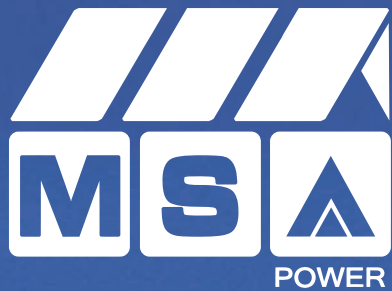




**DISTRIBUTION AND POWER  
TRANSFORMERS**





More than 30 years of know-how and experience is reflected in the transformers made by the ASTOR Group. Our production in Istanbul and Ankara, with around 20.000 Distribution Transformer manufacture capacity per year is based on high-quality production materials, and we place the highest emphasis on first-class workmanship.

Our new Factory Ankara is built in 2011 on a closed area of 40.000 qm. With the Factory in Ankara (on 24.000 qm closed area) MSA has been preferred by customers in over 50 countries.

Under MSA brands, we are producing economical, secure, long productive period, between 25 to 2500 kVA power interval, up to 36 Kv voltage level distribution transformers. Additionally, upon requests from customers, specific transformers might also be produced.

Under our MSA brand, we also produce cast resin dry-type distribution transformers with the options of natural air cooler (AN) or fan cooler (FA), between 25 to 2500 kVA power interval and up to 36 Kv voltage level.

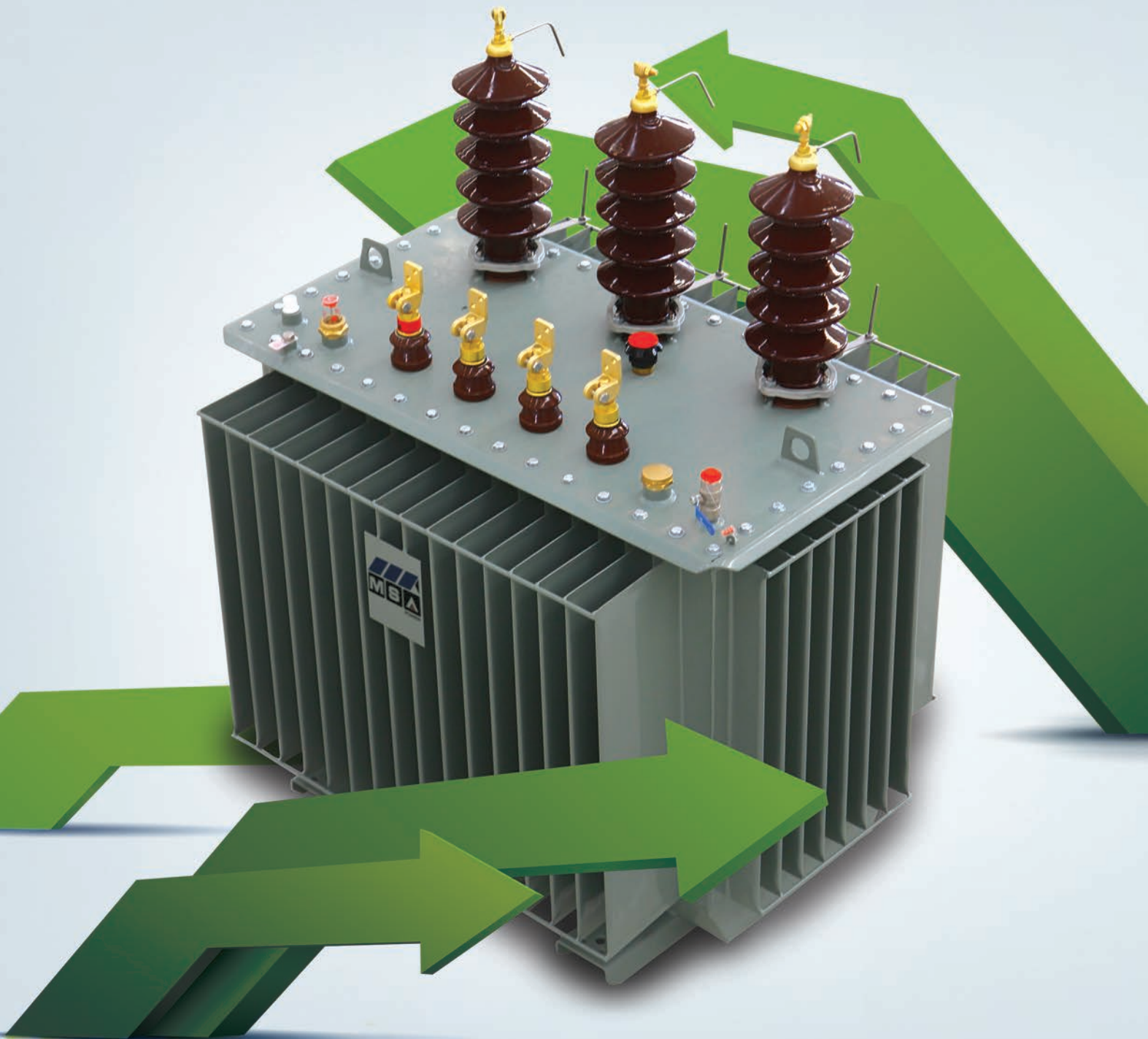
Additionally, our facilities are capable of producing transformers with power levels up to 150 MVA and voltage levels up to 220 kV.

Our main purpose is, to follow the technological improvements and manufacturing high quality products. We are trying to develop and increase our production capacity and satisfaction of the our customers.

We know that in order to improve our company, quality of products should be at the highest point and we should keep it there continously with our expert workers. Our goal is to work synergistically with customers and potential customers. The most important difference of us is we do not only want to sell our products to the other companies in this sector, but also we want to be a part of solution of these companies. Our basic understanding is to consider the customer suggestions and potential problems for obtaining solutions.

ASTOR Group has the ISO 9001-2000 Quality System document and we can be successful not only national and international competition but also giving necessary after sale technical support. Our all activities consider improving / changing customer requirements and the customer satisfaction.

As a result of this, our company name and trade marks are known and reliable in Turkey and internationally.







We are manufacturing distribution transformers with rated capacity ranging between 25 kVA - 3500 kVA and having 36 kV as upper limit and 400 V and the like as lower limit.

We apply routine inspections and tests on each of our transformers manufactured in accordance with IEC 60076 (TS 267) within our facilities

before dispatching to customers. Upon customer's request, we are able to perform typical tests and special tests with our own available means except for the mechanical endurance test against short-circuit which can be done in the overseas test laboratories of the international accredited institutions viz. Cesi/Italy and IPH/Berlin, Germany.







Round or flat electrolytic copper or aluminum conductors with resin or paper insulations are used in the distribution transformers windings as conduction material.

Homogeneous distribution of voltage impulses is obtained by means of applying special winding process to the windings exposed to high temperatures and voltages, and increasing the layer thickness of the insulation at the coil inlet and outlet. Thus abnormal stresses on the windings are prevented.

According to the design specifications, the winding configuration could be folded winding or layer winding in power transformers. In order to facilitate the production of the layer windings and eliminate the gaps on the contact surfaces of windings, horizontally and vertically operating winding (and insulation) machines having press-like system are used.





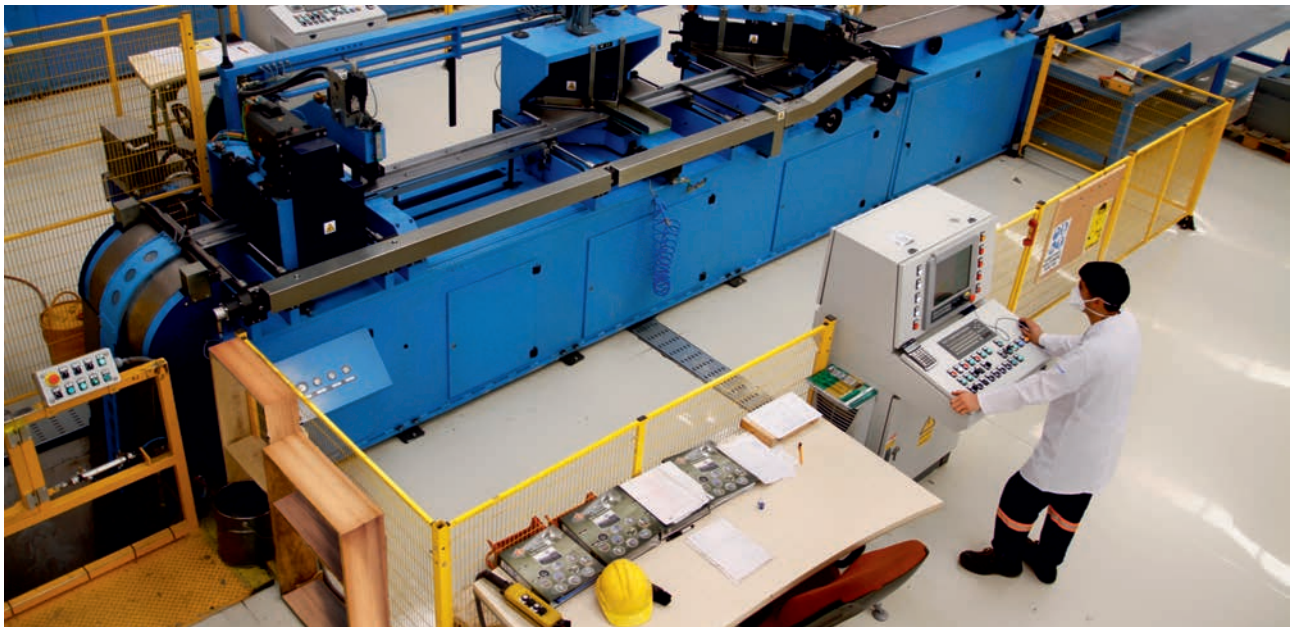


It is of laminated core type and manufactured from silicon alloy sheet steels like M5, M4, M3, MOH and ZDKH with directed crystalline orientation (grain-oriented) and having thicknesses of 0.30 mm, 0.27 mm and 0.23 mm. The sheet steel cut to a mitered form of 45 degrees angle at the section where the magnetic flux passes are slitted into intended shape and stacked with CNC slitting machine and packed to form a magnetic circuit. Cutting and packing operations for magnetic circuit are handled with a

method known as step-lap which reduces iron losses to a minimum. The core is packed by applying step-lap method both crosswise and lengthwise.

The cross sections of leg and connecting cap piece are the same and multisteped and theoretically it is assumed to be round cross section.

Core laminations, U-core and connecting cap piece are so compacted by way of steel studs passing through insulated bushings that the external sight of the them are kept minimum.







Our tanks used to store and keep the cooling and insulation substance in oil type transformers, depending on their available cooling surfaces, are manufactured with corrugated walls for the transformers up to 3150 kVA rated power and equipped with radiator for those greater than 3150 kVA rated power.

CNC plasma shape cutting machine is used in tank production. After finishing the welding works and assembly of tank, it is tested for leakage under pressure in accordance with IEC standards. Tanks with corrugated walls are designed to withstand 0.65 bar vacuum pressure and tanks with radiators are designed to withstand 1 bar vacuum pressure. The finished tanks manufactured in

accordance with the customers' specifications are sandblasted afterwards.

Cover of the tank is designed in such a way that the winding terminals can go out. There are insulators, phase markings, lifting lugs for taking out the active part, thermometer pocket, grounding bushing and supplementary components on the cover of tank.

There is a possibility of coating the tanks with hot-dip galvanizing, when it is particularly requested to do so. Moreover, again upon request, there is another possibility of providing a safeguard made of sheet steel and assembled on the cover in order to cover and protect bushings pursuant to IEC standards.







In our ongoing standard transformer production, a gray colour known as RAL7033 is used as standard, but we can also manufacture with different colours on customers' request. Our transformers which are painted by way

of spilling and spraying methods are primed once and then painted twice on the automated assembly line. Eventually the paint thickness reaches to an extent not less than 105 microns.



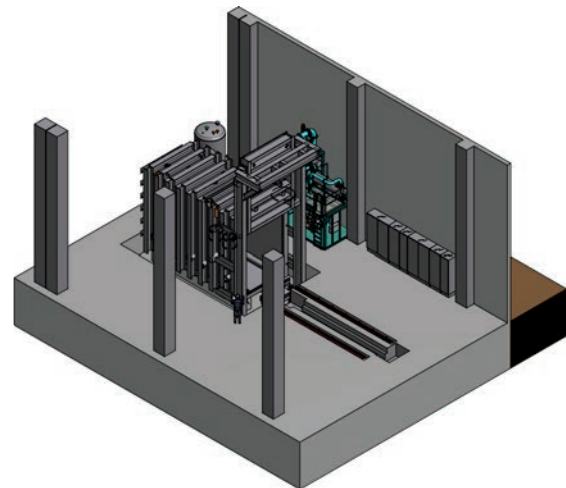
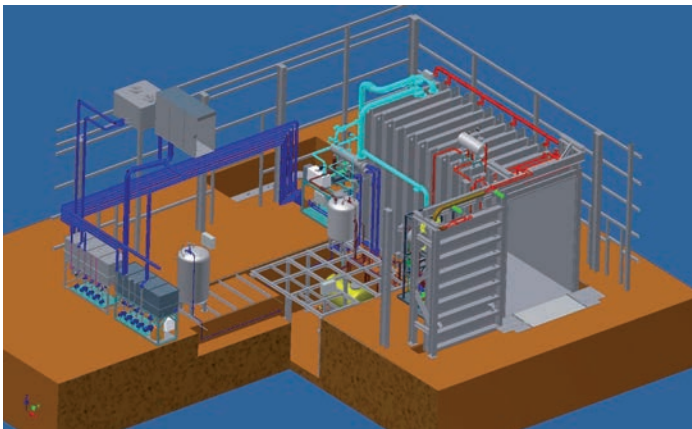






After drying the transformers whose assembly of active part is completed, in the drying furnaces at 120 degrees Celcius are put into tanks and filled with oil in the vacuum chamber. The air entrapped in the transformer tank is removed by the suction effect in the

vacuum chamber and this helps penetrate the insulating oil into the active part thoroughly. The oil filled serves as insulation and coolant. Drying process is accomplished according to a predefined program depending upon the rated voltage and power of the transformer.





### **BUCHHOLZ RELAY**

It is fitted in the connection pipe between the transformer tank and conservator tank in order to monitor and protect transformers and other oil filled electrical equipment from faults arising internally, such as inter turn short circuits in coils and windings and against oil loss. Depending on the type of fault which occurs and the switching device which is actuated by the relay, the relay trips an alarm signal or causes the transformer to switch itself off. Two micro switches are rated at 5 A, 250 VAC or 0.2 A, 250 VDC

### **THE DEHYDRATING BREATHER**

It is a uni-directional breather, where air circulation is controlled by the liquid seal located in the breather. The size of dehydrating breather is determined by the quantity of oil in the transformer.



### **HERMETIC PROTECTING RELAY (DGPT2)**

Preferable for hermetic design. This relay is monitored the discharge of gases, the temperature and the pressure in

the tank. It is used for bigger than 500 kVA power of the transformer. It has got two contacts for each one the discharge gases, the tank pressure and the temperature.





## PRESSURE RELIEF VALVE

Preferable for hermetic design. This valve protects the transformer tank from sudden overpressure surge. It is fitted to the transformer cover and adjusted in such a way that it opens briefly in the event of overpressure and creates a compensation between the pressure inside the tank and outside air pressure then automatically recloses.



## ALCOHOL THERMOMETER

Alcohol thermometer is used in order to only display oil temperature. It is without contact.

## THE OIL THERMOMETERS WITH CONTACTS

It has a maximum indicator in order to display maximum oil temperature, which can be returned to starting position by means of reset button located on the underside of the housing. It has a smooth scale up to 120°C, two micro switches rated at 5 A, 250 VAC or 0.2 A, 250 VDC.



## MAGNETIC OIL LEVEL INDICATOR

The magnetic oil indicator is used in order to display the level of the transformer oil in conservator tank. The transformation of the oil movement to display itself is effected by two permanent magnets which are matched to one another. This oil level indicator depends on the diameter of conservator tank. If required, the level indicator with contacts can be used.





## Test Laboratory Accreditation

Our aim is, to present a complete, accurate, unbiased and repeatable test process to our customers. MSA Test Laboratories are approved by TÜRKAK. By this accreditation; our test laboratories achieved the status to give test service to other companies as an independent laboratory.

MSA Power has the TS EN ISO/IEC 17025:2005 Laboratory Accreditation certificate

## APPLIED TESTS

The following routine and typical tests in compliance with TS 267 (IEC 60076), are applied to the transformers completely assembled and filled with oil after drying process:

### TYPICAL TESTS

- Temperature increase (Heat run test)
- Transformer impulse test — full wave
- Audible noise level measurement
- Tank lifetime test (for hermetically sealed transformers)

- Mechanical endurance test against short-circuit (this test is carried out in test laboratories overseas at CESI/ITALY and IPH/GERMANY)

- All of the tests other than mechanical endurance test against short-circuit are performed in the laboratories of our company.

## ROUTINE TESTS AND INSPECTIONS

- Winding resistances measurement
- Turns ratio measurement
- Polarity or check of polarities and connections
- Short-circuit voltage and measurement of load losses
- No-load current and no-load loss measurement
- Induced voltage test
- Measurement of insulation resistances

## SPECIAL TESTS

- Winding resistances measurement
- Loss angle (td) measurement (DOBLE - Power factor testing)
- Measurement of paint coat thickness



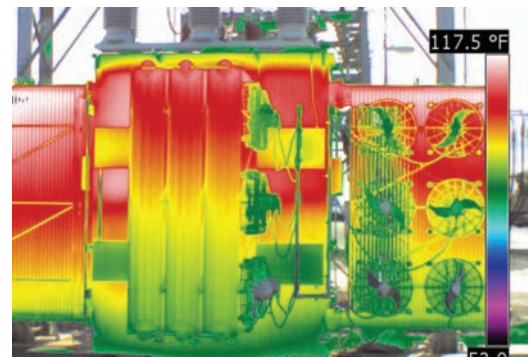
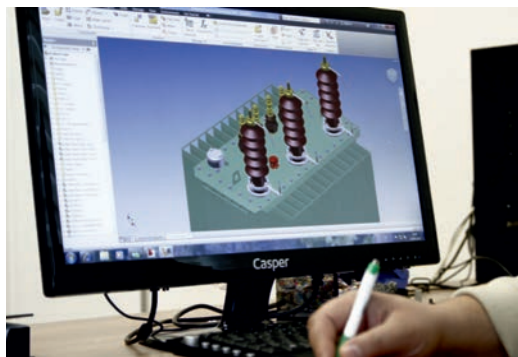


Having moved to the new manufacturing facility in 2012, MSA Power is aiming to increase the competitive advantage of its customers by continuously developing new technologies and empowering the already existing ones within the organization with an eco-friendly approach accompanied with its new factory, investments and corporate identity. Our company has accelerated the R&D activities in order to address the fast-changing requirements of the industry as well as its customers. The R&D activities not only include the studies in the field of electricity but also extend to machinery technologies and production.

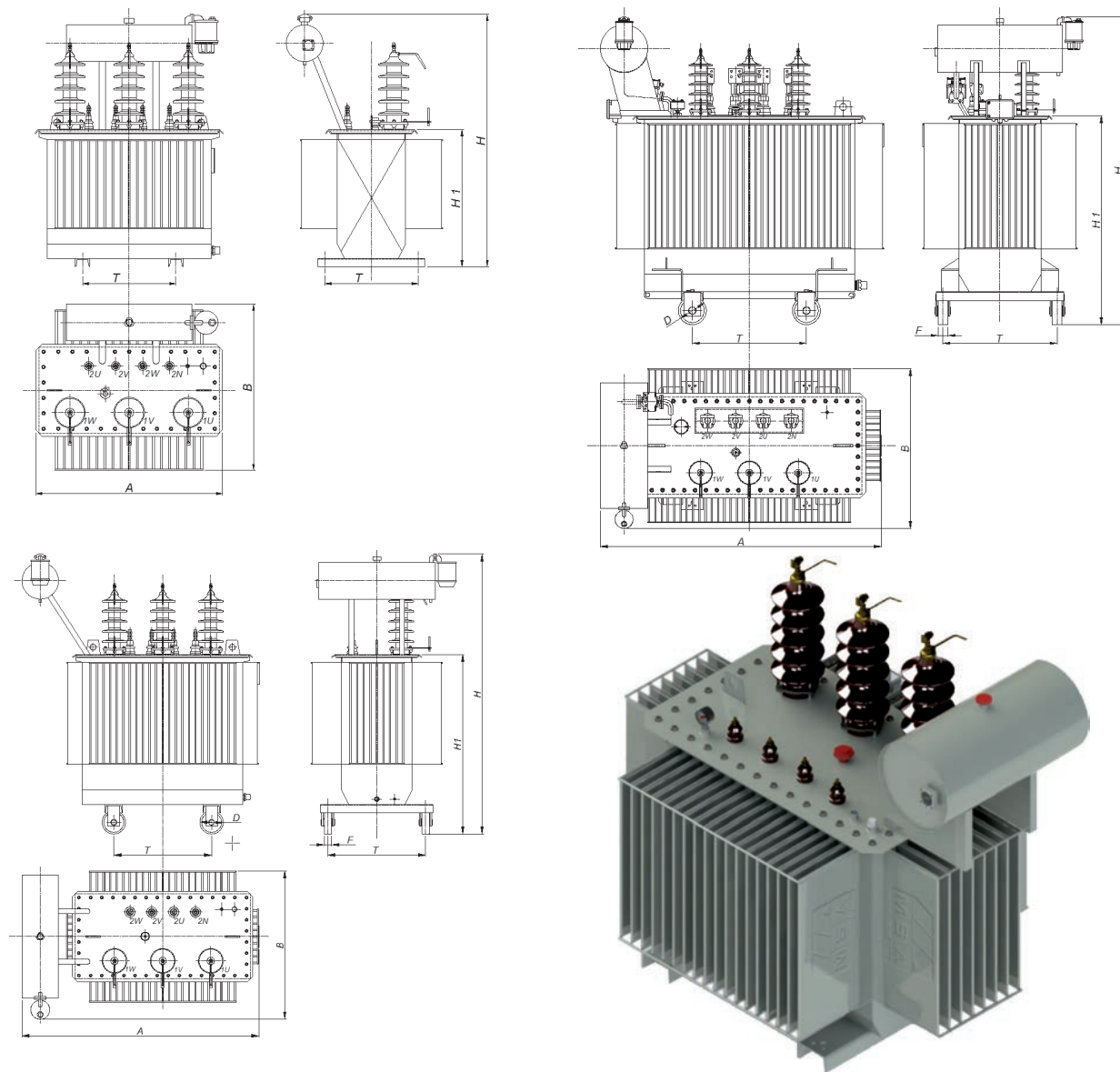
In addition to the in-house R&D

activities, we also have 8 projects, which were granted support by The Scientific and Technological Research Council of Turkey (TUBITAK). Out of these projects, four of them have already been completed and the other four are still in progress. As part of the R&D activities, we are also continuing with software development investments. Our objective is to create a R&D development center using the experience gained from these projects.

We are carrying on our R&D activities with a highly talented and qualified team, keeping in mind its importance both for our company and for our country.



## Three Phase Transformers 25-2500 kVA Design With Conservator Tank





## Three Phase Transformers 25-2500 kVA Design With Conservator Tank

L.V. Rated Voltage 400V

H.V. Rated Voltage up to 15kV

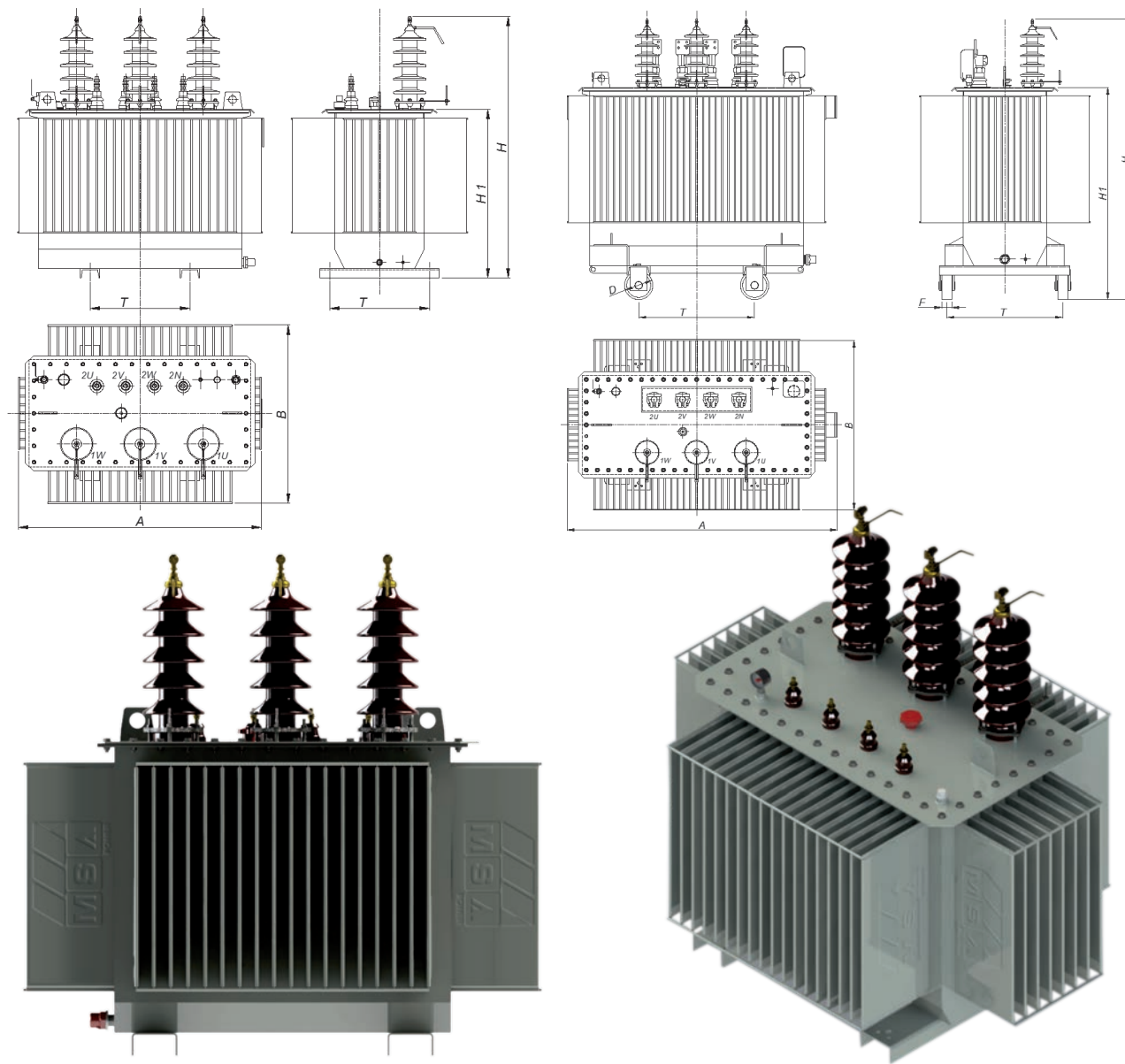
Rated Power	Vector Group	Imp. Voltg.	Losses		No-load Current	Sound Level	Length A	Width B	Hei. H	Height Cov. H 1	Oil Weight	Total Weight	Regulation at Full Load		Efficiency at Full Load	
			Load	No-load									pF=0.8	pF=1.0	pF=0.8	pF=1.0
kVA/Kv	-	%	W	W	%	dB(A)	mm	mm	mm	mm	kg	kg				
25 / 6,3-15	Yzn11	4	850	140	2.4	53	800	700	1100	700	80	370	3.98	3.42	95.29	96.2
40 / 6,3-15	Yzn11	4	960	160	2.3	53	820	700	1130	700	90	400	3.85	2.45	96.62	97.28
50 / 6,3-15	Yzn11	4	1100	190	2.2	55	850	700	1180	750	100	440	3.77	2.26	96.88	97.48
63 / 6,3-15	Yzn11	4	1280	225	2.1	56	880	720	1200	770	120	470	3.7	2.09	97.1	97.67
80 / 6,3-15	Yzn11	4	1500	280	2.1	58	900	720	1220	790	135	500	3.63	1.94	97.29	97.82
100 / 6,3-15	Yzn11	4	1750	320	2	59	950	720	1250	820	160	620	3.57	1.81	97.48	97.97
125 / 6,3-15	Yzn11	4	2050	360	1.9	60	980	800	1270	840	180	700	3.52	1.71	97.65	98.11
160 / 6,3-15	Yzn11	4	2350	460	1.8	62	1100	850	1310	870	240	930	3.43	1.54	97.85	98.27
200 / 6,3-15	Yzn11	4	2850	650	1.8	63	1140	860	1340	900	250	980	3.41	1.49	97.86	98.28
250 / 6,3-15	Dny11	4	3250	650	1.6	65	1450	700	1450	950	340	1250	3.33	1.37	98.09	98.46
315 / 6,3-15	Dny11	4	3900	770	1.5	66	1500	850	1520	990	350	1350	3.3	1.31	98.18	98.54
400 / 6,3-15	Dny11	4	4600	930	1.5	68	1580	850	1450	950	390	1610	3.24	1.22	98.3	98.64
500 / 6,3-15	Dny11	4	5500	1100	1.4	69	1700	950	1700	1120	430	1650	3.2	1.17	98.38	98.7
630 / 6,3-15	Dny11	4	6500	1300	1.4	70	1700	950	1850	1300	520	2250	3.17	1.11	98.48	98.78
800 / 6,3-15	Dny11	6	8500	1500	1.3	71	1900	900	1900	1330	630	2600	3.9	1.28	98.33	98.66
1000 / 6,3-15	Dny11	6	10500	1700	1.2	73	2050	1200	2030	1320	650	3050	4.47	1.22	98.47	98.77
1250 / 6,3-15	Dny11	6	13000	2100	1.2	74	2100	1300	2050	1340	820	3600	4.46	1.21	98.51	98.8
1600 / 6,3-15	Dny11	6	17000	2600	1.1	76	2100	1320	2100	1500	950	4200	4.48	1.24	98.49	98.79
2000 / 6,3-15	Dny11	6	21000	3200	1	77	2250	1280	2200	1530	1100	5050	4.47	1.22	98.51	98.8
2500 / 6,3-15	Dny11	6	24000	3600	0.9	78	2350	1350	2300	1600	1250	5700	4.41	1.14	98.64	98.91

L.V. Rated Voltage 400V

H.V. Rated Voltage up to 30 kV

Rated Power	Vector Group	Imp. Voltg.	Losses		No-load Current	Sound Level	Length A	Width B	Hei. H	Height Cov. H 1	Oil Weight	Total Weight	Regulation at Full Load		Efficiency at Full Load	
			Load	No-load									pF=0.8	pF=1.0	pF=0.8	pF=1.0
kVA/Kv	-	%	W	W	%	dB(A)	mm	mm	mm	mm	kg	kg				
25 / 30	Yzn11	4.5	880	160	3	50	880	750	1250	730	120	420	4.5	3.56	95.06	96.01
40 / 30	Yzn11	4.5	980	190	2.9	50	900	750	1290	740	140	470	4.25	2.52	96.47	97.16
50 / 30	Yzn11	4.5	1250	230	2.7	52	950	800	1320	770	160	490	4.26	2.57	96.43	97.13
63 / 30	Yzn11	4.5	1250	260	2.6	53	980	820	1340	790	180	530	4.03	2.07	97.06	97.66
80 / 30	Yzn11	4.5	1750	320	2.4	54	930	820	1350	810	200	600	4.13	2.26	96.87	97.48
100 / 30	Yzn11	4.5	1950	380	2.2	56	1050	820	1380	830	220	800	4.01	2.03	97.17	97.72
125 / 30	Yzn11	4.5	2400	420	2	57	1050	830	1410	860	240	920	4	2	97.26	97.79
160 / 30	Yzn11	4.5	2550	520	1.9	59	1120	890	1430	880	260	960	3.83	1.68	97.96	98.12
200 / 30	Yzn11	4.5	3500	580	1.8	60	1280	900	1470	920	290	1020	3.91	1.84	97.51	98
250 / 30	Dny11	4.5	3500	780	1.7	62	1500	700	1550	960	370	1290	3.72	1.49	97.9	98.32
315 / 30	Dny11	4.5	5150	850	1.6	63	1550	850	1580	1020	390	1450	3.76	1.55	97.93	98.34
400 / 30	Dny11	4.5	4900	1120	1.6	65	1600	850	1650	1050	430	1650	3.62	1.32	98.15	98.52
500 / 30	Dny11	4.5	6750	1250	1.5	66	1700	1000	1750	1160	450	1700	3.69	1.44	98.04	98.43
630 / 30	Dny11	4.5	6650	1450	1.5	67	1700	1000	1850	1340	640	2350	3.51	1.15	98.42	98.73
800 / 30	Dny11	6	8700	1750	1.4	67	1980	950	2000	1350	740	2750	4.57	1.39	98.28	98.62
1000 / 30	Dny11	6	10500	2000	1.3	68	2080	1150	2050	1300	640	3250	4.47	1.22	98.47	98.77
1250 / 30	Dny11	6	13000	2250	1.3	69	2100	1300	2070	1380	840	3700	4.46	1.21	98.51	98.8
1600 / 30	Dny11	6	17000	2800	1.2	71	2100	1350	2150	1520	1000	4300	4.48	1.24	98.49	98.79
2000 / 30	Dny11	6	21000	3200	1.1	72	2300	1320	2280	1580	1200	5300	4.47	1.22	98.51	98.8
2500 / 30	Dny11	6	24000	3600	1	73	2400	1450	2280	1650	1350	5800	4.41	1.14	98.64	98.91

## Three Phase Transformers 25-2500 kVA Design Hermetically Sealed Type





# technical drawing & tables



## Three Phase Transformers 25-2000 kVA Design Hermatically Sealed Type

L.V. Rated Voltage 400 V

H.V. Rated Voltage up to 15 kV


Rated Power	Vector Group	Imp. Voltg.	Loses		No-load Current	Sound Level	Length A	Width B	Hei. H	Height Cov. H 1	Oil Weight	Total Weight	Regulation at Full Load		Efficiency at Full Load	
			Load	No-load									pF=0,8	pF=1,0	pF=0,8	pF=1,0
kVA/Kv	-	%	W	W	%	dB(A)	mm	mm	mm	mm	kg	kg				
25 / 6,3-15	Yzn11	4	850	140	2.4	53	800	750	1010	700	100	390	3.98	3.42	95.29	96.20
40 / 6,3-15	Yzn11	4	960	160	2.3	53	820	800	1030	700	110	440	3.85	2.45	96.62	97.28
50 / 6,3-15	Yzn11	4	1100	190	2.2	55	850	800	1080	750	120	450	3.77	2.26	96.88	97.48
63 / 6,3-15	Yzn11	4	1280	225	2.1	56	880	820	1120	770	130	470	3.7	2.09	97.1	97.67
80 / 6,3-15	Yzn11	4	1500	280	2.1	58	900	820	1120	790	150	520	3.63	1.94	97.29	97.82
100 / 6,3-15	Yzn11	4	1750	320	2	59	950	820	1160	820	160	650	3.57	1.81	97.48	97.97
125 / 6,3-15	Yzn11	4	2050	360	1.9	60	980	820	1180	840	200	690	3.52	1.71	97.65	98.11
160 / 6,3-15	Yzn11	4	2350	460	1.8	62	1100	850	1220	870	220	930	3.43	1.54	97.85	98.27
200 / 6,3-15	Yzn11	4	2850	650	1.8	63	1140	860	1240	900	240	960	3.41	1.49	97.86	98.28
250 / 6,3-15	Dny11	4	3250	650	1.6	65	1200	850	1360	950	350	1220	3.33	1.37	98.09	98.46
315 / 6,3-15	Dny11	4	3900	770	1.5	66	1250	869	1390	990	370	1340	3.30	1.31	98.18	98.54
400 / 6,3-15	Dny11	4	4600	930	1.5	68	1350	860	1450	1030	400	1590	3.24	1.22	98.3	98.64
500 / 6,3-15	Dny11	4	5500	1100	1.4	69	1500	900	1550	1120	430	1630	3.22	1.17	98.38	98.7
630 / 6,3-15	Dny11	4	6500	1300	1.4	70	1570	900	1750	1300	570	2270	3.17	1.11	98.48	98.78
800 / 6,3-15	Dny11	6	8500	1500	1.3	71	1650	900	1750	1330	630	2650	3.90	1.28	98.33	98.66
1000 / 6,3-15	Dny11	6	10500	1700	1.2	73	1750	1240	1830	1320	670	3100	4.47	1.22	98.47	98.77
1250 / 6,3-15	Dny11	6	13000	2100	1.2	74	1860	1280	1850	1340	850	3650	4.46	1.21	98.51	98.80
1600 / 6,3-15	Dny11	6	17000	2600	1.1	76	1800	1280	1900	1500	920	4120	4.48	1.24	98.49	98.79
2000 / 6,3-15	Dny11	6	21000	3200	1	77	1850	1280	1900	1530	1100	4870	4.47	1.22	98.51	98.80



L.V. Rated Voltage 400V

H.V. Rated Voltage up to 30 kV

Rated Power	Vector Group	Imp. Voltg.	Loses		No-load Current	Sound Level	Length A	Width B	Hei. H	Height Cov. H 1	Oil Weight	Total Weight	Regulation at Full Load		Efficiency at Full Load	
			Load	No-load									pF=0,8	pF=1,0	pF=0,8	pF=1,0
kVA/Kv	-	%	W	W	%	dB(A)	mm	mm	mm	mm	kg	kg				
25 / 30	Yzn11	4.5	880	160	3	50	880	800	1150	730	140	420	4.50	3.56	95.06	96.01
40 / 30	Yzn11	4.5	980	190	2.9	50	900	850	1190	740	160	470	4.25	2.52	96.47	97.16
50 / 30	Yzn11	4.5	1250	230	2.7	52	950	800	1220	770	180	500	4.26	2.57	96.43	97.13
63 / 30	Yzn11	4.5	1250	260	2.6	53	980	850	1240	790	190	530	4.03	2.07	97.06	97.66
80 / 30	Yzn11	4.5	1750	320	2.4	54	930	850	1250	820	210	600	4.13	2.26	96.87	97.48
100 / 30	Yzn11	4.5	1950	380	2.2	56	1050	850	1300	830	220	800	4.01	2.03	97.17	97.72
125 / 30	Yzn11	4.5	2400	420	2	57	1080	850	1310	860	240	910	4.00	2.00	97.26	97.79
160 / 30	Yzn11	4.5	2550	520	1.9	59	1120	890	1330	880	240	990	3.83	1.68	97.96	98.12
200 / 30	Yzn11	4.5	3500	580	1.8	60	1180	900	1380	920	280	1030	3.91	1.84	97.51	98.00
250 / 30	Dny11	4.5	3500	780	1.7	62	1250	850	1450	960	380	1250	3.72	1.49	97.9	98.32
315 / 30	Dny11	4.5	5150	850	1.6	63	1300	860	1450	1020	390	1400	3.76	1.55	97.93	98.34
400 / 30	Dny11	4.5	4900	1120	1.6	65	1450	860	1510	1040	440	1670	3.62	1.32	98.15	98.52
500 / 30	Dny11	4.5	6750	1250	1.5	66	1580	950	1600	1160	470	1750	3.69	1.44	98.04	98.43
630 / 30	Dny11	4.5	6650	1450	1.5	67	1600	950	1810	1340	640	2350	3.51	1.15	98.42	98.73
800 / 30	Dny11	6	8700	1750	1.4	67	1750	960	1850	1350	740	2800	4.57	1.39	98.28	98.62
1000 / 30	Dny11	6	10500	2000	1.3	68	1780	1150	1850	1400	740	3200	4.47	1.22	98.47	98.77
1250 / 30	Dny11	6	13000	2250	1.3	69	1900	1300	1900	1380	880	3720	4.46	1.21	98.51	98.80
1600 / 30	Dny11	6	17000	2800	1.2	71	1850	1320	1950	1520	1050	4400	4.48	1.24	98.49	98.79
2000 / 30	Dny11	6	21000	3200	1.1	72	1920	1320	1980	1680	1200	5100	4.47	1.22	98.51	98.8



  
**POWER**

<p><b>No-load losses performance</b> Minera oil-immersed transformers according to EN 50464-1</p> <p></p> <p><b>Yüksüz kayıp performansı</b> Mineral yağ soğutmalı trafolar EN 50464-1'e göre</p>	<p><b>Load losses performance</b> Minera oil-immersed transformers according to EN 50464-1</p> <p></p> <p><b>Yükte kayıp performansı</b> Mineral yağ soğutmalı trafolar EN 50464-1'e göre</p>
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# AoAk transformers



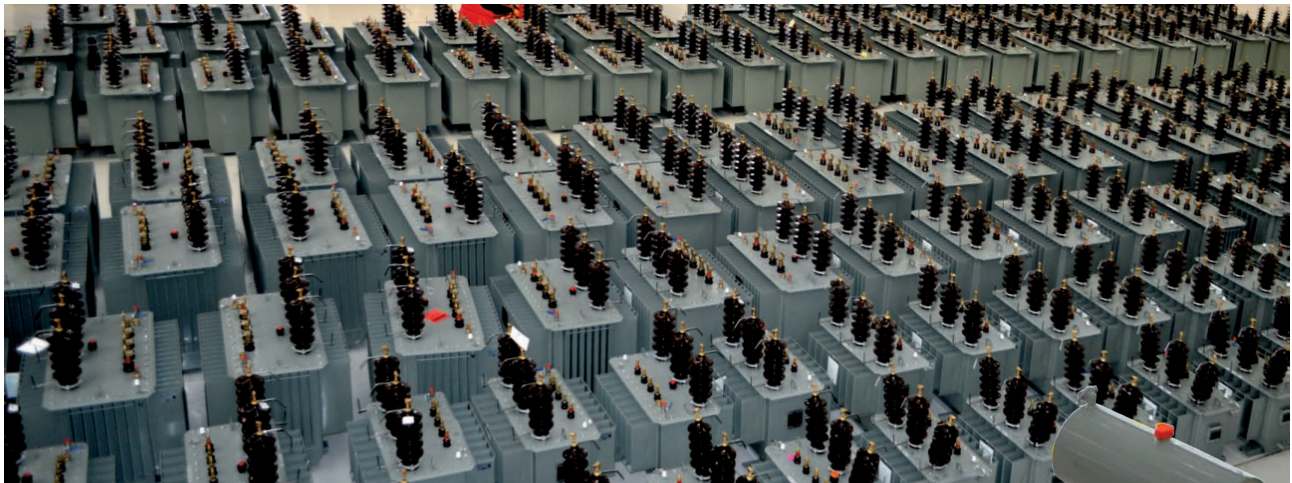
## **Standards**

*These transformers comply with standards:*

•EN50464-1

•EN60076-1 to 10

*Mineral oil-immersed, 50 Hz, three-phase distribution transformers.*





electrical characteristics				
rated power (kVA)		50	100	160
rated voltage	primary	36 kV		
	secondary at no-load	400 to 433 V between phases, 231		
rated insulation level <sup>(1)</sup>	primary	36 kV		
MV tapping range (off-circuit)		± 2,5 % and/or ± 5 %		
vector group		Yzn 11 (50 kVA version only)	Dyn 11	
losses (W)	no-load	160	270	390
	due to load at 75°C	1050	1650	2150
	combination of losses according to EN 50464	AoAk	AoAk	AoAk
rated impedance voltage (%)		4,5	4,5	4,5
no load current (%)		2,16	1,76	1,52
at full load (%)	P.F.=, 0,8	4,0865	3,8598	3,6864
efficiency (%)	100% P.F.=, 1	0,9764	0,9812	0,9844
	load P.F.=, 0,8	0,9706	0,9766	0,9805
	75% P.F.=, 1	0,9804	0,9843	0,9868
	load P.F.=, 0,8	0,9756	0,9804	0,9836
noise	acoustic power LWA	50	54	57

electrical characteristics						
rated power (kVA)		50	100	160	250	
rated voltage	primary		15 and/or 20 kV			
	secondary at no-load		400 to 433 V between phases, 231 to 250 V phase to			
rated insulation level (1)	primary		17,5 kV for 15 kV			
			24 kV for 20 kV			
MV tapping range (off-circuit)	± 2,5 % and/or ± 5 %					
vector group			Yzn 11 (50 kVA version only) Dyn 11			
losses (W)	no-load		125	210	300	425
	due to load at 75°C		875	1475	2000	2750
	combination of losses according to EN 50464		COBk	COBk	COBk	COBk
rated impedance voltage (%)			4	4	4	4
no load current (%)			1,5	1,5	1,4	1,3
efficiency (%)	100% P.F=, 1		98,04	98,34	98,58	98,75
	load P.F=, 0,8		97,56	97,94	98,23	98,44
	75% P.F=, 1		98,38	98,63	98,83	98,96
	load P.F=, 0,8		97,98	98,3	98,54	98,7
noise	acoustic power LWA		47	49	52	55
level dB(A)(2)	acoustic pressure LPA at 1 m		38	41	43	45

(1) reminder of insuation levels:



250	400	630	800	1000	1250	1600	2000	2500
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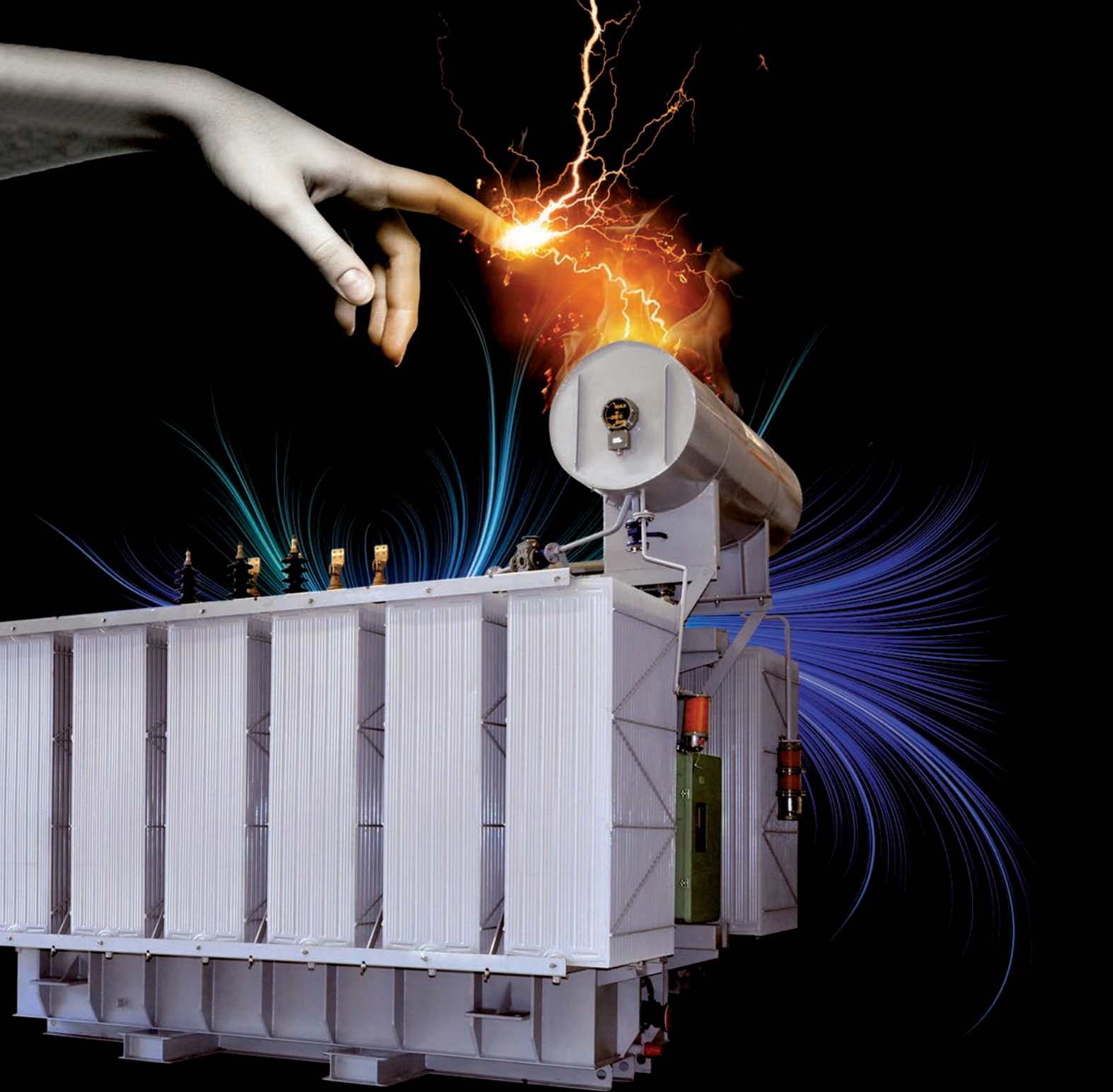
to 250 V phase to neutral								

550	790	1100	1300	1450	1750	2200	2700	3200
3000	4150	5500	7000	8900	11500	14500	18000	22500
AoAk	AoAk	AoAk	AoAk	AoAk	AoAk	AoAk	AoAk	AoAk
4,5	4,5	4,5	6	6	6	6	6	6
1,36	1,28	1,2	1,12	1,04	1,04	0,96	0,88	0,88
3,6	3,4987	3,3923	4,3507	4,3609	4,3813	4,3719	4,3677	4,2793
0,986	0,9878	0,9896	0,9897	0,9898	0,9895	0,9897	0,9898	0,9898
0,9826	0,9848	0,9871	0,9872	0,9872	0,9869	0,9871	0,9872	0,9873
0,9882	0,9897	0,9912	0,9913	0,9915	0,9913	0,9914	0,9915	0,9916
0,9853	0,9871	0,989	0,9892	0,9894	0,9892	0,9893	0,9894	0,9895
60	63	65	66	67	68	69	71	73

315	400	500	630	630	800	1000	1250	1600	2000	2500
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neutral										

520	610	720	860	800	930	1100	1350	1700	2100	2500
3250	3850	4600	5400	5600	7000	9000	11000	14000	18000	22000
COBk	COBk	COBk	COBk	COBk	COBk	COBk	COBk	COBk	COBk	COBk
4	4	4	4	6	6	6	6	6	6	6
1,3	1,2	1,2	1,1	1,1	1,1	1	1	1	1	1
98,82	98,9	98,95	99,02	98,99	99,02	99	99,02	99,03	99	99,03
98,53	98,63	98,69	98,77	98,75	98,78	98,75	98,78	98,79	98,76	98,76
99,02	99,08	99,13	99,18	99,17	99,2	99,19	99,2	99,21	99,19	99,21
98,77	98,86	98,91	98,98	98,97	99	98,98	99	99,01	98,99	99,02
57	58	59	60	60	61	63	64	66	68	71
47	48	49	50	50	50	52	52	54	56	59





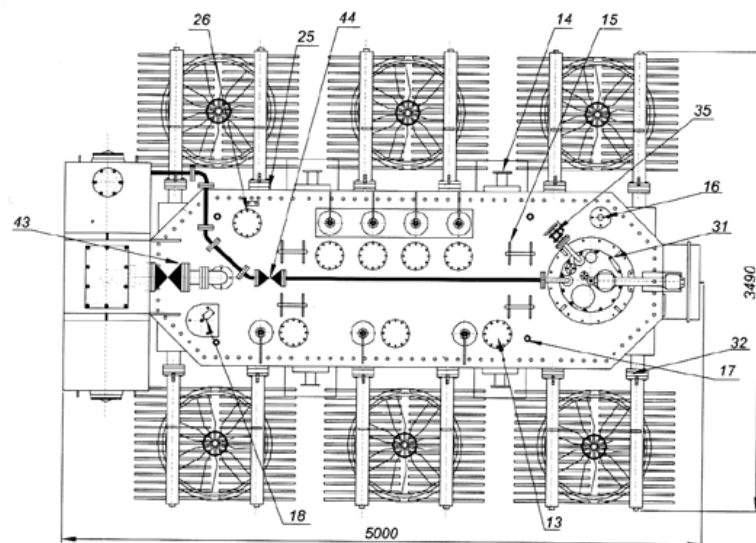
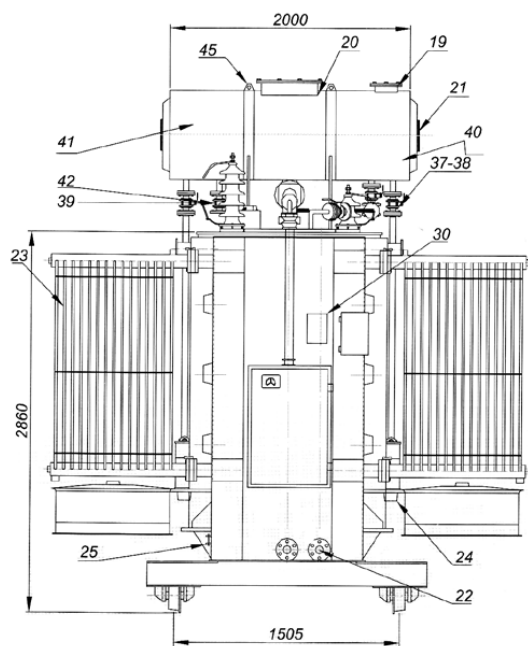
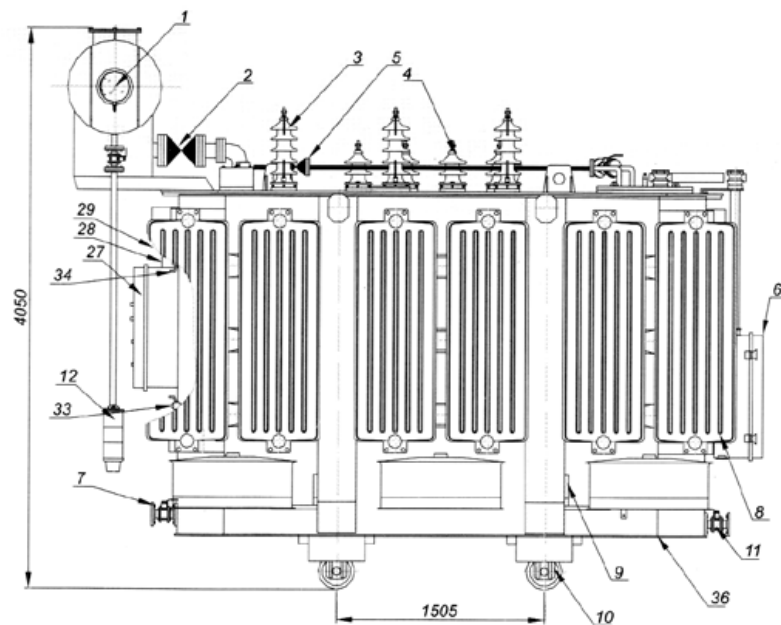
# power transformers



We are manufacturing power transformers with rated capacity ranging between 3.500 kVA - 100.000 kVA. We are responding to customers'

demands without a moment's delay with our engineering staff well experienced on power transformers.





1. Oil Level Indicator (Transformer)
2. Buchholz Relay (Transformer)
3. H.V. Bushings
4. L.V. Bushings
5. Buchholz Relay (On-Load Tap Changer)
6. Motor Drive Unit
7. Oil Refination Valve (Bottom)
8. Cooling Fans
9. Jack Basis
10. 90° Orientable Wheels
11. Oil Drain Valve
12. Dehydrating Breather (Transformer)
13. Survey Holes
14. Transformer Tank Crane Lifting
15. Active Part Crane Lifting
16. Vacuum Valve
17. Thermometer Pocket
18. Pressure Safety Valve
19. Expansion Reservoir Cover (On-Load Tap Changer)
20. Expansion Reservoir Cover (Transformer)
21. Oil Level Indicator (On-Load Tap Changer)
22. Oil Refination Valve (Top)
23. Radiators 15/1000
24. Dehydrating Breather (On-Load Tap Changer)
25. Earthing Terminals
26. Earthing Survey Hole
27. Fan Control Panel
28. Thermometer with double contact
29. Fan Control Thermometer
30. Power Plate
31. On-Load Tap Changer
32. Radiator Butterfly Gates
33. Valve To Take Sample (Bottom)
34. Valve To Take Sample (Top)
35. Pressure Relay (On-Load Tap Changer)
36. Transformer Pulling Slot
37. Oil Filling Valve of On-Load Tap Changer
38. Oil Drain Valve of On-Load Tap Changer
39. Oil Drain Valve of On-Load Tap Changer
40. Oil Expansion Reservoir of On-Load Tap Changer
41. Oil Expansion Reservoir of Transformer
42. Oil Filling Valve of Transformer
43. Buchholz Butterfly Gates (Transformer)
44. Buchholz Butterfly Gates (On-Load Tap Changer)
45. Oil Expansion Reservoir Crane Lifting





In our research and development department, we are working on many projects regarding out-of-ordinary transformer designs.

Our company is well on its way on becoming a global brand with its machinery park equipped with high technology and professional production staff and technical assistance personnel.

A leader and pioneer in the quality of

service and products provided, ready for international competition, eager to use the highest technology and newest manufacturing techniques and environment-friendly MSA Power, without compromising from its work ethics, evaluates success based on the content of its clients. It provides fast, competitive products that meet their clients' expectations with a dynamic teamwork.







Turkey



Poland



Germany



Yemen



Syria



Ireland



Spain



Malta



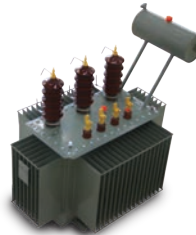
Bulgaria



Greece



Netherlands



Kosovo



Romania



Serbia



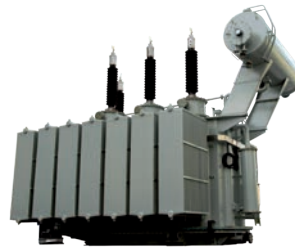
Belgium



U.Kingdom



Azerbaijan



Denmark



Turkmenistan



Saudi Arabia



Kazakhstan



Iran







Georgia



Russian Federation



Lebanon



Kyrgyzstan



Tanzania



Tajikistan



Ethiopia



Afghanistan



Rep. Of Congo



Libya



Madagascar



Egypt



Sierra Leone



Mozambique



Djibouti



Nigeria



Côte d'Ivoire



Sudan



Palestine



Jordan



Senegal



South Africa



## export

MSA Power, exports 60% of its products to over forty countries, some of which being Turkey, Poland, Denmark, Germany, Spain, Bulgaria, Romania, Ireland, Malta, Greece, Kosovo, Serbia, United Kingdom, Belgium, Netherlands, Iran, Yemen, Azerbaijan, Turkmenistan, Kazakhstan, Saudi Arabia, Syria, Jordan, Lebanon, Palestine, Afghanistan, Tajikistan, Kyrgyzstan, Russian Federation, Nigeria, Libya, Tanzania, Ethiopia, Senegal, Egypt, Djibouti, Sierra Leone, Madagascar, Mozambique, South Africa, Côte d'Ivoire, Rep. Of Congo, Sudan and Georgia.



## quality

With a grounded Quality Management System, MSA Power is both ISO 9001, ISO 14001 and ISO 18001 Quality Management System certified. Our company is well on its way on becoming a global brand with its machinery park equipped with high technology and professional production staff and technical assistance personnel.

A leader and pioneer in the quality of service and products provided, ready for international competition, eager to use the highest technology and newest manufacturing techniques and environment-friendly MSA Power, without compromising from its work ethics, evaluates success based on the content of its clients. It provides fast, competitive products that meet their clients' expectations with a dynamic teamwork.









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