



Minsk Electrotechnical Plant  
named after V.I. Kozlov

# POWER TRANSFORMERS



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## ESTEEMED CUSTOMERS

The history of our enterprise has started in 1956. For the 55-year development period Minsk Electrotechnical Plant has become one of the world biggest producers of electric engineering equipment.

The Plant has got its own research and development and design-engineering basis, advanced equipment and skilled personnel. A full production cycle for electric devices proceeds from metalworking and preparation of metalware to ready-made apparatuses. We pay great attention to development of the new updated products. Technical characteristics and design solutions are constantly upgraded. Our research and test labs are equipped with all facilities providing for the items necessary testing.

Our main products are as follows:

- ◆ power distribution transformers oil-immersed type rating 10 to 2500 kVA, of up to 35 kV voltage class
- ◆ power distribution transformers dry-type rating 100 to 2500 kVA, of 10 kV voltage class
- ◆ low-power multifunctional transformers rating up to 10 kVA
- ◆ substations and electric devices for industrial, rural and urban power supply, for oil and gas production, for oil and gas pipelines, auxiliaries substations for nuclear-, heat- and hydro-power stations

As agreed with a Customer the Plant can manufacture items with characteristics and parameters differing from those of serial production stock. We can offer optimal specific solutions, basing on profound experience, to provide fabrication of the pieces of equipment able to satisfy the most demanding requirements of our users.



# WORLD RATING TECHNOLOGIES

In partnership with “Georg” Company of Germany, “Alsthom” Company of France and “Motoman” Company of Japan the Plant has created production facilities for corrugated tanks of power transformers – unique facilities as to their scale, system integration and completeness. Manufacturing of tanks embraces a full set of operations: from straightening of coiled steel strips to outcome of the finished product. Unique efficiency of this manufacturing complex, its processing flexibility provide for immediate reaction to any design changes. Perfect quality of oil-proof welds by a robotic welder, reliable testing, manless coating process, along with other numerous specific features of the technique, serve to meet requirements of the most demanding users.



THE SLITTING AND CUT-TO LENGTH LINES FOR ELECTRICAL STEEL (GEORG COMPANY)



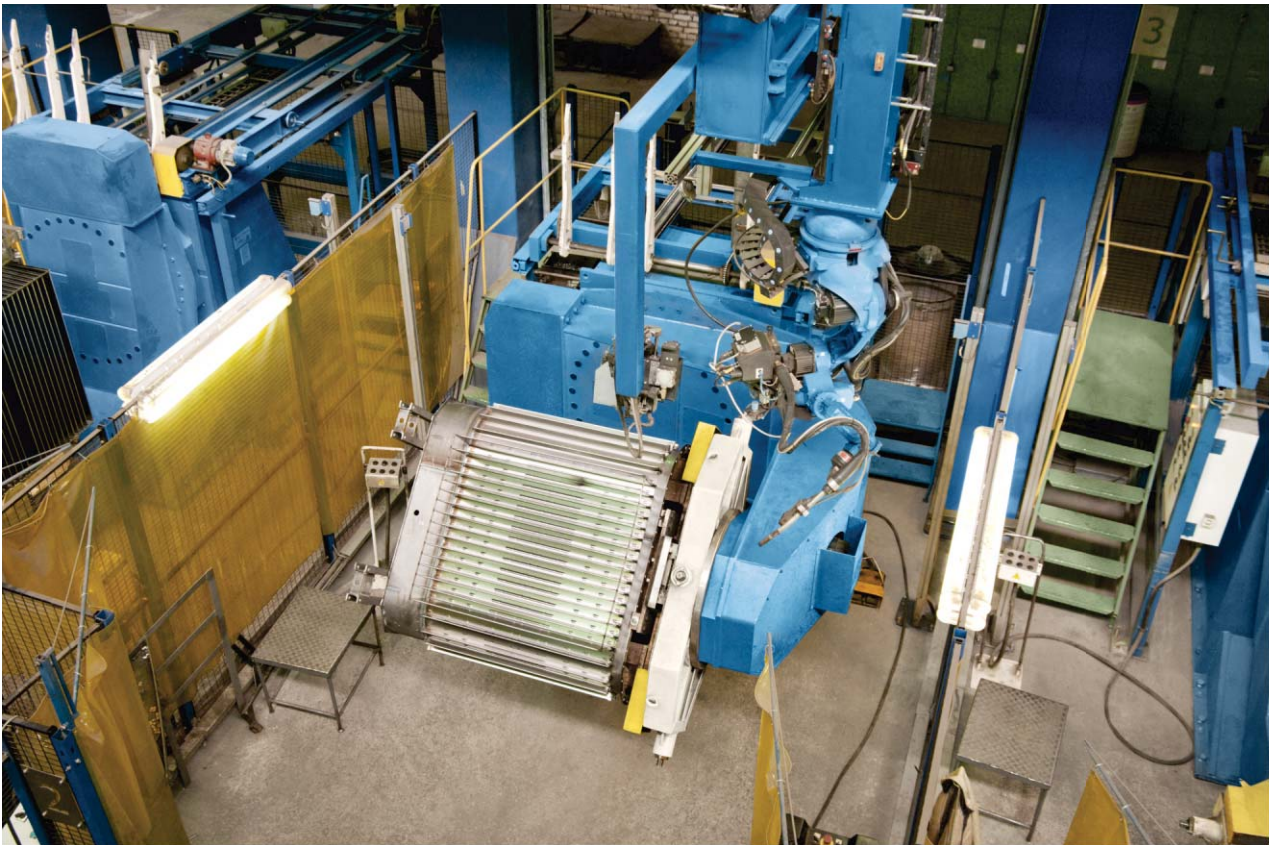


LINE FOR CORRUGATED WALLS OF THE TRANSFORMER TANKS (BY GEORG COMPANY)



LINE FOR PLASMA WELDING OF CORRUGATED WALLS





ROBOTIC WELDER OF MOTOMAN (JAPAN)



POWDER COATING LINE OF NORDSON (USA) AND ZYGIL COMPANY (POLAND)

# POWER DISTRIBUTION TRANSFORMERS of Minsk Electrotechnical Plant

Our enterprise produces transformers with rather wide consumer properties.

As to the type our transformers are conventionally divided into two main groups: oil-immersed type and dry-type. They can be 10 to 2500 kVA as to power rating, single-phase and three-phase, intended for cold, temperate or tropical climate, of any voltage class up to 35 kV inclusive, of various connection/vector groups .

The transformers of Minsk Electrotechnical Plant produce meet IEC standards, as well as seismic resistance special requirements under earthquakes of 9 magnitude as to MSK-64 scale.

The transformers for electric drives of immersion pumps for oil wells are on serial production, their design being constantly upgraded. To solve problems of the electric energy quality under asymmetric loads the Plant has mastered production of the transformers equipped with balancers, of 25 to 250 kVA power rating.

To reduce transformer operational costs and to apply a more optimum economical alternative of energy supply for various demands the Plant has created the transformer series with varying relationship between no-load and short-circuit losses.



More than one million transformers manufactured by Minsk Electrotechnical Plant are functioning at industrial installations, in urban and rural networks, reliably and with minimum operational expenses

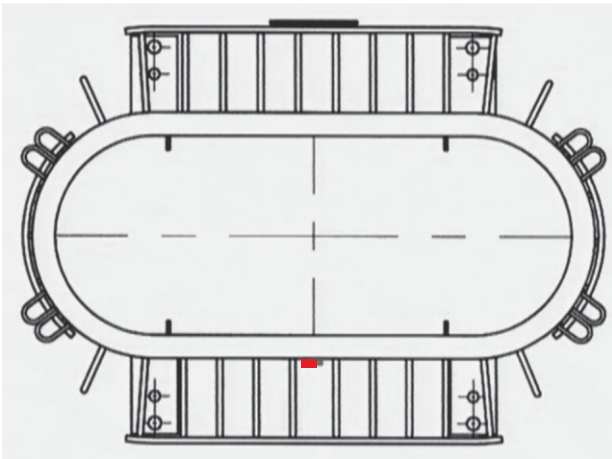


# ADVANTAGES OF OIL-IMMERSED TRANSFORMERS OF MINSK ELECTROTECHNICAL PLANT

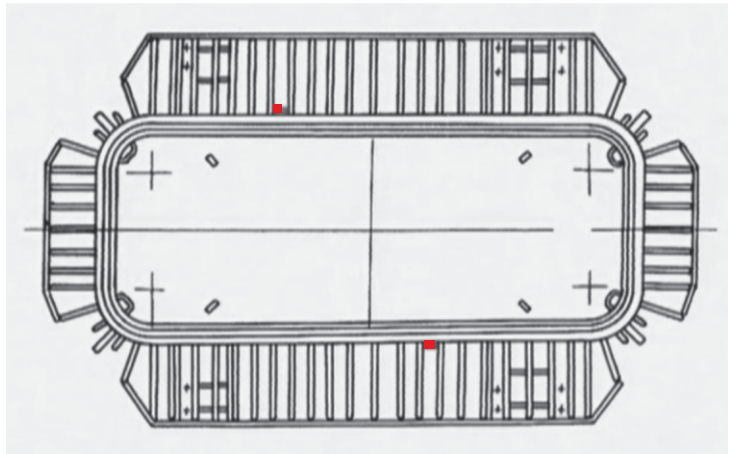
## 1. Oval design of a corrugated tank

In addition to increased structural reliability due to reduced welds, oval tanks, as compared with competing rectangular ones, are more economical in respect of the transformer oil consumption, and one more important point is that they have got greater mechanical strength.

*Before putting into quantity production the corrugated tanks of the sealed oil transformers by the Minsk Plant are subjected to mechanical cyclic testing to verify their endurance with regard to estimated service life making 25 years (10000 cycles of maximum and minimum pressure).*



**Oval tank  
(one weld)**

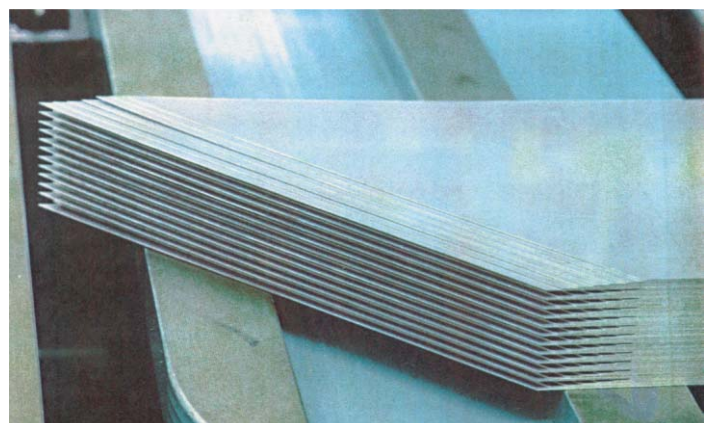
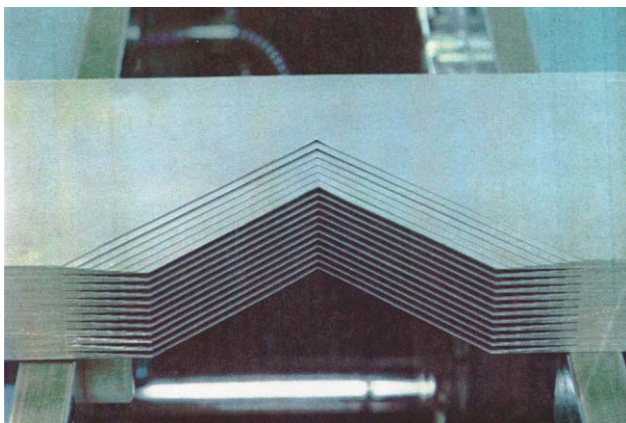


**Rectangular tank  
with rounded corners  
(two welds)**

## 2. Core and winding design and manufacturing procedure

The core principal design is based on planar system, with stepwise gradation in legs and yokes – through stacking, using step-lap pattern.

Design of the windings and use of the increased rigidity yoke beams made of channel bars provide mechanical stability.



**LAMINATION PACKS STACKED AS TO STEP-LAP PATTERN**

### 3. Transformers are manufactured in a sealed version, with a full oil-filling, they carry no conservators and have neither air- nor gas-cushion.

- ✓ there is no interchange between transformer oil and ambient air, which eliminates oil humidication, oxidation or sludging.
- ✓ oil is degassed before filling-in, transformer tanks are filled in a special chamber (under fine vacuum), which provides for much higher strength of the transformer insulation.
- ✓ the oil in sealed transformers practically does not change its properties within the whole transformer service life. Therefore there is no need in oil test sampling with this type transformers either in their storage or when putting into operation or in operating process as such.
- ✓ no preventive, running or overhaul repairs are required within the transformer whole service life.



**TRANSFORMER OIL DEGASSING UNIT**



**OIL-FILLING VACUUM CHAMBER**



## TECHNICAL SOLUTIONS AND DESIGN

IN THE NEXT PART OF THIS DATA SHEET  
WE PRESENT THE INFORMATION  
ON POWER DISTRIBUTION TRANSFORMERS DIVIDED  
INTO OIL-IMMERSED AND DRY-TYPES

# OIL-IMMERSED SEALED THREE-PHASE TRANSFORMERS





## OIL-IMMERSED SEALED THREE-PHASE TRANSFORMERS

The transformers are designed for electrical energy transforming in power systems and at consumers by outdoor or indoor installation under temperate (minus 45 to plus 40°C) or cold (minus 60 to plus 40°C) climate. The environment shall be inexplusive, with dust content concentrations not affecting negatively the transformer parameters to inadmissible limits. Transformers should not be operated under conditions of jolting, vibration, shocks and chemically active environment. Operative altitude 1000 m max.

Rated frequency 50 Hz. The voltage regulation within  $\pm 5\%$  range is carried out with a fully de-energized transformer through HV-winding tap-changing in 2.5% steps.

The transformer LV-side neutral input is rated for continuous operation at the current equal to 100% rated current of LV-winding.

The temperature induced variations of the oil volume are accomodated by the tank wall corrugations flexible deformation.

Oil level control is provided by a float type oil-level indicator.

16 ... 63 kVA transformers are fitted with safety valve for tank overpressure prevention.

As an option it is provided as follows:

- electric-contact pressure-vacuum gage for internal pressure control;

- liquid-in-glass thermometer for oil top layers temperature measurement;

- manometric signaling thermometer for measurement of oil top layers temperature and external electric circuits control.

250 ... 2500 kVA transformers are fitted with carrying rollers for transformer moving (for 160 kVA – as an option)

Table 1

Rated power, kVA	Rated high voltage, kV	Rated low voltage, kV	Winding connection/vector group	Short-circuit loss, W	Short-circuit voltage, %	No-load loss, W	Sound power level, dBA	Length, mm (L)	Width, mm (W)	Height, mm (H)	Weight, kg
<b>16</b>	10	0.4	Yzn11	500	5.0	85	55	800	640	890	230
<b>25</b>	10	0.4	Yzn11	690	4.7	115	55	800	640	930	240
	10	0.4	Yyn0	600	4.5	85	50	810	560	940	240
	15	0.4	Yzn11	690	4.7	115	55	800	640	1000	280
	27.5	0.4	Yyn0	650	6.0	145	55	1100	800	1350	590
<b>40</b>	10	0.4	Yzn11	1000	4.7	155	55	840	680	1000	300
	10	0.4	Yyn0	880	4.5	105	50	850	585	1015	300
	15	0.4	Yzn11	1000	4.7	165	55	840	680	1100	350
<b>63</b>	10	0.4	Yzn11	1470	4.7	220	55	950	730	1020	420
	15	0.4	Yzn11	1470	4.7	220	55	950	730	1100	420
	10	0.4	Yyn0	1280	4.5	170	50	960	725	1015	420
<b>100</b>	10	0.4	Yzn11	2270	4.7	270	59	1020	750	1180	540
	15	0.4	Yzn11	2270	4.7	270	59	1020	750	1240	925
	27.5	0.4	Yyn0	1970	6.5	320	59	1260	840	1780	1215
	35	0.4	Yzn11	2270	6.8	320	59	1260	840	1780	1215
	10	0.4	Yzn11	2270	4.7	290	59	935	730	1060	490
	15	0.4	Yzn11	2270	4.7	290	59	935	730	1140	490
	10	0.4	Yyn0	1970	4.5	220	52	1000	720	1180	540
	<b>160</b>	10	0.4	Dyn11	2900	4.5	410	62	1100	780	1180
10		0.4	Yzn11	2900	4.7	410	62	1100	780	1180	925
15		0.4	Yzn11	2900	4.7	410	62	1100	780	1240	925
27.5		0.4	Yyn0	2650	6.5	480	62	1350	860	1850	1295
35		0.4	Yzn11	3100	6.8	480	62	1350	860	1850	1295
10		0.4	Dyn11	2900	4.5	410	62	1020	755	1185	670
10		0.4	Yzn11	2900	4.7	410	62	1020	755	1185	670
10		0.4	Yyn0	2600	4.5	320	54	1120	750	1220	710
15		0.4	Yzn11	2900	4.7	410	62	1020	755	1245	670
<b>250</b>	10	0.4	Dyn11	4200	4.5	580	65	1220	840	1220	950
	15	0.4	Dyn11	4200	4.5	580	65	1220	840	1280	1160



Table 1 (continuation)

Rated power, kVA	Rated high voltage, kV	Rated low voltage, kV	Winding connection/vector group	Short-circuit loss, W	Short-circuit voltage, %	No-load loss, W	Sound power level, dBA	Length, mm (L)	Width, mm (W)	Height, mm (H)	Weight, kg
<b>250</b>	27.5	0.4	Yyn0	3700	6.5	700	65	1450	950	1880	1550
	35	0.4	Yzn11	4200	6.8	700	65	1450	950	1880	1550
	10	0.4	Dyn11	4200	4.5	570	65	1140	820	1270	920
	15	0.4	Dyn11	4200	4.5	570	65	1140	820	1330	920
	10	0.4	Dyn11	4200	4.5	450	56	1220	840	1320	1020
<b>400</b>	10	0.4	Dyn11	5600	4.5	830	68	1300	860	1350	1360
	15	0.4	Dyn11	5800	4.5	830	68	1300	860	1410	1360
	27.5	0.4	Yyn0	5500	6.5	950	68	1650	1000	1950	2190
	35	0.4	Yyn0	5500	6.5	950	68	1650	1000	1950	2190
	10	0.4	Dyn11	5600	4.5	830	68	1350	855	1415	1255
	15	0.4	Dyn11	5800	4.5	830	68	1300	855	1475	1255
	10	0.4	Ynd11	5400	4.5	830	68	1350	855	1415	1255
	10	0.4	Dyn11	4600	4.5	610	60	1330	850	1635	1370
	15	0.4	Dyn11	4600	4.5	610	60	1330	850	1695	1370
	10	0.4	Dyn11	5600	4.5	600	58	1300	860	1480	1480
<b>630</b>	10	0.4	Dyn11	7600	5.5	1240	70	1540	1060	1470	2000
	20	0.4	Dyn11	7600	5.5	1240	70	1540	1000	1470	2100
	10	0.4	Dyn11	7450	5.5	1060	70	1545	1000	1540	1860
	10	0.4	Dyn11	6750	5.5	800	61	1390	1000	1710	1870
	10	0.4	Dyn11	7600	5.5	940	62	1540	1060	1600	2100
<b>1000</b>	10	0.4	Dyn11	10800	5.5	1600	73	1770	1100	1900	2900
	20	0.4	Dyn11	10800	5.5	1600	73	1770	1100	1900	3100
	10	0.4	Dyn11	10800	5.5	1400	73	1720	1135	1860	2750
	10	0.4	Dyn11	10500	5.5	1100	64	1600	1000	1970	2820
	10	0.4	Dyn11	10800	5.5	1250	65	1770	1100	1900	3000
<b>1250</b>	10	0.4	Dyn11	12400	6.0	1800	75	1770	1100	1900	3600
	20	0.4	Dyn11	12000	6.0	1750	75	1770	1100	1900	3550
	10	0.4	Dyn11	13500	6.0	1650	75	1825	1130	2020	3250
	10	0.4	Dyn11	13250	6.0	1350	65	1800	1110	2100	3630
	15	0.4	Dyn11	13250	6.0	1350	65	1800	1110	2100	3630
<b>1600</b>	10	0.4	Dyn11	16500	6.0	2150	75	2180	1260	2170	4250
<b>2500</b>	10	0.4	Dyn11	26500	6.0	2600	76	2350	1350	2500	7000

At a Customer's order can be manufactured transformers designed for operation under tropical climate conditions at the altitudes over 1000 m above sea level, with no-load and short-circuit losses differing from those indicated in Table 1, having various winding connection/vector groups.

Table 2 lists parameters of the transformers tailored according to specific orders for supplies to Europe, Asia, Africa, Central and Latin America countries.

Table 2

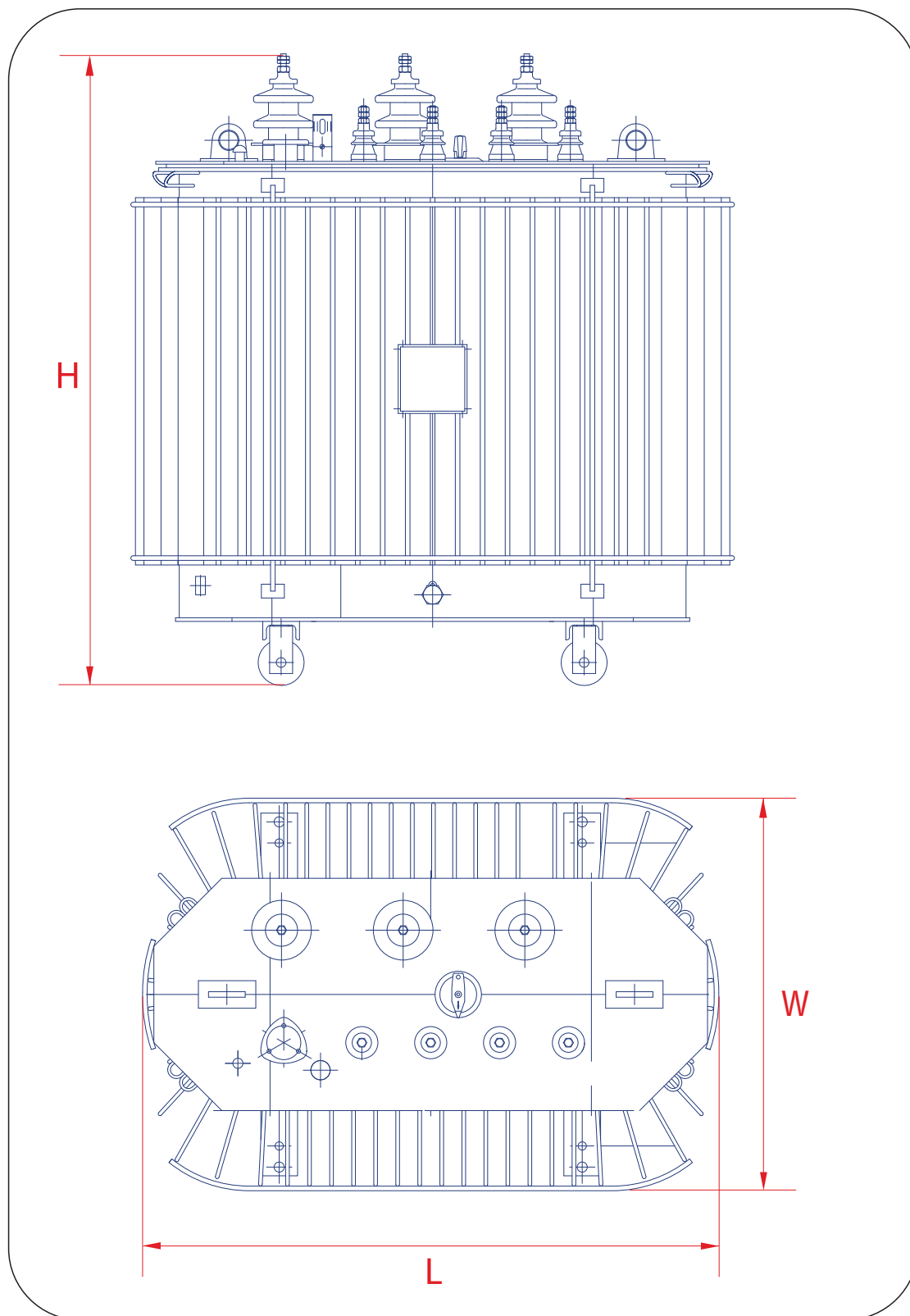
Rated power, kVA	Rated high voltage, kV	Rated low voltage, kV	Temperature rise in windings, °C	Temperature rise in oil, °C	Winding connection/vector group	Short-circuit loss, W	Short-circuit voltage, %	No-load loss, W	Sound power level, dBA	Length, mm (L)	Width, mm (W)	Height, mm (H)	Weight, kg
<b>25</b>	20	0.4	50	45	Dyn11	600	4.0	120	55	860	550	1130	331
	11	0.4	55	50	Dyn11	500	4.0	705	51	290	400	1060	300
<b>40</b>	15.75	0.4	65	60	Yzn5	1000	4.7	165	55	840	680	1100	350
<b>50</b>	22-11	0.433	55	50	Dyn11	840	4.0	105	42	930	710	1350	535
	11	0.4	55	50	Dyn11	1000	4.0	145	55	840	680	1000	370
	11	0.4	55	50	Dyn11	1000	4.0	145	55	840	680	1000	370
<b>63</b>	15.75	0.4	65	60	Yzn5	1470	4.7	220	55	950	730	1100	420
<b>75</b>	20	0.4	55	50	Dyn11	1650	4.5	290	59	935	730	1275	510
	11	0.4	55	50	Dyn11	1350	4.0	200	58	1020	750	1180	575
<b>100</b>	22-11	0.433	55	50	Dyn11	1420	4.0	170	44	1000	790	1450	770
	20	0.4	55	50	Dyn11	1475	4.0	260	57	970	750	1260	600
	20	0.4	55	50	Dyn11	2200	4.5	250	59	1020	750	1360	605
	11	0.4	55	50	Dyn11	1650	4.0	250	59	1020	770	1180	610
	11	0.416	50	45	Dyn11	1750	4.0	230	59	990	760	1255	630
	15.75	0.4	65	60	Yzn5	2270	4.7	290	59	930	780	1155	500
	11	0.4	55	50	Dyn11	1650	4.0	250	59	1020	770	1180	610
<b>120</b>	20	0.4	55	50	Dyn11	2400	4.5	410	62	1020	755	1380	725
<b>160</b>	20	0.4	50	45	Dyn11	2800	4.0	410	62	1235	790	1470	915



Table 2 (continuation)

Rated power, kVA	Rated high voltage, kV	Rated low voltage, kV	Temperature rise in windings, °C	Temperature rise in oil, °C	Winding connection/vector group	Short-circuit loss, W	Short-circuit voltage, %	No-load loss, W	Sound power level, dBA	Length, mm (L)	Width, mm (W)	Height, mm (H)	Weight, kg
<b>160</b>	15-20	0.41	65	60	Dyn11	2300	4.0	425	62	1100	780	1410	810
	11	0.416	50	45	Dyn11	1650	4.0	410	62	1020	755	1185	830
	15.75	0.4	65	60	Yzn5	2900	4.7	410	62	1020	755	1255	670
<b>200</b>	22-11	0.433	55	50	Dyn11	2300	4.0	280	49	1160	880	1550	1265
	20	0.4	55	50	Dyn11	2200	4.0	430	61	1220	840	1450	1160
	11	0.4	55	50	Dyn11	3100	4.0	600	58	1200	820	1470	1010
	11	0.4	55	50	Dyn11	3100	4.0	600	58	1200	820	1470	1010
<b>250</b>	15-20	0.41	65	60	Dyn11	3200	4.0	600	65	1220	840	1480	1130
	11	0.416	50	45	Dyn11	3800	4.0	480	59	1260	800	1360	1060
	11	0.416	50	45	Dyn11	3500	4.0	510	65	1190	860	1240	1030
	15.75	0.4	65	60	Dyn5	4200	4.5	570	65	1140	820	1330	920
	11	0.4	55	50	Dyn11	3250	5.0	500	65	1220	840	1220	1140
<b>400</b>	11	0.416	50	45	Dyn11	4600	4.0	730	68	1270	990	1560	1700
	11	0.416	50	45	Dyn11	4500	4.0	750	68	1060	1190	1450	1470
	15.75	0.4	65	60	Dyn5	5800	4.5	830	68	1350	855	1475	1255
	11	0.22	65	60	Dyn11	5700	8.0	840	68	1400	950	1550	1500
	34.5	0.22	65	60	Yyn0	6000	8.0	870	68	1400	980	1860	1650
<b>500</b>	11	0.4	55	50	Dyn11	5700	5.0	800	66	1380	920	1350	1780
	11	0.4	55	50	Dyn11	5700	5.0	800	66	1380	920	1350	1780
<b>630</b>	20	0.4	55	50	Dyn11	5300	6.0	830	68	1600	1060	1775	2860
	11	0.416	50	45	Dyn11	7250	6.0	1000	70	2070	1230	1515	2200
	15.75	0.4	65	60	Dyn5	7450	5.5	1060	70	1545	1000	1600	1860
	6.3	0.4	55	50	Dyn11	5750	5.5	1270	70	1545	1000	1540	2070
<b>1000</b>	20	0.4	55	50	Dyn11	10500	5.5	1500	72	1830	1180	2035	3280
	11	0.4	55	50	Dyn11	10000	5.5	1550	73	1770	1100	1900	3540
	11	0.416	50	45	Dyn11	10400	6.0	1400	73	2110	1260	1800	3475
	15.75	0.4	65	60	Dyn5	10800	5.5	1400	73	1720	1135	1920	2750
	33	0.48	55	50	Yyn0	11000	5.5	1900	73	2180	1260	2275	3900

Fig. 1. Oil-immersed hermetically sealed three-phase transformers



# THREE-PHASE DRY-TYPE POWER TRANSFORMERS WITH CAST RESIN INSULATION





# THREE-PHASE DRY-TYPE POWER TRANSFORMERS WITH CAST RESIN INSULATION

Three-phase dry-type power transformers with GEAFOL cast resin insulation, with voltage up to 10 kV are intended for transforming of a.c. energy in power networks and at energy consumers, of 50 Hz rated frequency.

The transformers are designed for indoor operation, under temperate climate conditions (minus 45 to plus 40 °C). Relative air humidity 75% at 15 °C. The environment shall be inexplusive, with dust content concentrations not affecting the transformer parameters to inadmissible limits. Operation altitude 1000 m max.

The transformers are equipped with SIEMENS windings. The insulation thermal-endurance is of F class. For windings insulation is applied epoxy compound with a quartz filler. Additionally the windings are reinforced with fiberglass which excludes cracking of epoxy compound even under the transformer overload. GEAFOL does not exert deleterious effect on environment, does not develop toxic gases even under arc discharges. Owing to such insulation the windings are maintenance-free.

Transformers are able to be operated in the networks exposed to lightning and switching over-voltages. They are of low noise level and of high withstandability against short-circuit currents.

Transformers provide full ecological and fire safety, can be installed in the places requiring increased safety (underground, mines, cinema, domestic and municipal buildings), in the places with high requirements for safe environment (water intake stations, athletic facilities, health resort zones), at industrial enterprises, iron-and-steel works, chemical plants, power plants in close proximity to load centers, that allows to avoid expenses connected with erection of electric power substations. The transformers provide saving of distributing bus-bars and low-voltage cables, reduce their electric losses.

Voltage regulation within  $\pm 5\%$  range is carried out by 2,5 % steps at a fully deenergized transformer through resetting of jumpers.

For overheat protection the transformers are equipped with thermister controlled devices inbuilt in LV-windings . For power increase up to 30 % transformers can be fitted with air fans automatically controlled. Noise level of transformers with operating fans does not exceed 80 dBA. At a Customer's order vibration damping supports can be delivered as an option.

Transformers are manufactured of various protection degrees: IP00, IP21, IP31. At a Customer's order the transformers may have characteristics differing from those indicated in Tables 3, 4, and be of any desired design and climatic versions.

**Table 3. Without enclosures**

Rated power, kVA	Rated high voltage, kV	Rated low voltage, kV	Winding connection/vector group	Short-circuit loss, W	Short-circuit voltage,%	No-load loss, W	Sound power level, dBA	Length, mm (L)	Width, mm (W)	Height, mm (H)	Weight, kg
<b>100</b>	10	0.4	Dyn11	1800	4.0	600	59	1250	700	1000	750
<b>160</b>	10	0.4	Dyn11	2550	4.0	700	62	1300	700	1080	800
<b>250</b>	10	0.4	Dyn11	3000	5.5	900	65	1420	1000	1245	1200
<b>400</b>	10	0.4	Dyn11	3900	5.5	1200	68	1420	1000	1395	1550
<b>630</b>	10	0.4	Dyn11	5730	5.5	1650	71	1520	1000	1530	1900
<b>1000</b>	10	0.4	Dyn11	8400	6.0	2150	74	1720	1000	1730	2550
	10	0.4	Dyn11	8400	8.0	2150	74	1720	1000	1730	2550
<b>1250</b>	10	0.4	Dyn11	10600	6.0	2250	75	1720	1000	1750	3000
	10	0.4	Dyn11	10600	8.0	2250	75	1720	1000	1750	3000
<b>1600</b>	10	0.4	Dyn11	11300	6.0	3200	76	1950	1080	1980	4300
	10	0.4	Dyn11	12800	8.0	3200	76	1950	1080	1980	4300
<b>2500</b>	10	0.4	Dyn11	16400	6.0	4400	78	2000	1400	2150	5000
	10	0.4	Dyn11	16400	8.0	4400	78	2000	1400	2150	5000

Table 4. With enclosures

Rated power, kVA	Rated high voltage, kV	Rated low voltage, kV	Winding connection/ vector group	Short-circuit loss, W	Short-circuit voltage, %	No-load loss, W	Sound power level, dBA	Length, mm (L)	Width, mm (W)	Height, mm (H)	Weight, kg
<b>100</b>	10	0.4	Dyn11	1800	4.0	600	59	1350	1050	1400	850
<b>160</b>	10	0.4	Dyn11	2550	4.0	700	62	1350	1050	1500	900
<b>250</b>	10	0.4	Dyn11	3000	5.5	900	65	1660	1110	2165	1500
<b>400</b>	10	0.4	Dyn11	3900	5.5	1200	68	1660	1110	2165	1705
<b>630</b>	10	0.4	Dyn11	5730	5.5	1650	71	1750	1220	2130	2160
<b>1000</b>	10	0.4	Dyn11	8400	6.0	2150	74	1950	1220	2130	3150
	10	0.4	Dyn11	8800	8.0	2150	74	1950	1220	2130	3150
<b>1250</b>	10	0.4	Dyn11	10600	6.0	2250	75	1950	1220	2130	3550
	10	0.4	Dyn11	10600	8.0	2250	75	1950	1220	2130	3550
<b>1600</b>	10	0.4	Dyn11	11300	6.0	3200	76	2150	1220	2305	4660
	10	0.4	Dyn11	12800	8.0	3200	76	2150	1220	2305	4660
<b>2500</b>	10	0.4	Dyn11	16400	6.0	4400	78	2260	1620	2420	5500
	10	0.4	Dyn11	16400	8.0	4400	78	2260	1620	2420	5500



Fig.2. Without enclosures

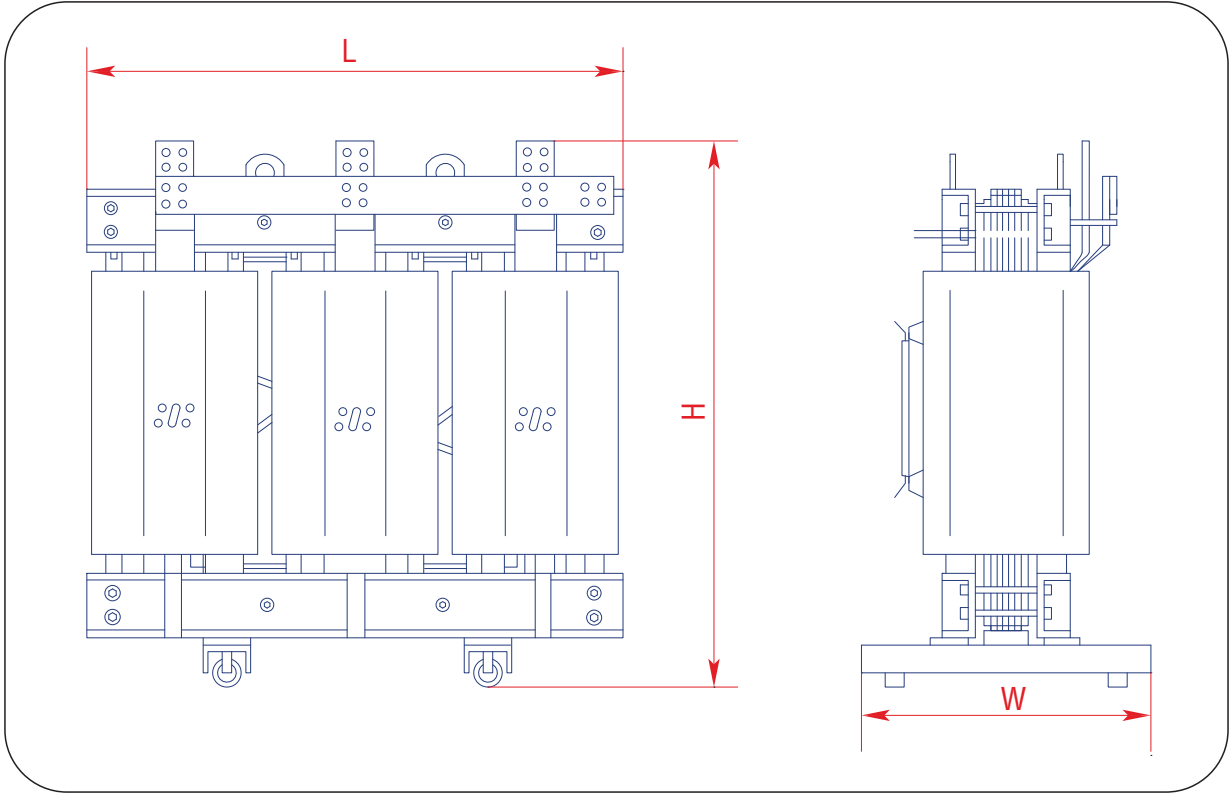
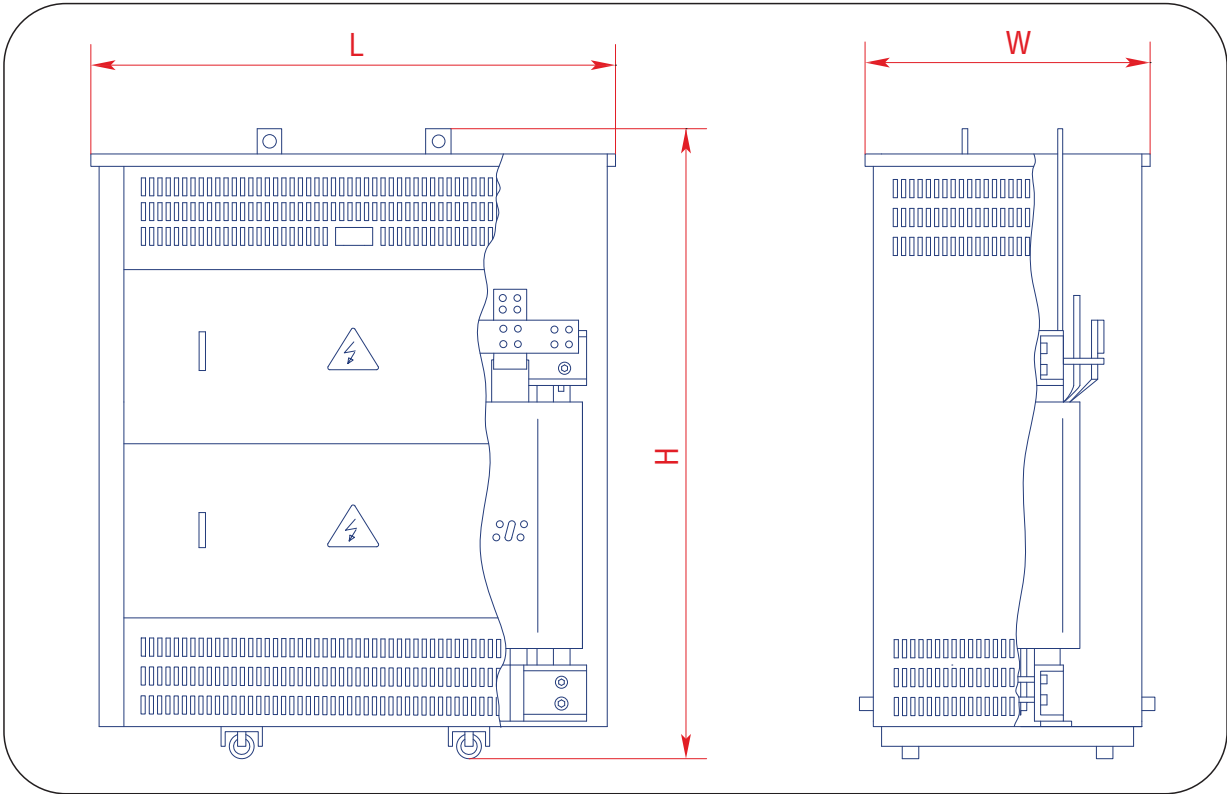


Fig.2. With enclosures



# ORDERING DETAILS

1	Transformer type	2	Rated power			
	_____		_____ kVA			
3	HV rated voltage	4	LV rated voltage			
	_____ kV		_____ kV			
5	Rated frequency	6	Off-load changing at			
	<input type="checkbox"/> 50 Hz <input type="checkbox"/> 60 Hz		<input type="checkbox"/> HV <input type="checkbox"/> LV range _____ steps _____			
7	Short- circuit voltage	8	Short- circuit losses			
	_____ %		_____ W			
9	No-load losses	10	Winding connection/vector group			
	_____ W		_____			
11	Withstand voltage	12	Climatic version and installation category			
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">HV _____ kV</td> <td style="width: 50%;">LV _____ kV</td> </tr> </table>	HV _____ kV	LV _____ kV		_____	
HV _____ kV	LV _____ kV					
13	Protection degree	14				
	IP _____		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">length _____</td> <td style="width: 33%;">width _____</td> <td style="width: 33%;">height _____</td> </tr> </table>	length _____	width _____	height _____
length _____	width _____	height _____				
15	Transformer weight					
	_____ kg					
16	Additional requirements					

Contact person

Phone: \_\_\_\_\_

Name: \_\_\_\_\_

## CONTACTS

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