In 1983 Tesar was the first to study and test the fire condition behavior.

In 2004 Tesar was one of the very first manufactures worldwide to reach E2 C2 F1 qualification (Environmental, Climatic and Fire test) and in 2013 to qualify E3 condition for transformer installations in windmills.

And still in 2014, ahead of the standard, the transformer electrical behavior after F1 fire test was successfully verified. 2014 ended with passing a test exceeding the C2 standards: Storage and transport up to -50°C.



Our Cast resin transformers

Special Design

For special applications

Tesar supports with special transformers.

6-Pulse, 12-Pulse, 18-Pulse and 24-Pulse Rectifier transformers suitable for traction and industrial applications.

Inverter transformers for photovoltaic applications.

Power Cast resin Transformers up to 20MVA - 36kV.

Single-Phase Transformers.



Metal enclosures

For maximum protection

Metal Enclosures

Provides protection against solid objects and liquids and prevents personnel from entering into direct contact with live parts. Fully custom designed and made to any kind of installation.

General characteristics

- Sendzimir steel sheet
- Colour RAL 7032
- Openings for HV/LV cable entry from top or bottom
- Transformer-mounted or floor-mounted

Optional accessories

- HV/LV cable boxes with or, without cable gland plates/glands
- Auxiliary connection box
- AREL mechanical interlocks
- Cable supports



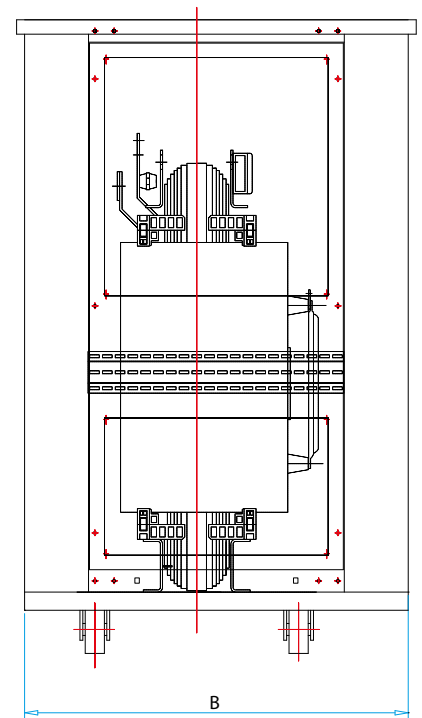
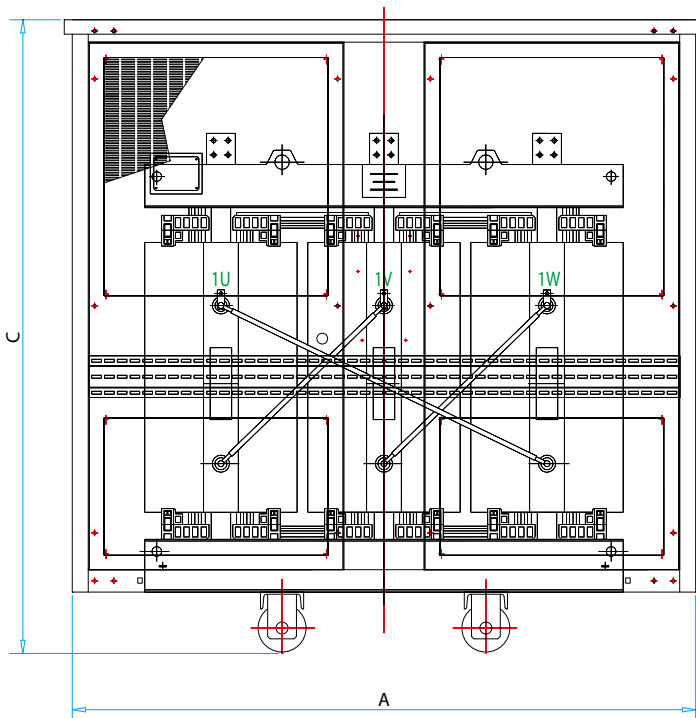
Metal Enclosure

Protection Degree	Solid Objects	Liquids	Installation
IP21	Protection against solid bodies 12mm	Protection against vertically falling drops of water	Indoor
IP31	Protection against solid bodies 2.5mm	Protection against vertically falling drops of water	Indoor
IP23	Protection against solid bodies 12mm	Protected against direct sprays of water up to 60° from the vertical	Indoor / Outdoor

Overall Dimensions

Type	A	B	C	Weight
	mm	mm	mm	kg
25	1800	1200	1760	245
28	2000	1200	2020	280
40	2200	1200	2350	400
41	2200	1200	2550	450
50	2500	1350	2500	500
51	2500	1350	2650	550
60	2700	1550	2500	600
61	2700	1550	2650	650
70	3000	1550	3000	850
90	3300	1850	3000	1050

The enclosure can be supplied assembled on transformer or in a separate kit



Metal Enclosure Drawing

Our Accessories

To equip the transformer exactly as needed

Different environments and applications have different needs. For that reason Tesar offers a wide range of accessories - to always have the perfect solution for our customer.



TSX1 Temperature Control Device

Electronic unit for temperature control of cast resin transformers.

- Nos. 4 analog input channels for windings and magnetic core temperature monitoring
 - Nos. 4 output relays (Fans, Alarm, Trip and Generic Alarm)
- Temperature is monitored through PT100 Ω . TSX1 temperature thresholds are fully adjustable. TSX1 is also available with RS485 serial port - RTU MODBUS protocol (TSX1s).



TSX3 Temperature Control Device

Electronic unit for temperature control of cast resin transformers.

- Nos. 4 analog input channels for windings and magnetic core temperature monitoring
 - Nos. 4 output relays (Fans, Alarm, Trip and Generic Alarm)
- Temperature is monitored through PTC.

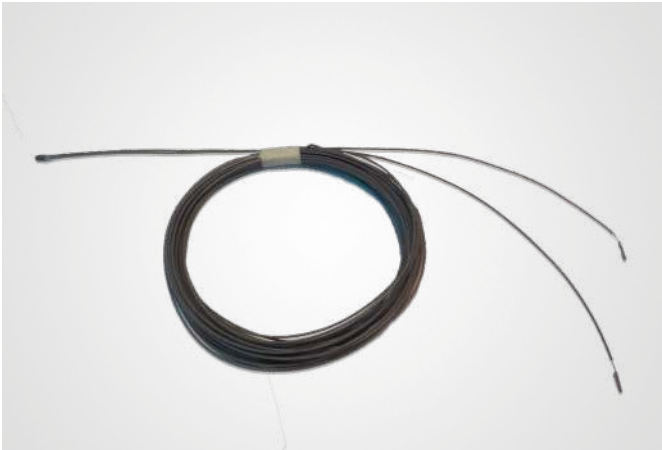


TSX6c Fan Protection Device

Electronic unit for protection and control of ventilation system.

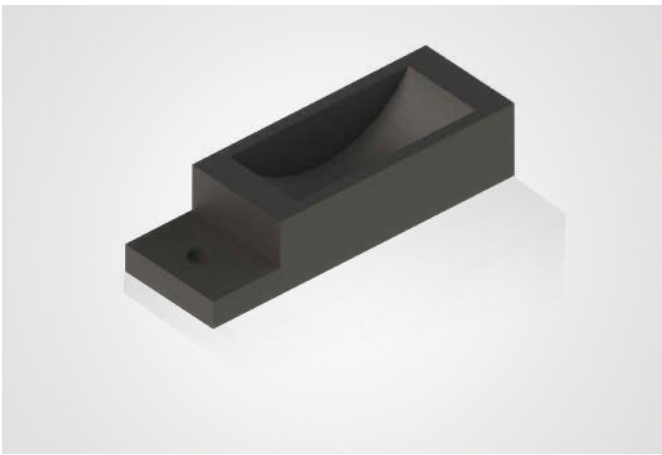
- Nos. 2 digital inputs for ventilation system enabling
- Nos. 2 output signals for fans malfunctioning
- Nos. 6 power supplies equipped with magnetic-thermal relay

Through the TSX6c relay, ventilation fans are constantly monitored and protected.



PT 100 Ω and PTC sensors

Provides real-time temperature monitoring. One PT 100 Ω sensor is installed in each LV winding. An additional PT 100 Ω sensor can be installed to monitor magnetic core temperature. Temperature sensors are wired to an auxiliary box installed on transformer metal frame. Two PTC's are installed on each LV winding, signaling when specific alarm and trip temperature thresholds are reached. Temperature sensors are wired to an auxiliary box installed on the transformer metal frame.



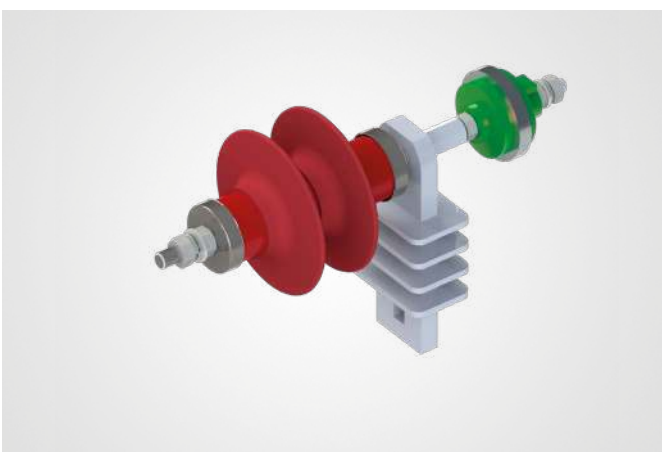
Antivibration pads

Anti-vibration pads are a smart and compact solution, reducing vibration and the noise level of a transformer. They prevent transformer vibrations from being transmitted to the surrounding environment.



Ventilation Bars

The air forced fan cooling system, reduces transformer operating temperature and allows for temporary or continuous-transformer power increase. The ventilation system, comprised of two fans bars each with three motors, can increase transformer rated power by up to 140%.



MV surge arresters

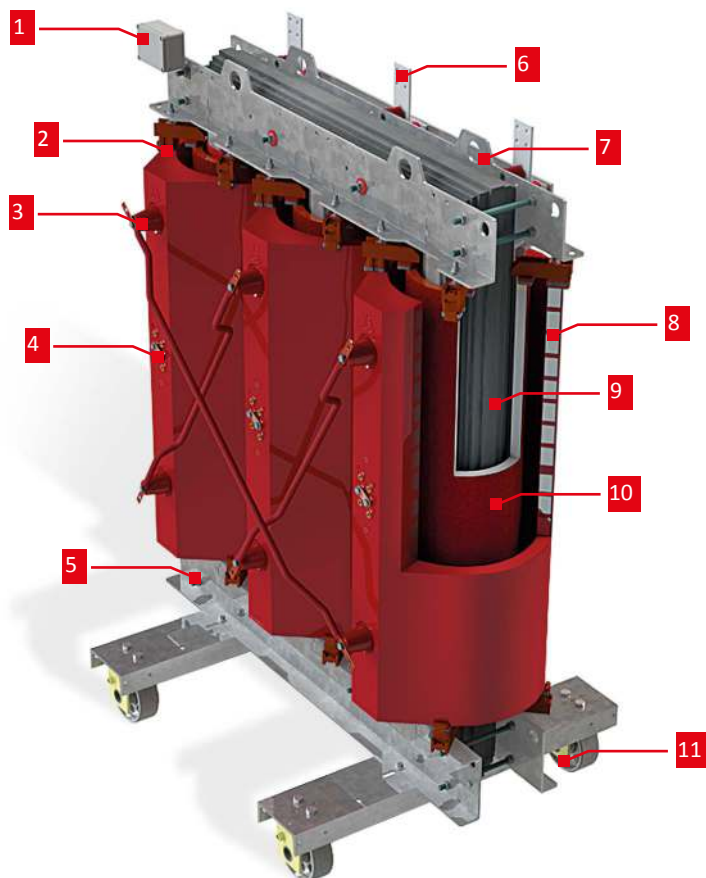
The primary protection against atmospheric and switching over voltages. A convenient and reliable solution to extend transformer lifetime. Highly recommended for installation where high lightning strike activity is foreseen.

Description and Characteristics

Description and characteristics

1. Auxiliary terminal box
2. PT 100 or PTC sensors in the LV windings
3. MV connections
4. MV tap changer
5. Magnetic core frame

6. LV connections
7. Lifting eyes
8. MV windings
9. Magnetic core
10. LV windings
11. Carriage with bi-directional wheels



Main Features

Low operation costs

The low losses in the magnetic core and in the windings reduce the costs of operation.

Frames

Hot deep galvanized frames assure the best performance in a polluted environment.

High reliability

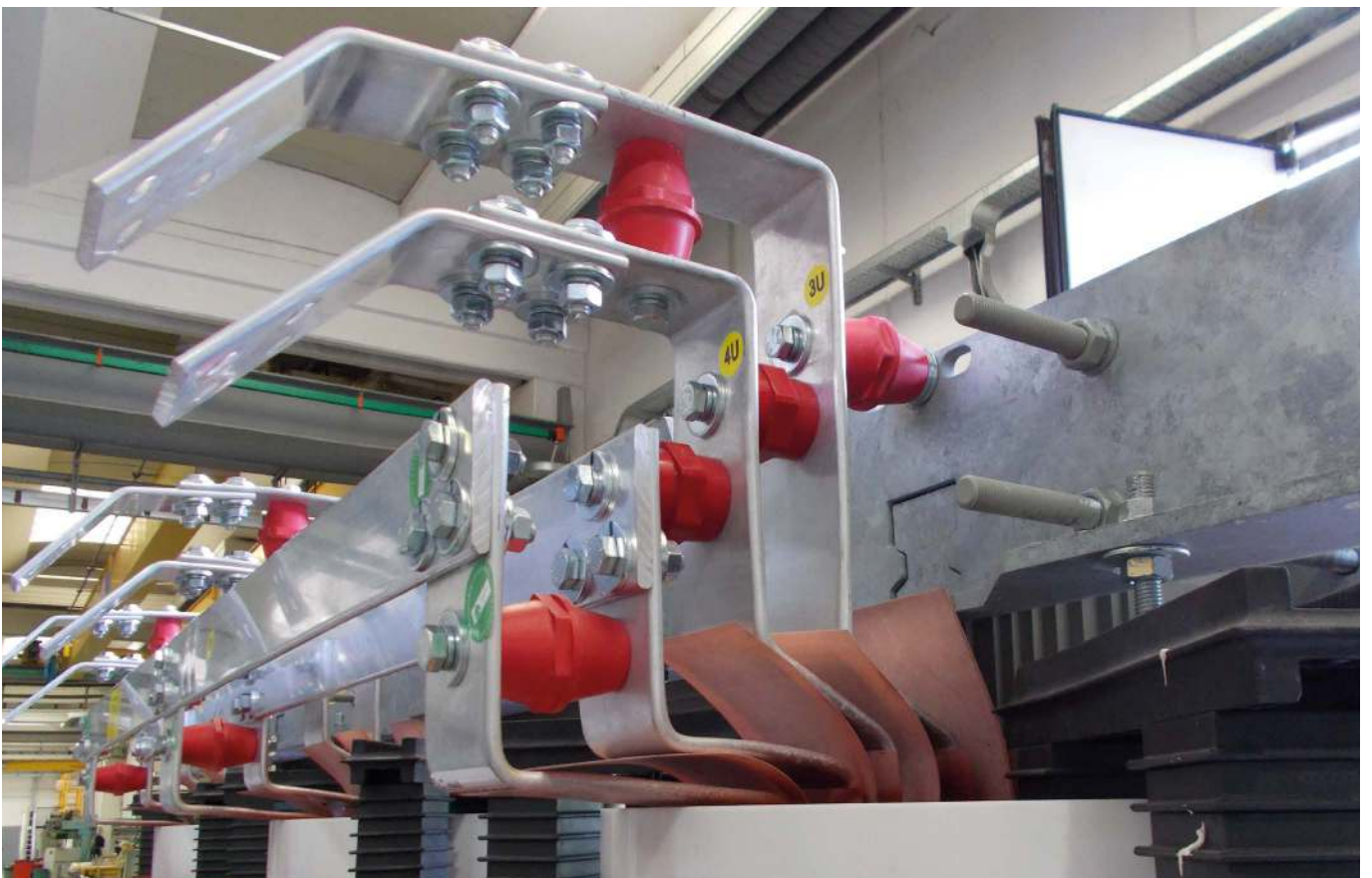
The high technology employed in the manufacturing process of windings gives the product a high level of reliability.

Maximum safety

The resin and insulating materials employed in the design and construction of Tesar transformers guarantee a high level of self-extinguishing characteristics and low emission of toxic gases.

No need for maintenance

Tesar cast resin transformers are designed in such a way as to withstand the worst climatic and environmental conditions. Preventive maintenance consists of a simple visual check.



No need for maintenance

Certified Quality with an impressive portfolio

Big difference in the Quality of manufacturing, control and outcome

Tesar is proud to claim fully approved CESI Laboratory and an impressive portfolio of routine, type and special tests, following the IEC standards in force or by other methods agreed with the client.

The Tesar instruments are always monitored and kept fully calibrated. Calibration certificates available upon request. Tesar is qualified to ISO 9001, ISO 14001 and OHSAS 18001 standards.

The image displays four certification certificates for Tesar SRL, arranged in a collage. The certificates are issued by IONet (The International Certification Network) and CSQ (Certification Service Quality).

- Top Left Certificate:** Issued by IONet, certifying Tesar SRL for ISO 14001:2004. The scope includes design, manufacture, and sale of cast resin power transformers and oil-immersed transformers with highest voltage for equipment (U_h ≤ 36 kV).
- Top Right Certificate:** Issued by CSQ, certifying Tesar SRL for ISO 9001:2008. The scope includes design, manufacture, and sale of measuring and protective transformers with highest voltage for equipment (U_h ≤ 36 kV).
- Bottom Left Certificate:** Issued by IONet, certifying Tesar SRL for ISO 14001:2004. The scope includes design, manufacture, and sale of cast resin power transformers and oil-immersed transformers with highest voltage for equipment (U_h ≤ 36 kV).
- Bottom Right Certificate:** Issued by CSQ, certifying Tesar SRL for ISO 9001:2008. The scope includes design, manufacture, and sale of measuring and protective transformers with highest voltage for equipment (U_h ≤ 36 kV).

The IONet logo is prominently displayed in the center of the collage, and the CSQ logo is visible in the bottom right corner. The certificates are in Italian and English, detailing the company's location, activities, and compliance with international standards.

Certified to the latest standards

E - C - F Classes

Tesar Cast resin transformers in all climates.

IEC 60076-11 imposed the transformers to be certified for environmental, climatic and fire classes. Tesar, one of the very first worldwide, to pass all off the classes, in 2004, E2 - C2 - F1.

Environmental Class E

- E2: The transformer is exposed to considerable. Condensation and heavy contamination / pollution or both
- E3: The transformer is suitable for installation where the most severe environmental conditions are foreseen, extending the limits specified by class E2

Climatic Class C

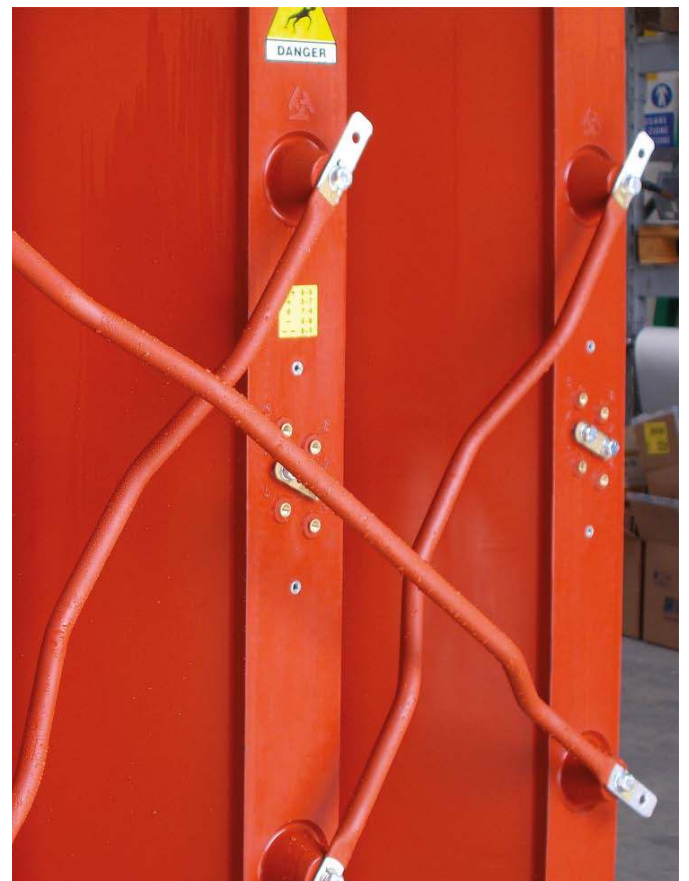
- C2: Storage, transportation and operation of the transformer is possible upto -25°C
- Tesar went beyond class C2 by testing the transformer at -50°C, proving it to be suitable for extreme climates

Fire Behavior Class F

F1: The transformer is used in an environment where a fire hazard is possible, so it is compulsory to offer a reduced risk of flammability. A transformer fire must be extinguishing by the transformer.



Tesar Transformer during climate test



Beyond the standards

Innovative, efficient and confidential

Beyond F1 test

Studying and testing the behavior of a transformer after the F1 (Fire) test, the result was positive: after a fire event, a Tesar transformer is in a condition to run without any problems.

Electromagnetic Analysis

The level of electromagnetic emission of electrical equipment must be kept under control in respect of the limit, imposed by law and above all the health of the people working or living in the surrounding area of the equipment. Tesar transformers not only fulfill the limit of 10 uT imposed by the DPCM regulation of 08.07.2003.

But the intensity of magnetic field can be additionally reduced by equipping the transformer with a metal enclosure.



Cap. Soc. 2.000.000.000 € i.r.l.
P.I.a 00340260811 - C.C.I.A.A. (A.R.E. N° 73845)
S2838 (Rome) Via Salaria 102 - Italy
Tel. +39 0675 9171 Fax +39 0675 917200
E-Mail: info@tesar.it http://www.tesar.it

ATTACHED TO THE TEST CERTIFICATE
2013.02.0003-001

Serial Number 2013020003-001	Rated Power [kVA] 1000	Frequency [Hz] 50	Group Dyn11
Voltage Ratio [kV] 11000 / 415	Regulation (+2) (-2) x 2,5%		

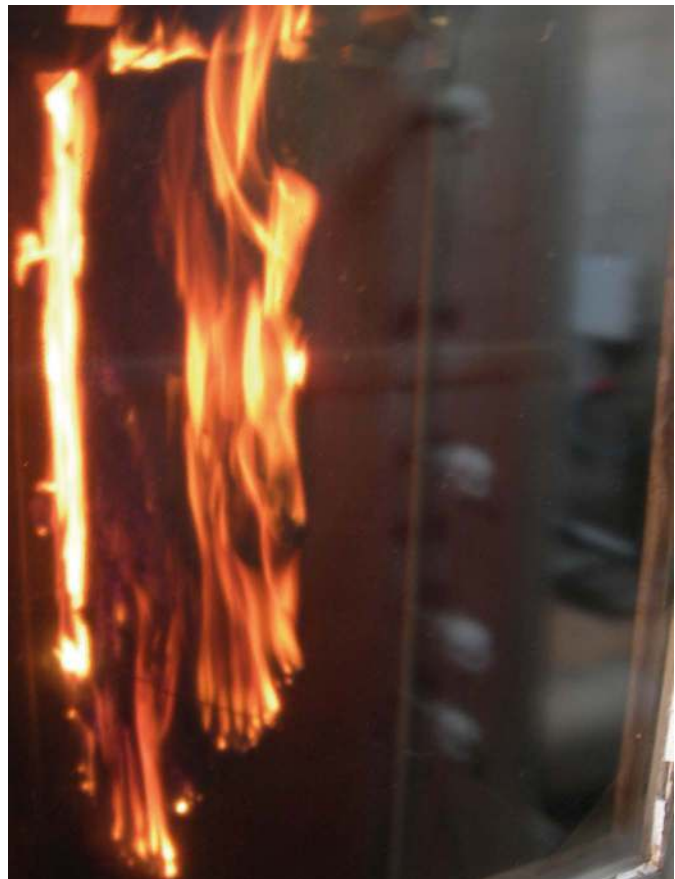
N°	Description	Result
1	INDUCE VOLTAGE TEST AT 80% OF RATED VOLTAGE (84V - 300Hz - 60s)	POSITIVE
2	SEPARATE SOURCE VOLTAGE TEST ON HV SIDE AT 80% OF RATED VOLTAGE (22,4kV - 50Hz - 60s)	POSITIVE
3	SEPARATE SOURCE VOLTAGE TEST ON LV SIDE AT 80% OF RATED VOLTAGE (2,4kV - 50Hz - 60s)	POSITIVE
4	MEASUREMENT OF VOLTAGE RATIO AND CHECK OF PHASE DISPLACEMENT	POSITIVE
5	PARTIAL DISCHARGE MEASUREMENT (LESS THAN 10pC)	POSITIVE

ATTACHED PICTURES



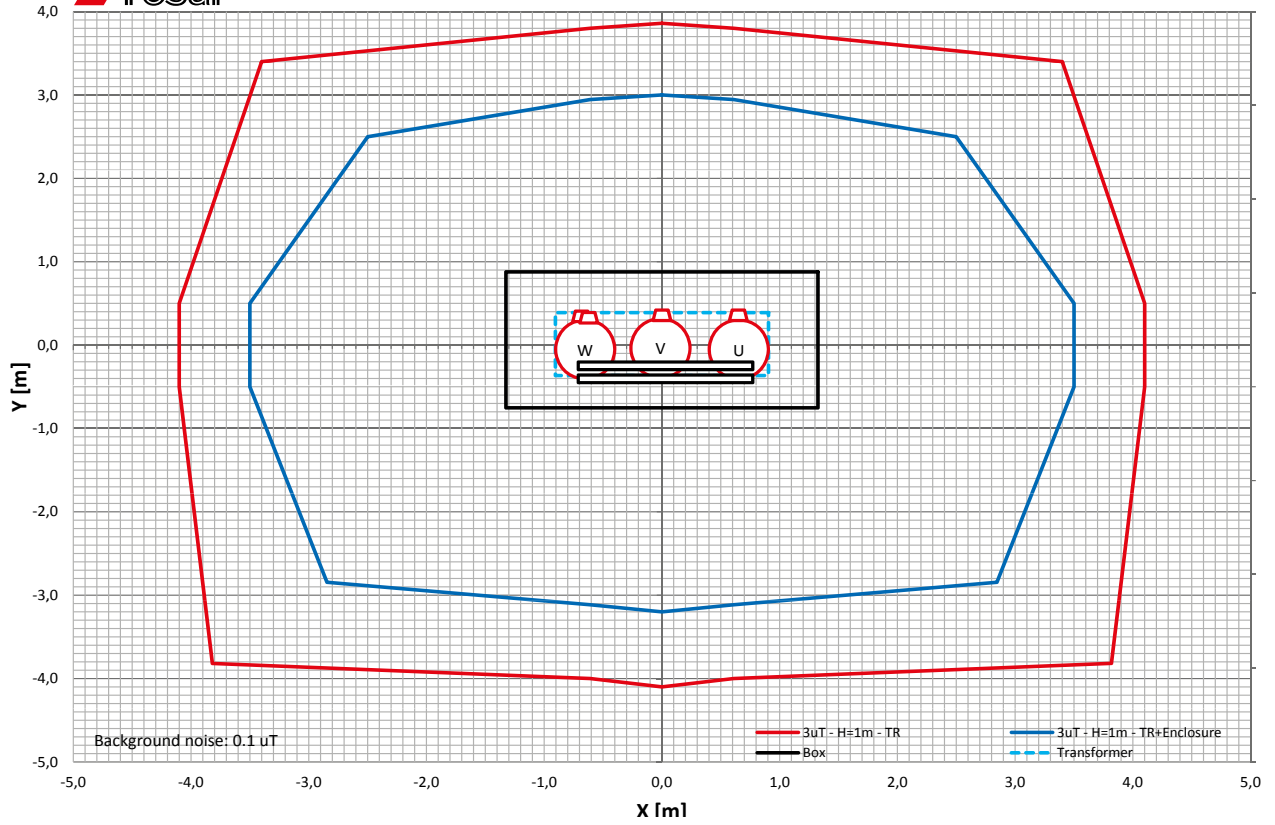
REMARKS
TESTS CARRIED OUT TO TESAR AFTER THE FIRE BEHAVIOR TEST CLASS F1 ON ONE COLUMN (PHASE IV) FROM THREE-PHASE DRY-TYPE DISTRIBUTION TRANSFORMER. SEE CEM INSPECTION REPORT N°0400316.
FOR THE TESTS THIS COLUMN HAS BEEN ASSEMBLED ON HIS MAGNETIC CORE.

Date: **07/04/2014** Testing room: Test Inspector: **TESAR s.r.l. TESTING ROOM MANAGER AGRANO ROSSI**



Cesi Certificate

Fire behaviour



Electromagnetic Analysis



Highest Quality

Companies of R&S

R&S International Holding

Reuslistrasse 32
4450 Sissach
Switzerland
info@the-rsgroup.com
www.the-rsgroup.com

SERW

Tymákovská 42, Sedlec
332 02 Starý Plzenec
Czech Republic
serw@serw.cz
www.serw.cz

Tesar

Loc. Chiaveretto
52010 Subbiano - Arezzo
Italy
info@tesar.eu
www.tesar.eu

Rauscher & Stoecklin

Reuslistrasse 32
4450 Sissach
Switzerland
info@raustoc.ch
www.raustoc.ch

ZREW Transformers

ul. Rokicińska 144
92-412 Łódź
Polen
transformatory@zrew-tr.pl
www.zrew-transformatory.pl

Tesar Polska

ul. Skarbową 34
32-005 Niepołomice
Polen
info@tesarpolska.pl
www.tesarpolska.pl

Tesar S.r.l.

Località Chiaveretto 37 / B,
IT-52010 Subbiano - Arezzo

T +39 0575 3171
F +39 0575 317201

info@tesar.eu
www.tesar.eu