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ULUSOY OIL TYPE TRANSFORMER

EATON

Powering Business Worldwide




Energizing a world that demands more.

We deliver:

- **Electrical solutions** that use less energy, improve power reliability and make the places we live and work safer and more comfortable
- **Hydraulic and electrical solutions** that enable machines to deliver more productivity without wasting power
- **Aerospace solutions** that make aircraft lighter, safer and less costly to operate, and help airports operate more efficiently
- **Vehicle drivetrain and powertrain solutions** that deliver more power to cars, trucks and buses, while reducing fuel consumption and emissions

Discover today's Eaton.

Powering business worldwide

As a global power management company, we help customers worldwide manage the power needed for buildings, aircraft, trucks, cars, machinery and businesses.

Eaton's innovative technologies help customers manage electrical, hydraulic and mechanical power more reliably, efficiently, safely and sustainably.

We provide integrated solutions that help make energy, in all its forms, more practical and accessible.

With 2019 sales $21.4 billion, Eaton has approximately 95.000 employees around the world and sells products in more than 175 countries.

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Powering Business Worldwide

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Introduction

Eaton Ankara manufactures oil type distribution transformers in accordance with national / international standards and customer requirements with a power range from 25kVA to 10MVA and a maximum voltage level of 36kV. Requests greater than 5000kVA should be evaluated on a project basis. Our transformer product groups are manufactured and tested in our factory in accordance with IEC 60076 standards.

Eaton Ankara designs and manufactures customized transformers according to customer requirements and global standards using state-of-the-art machinery.

Standards

Oil type transformers are manufactured in accordance with the following national and international standards:

- TS EN
- IEC
- IEEE
- CENELEC EN
- DIN EN 50588-1

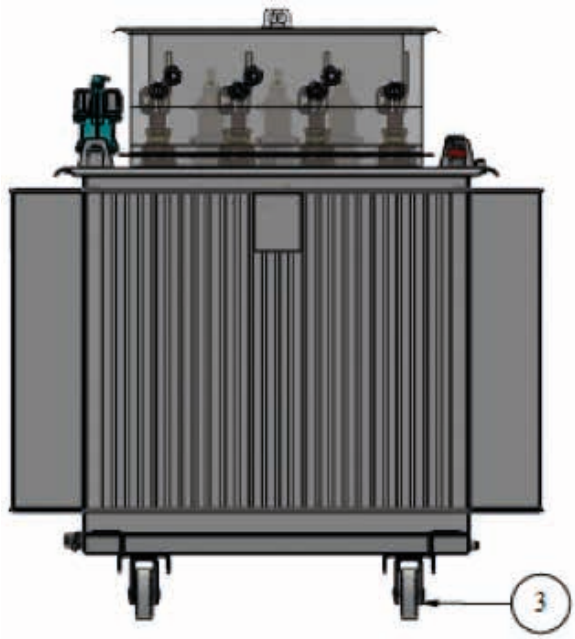
Products

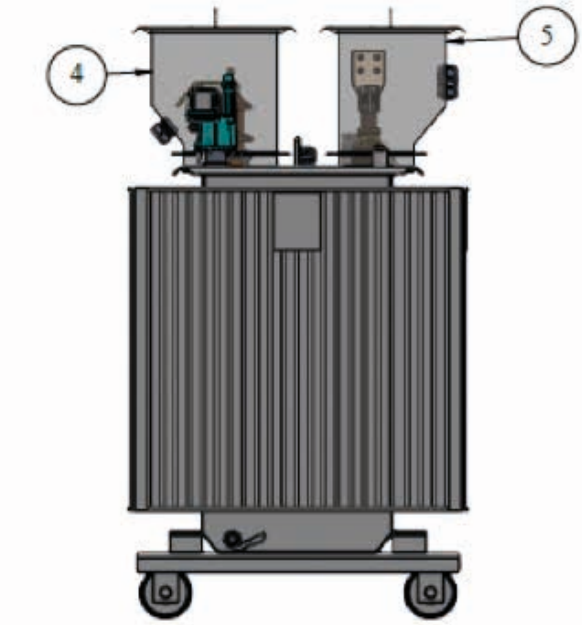
- Distribution Transformer
- Solar Power Plant Transformer
- Wind Turbine Transformer
- Earthing Transformer
- Dual Voltage Transformer
- Rectifier Transformer
- Starting Transformer
- Autotransformer
- Shunt Reactor
- Serial Reactor Limiting Short Circuit Current
- Multi Winding Transformer

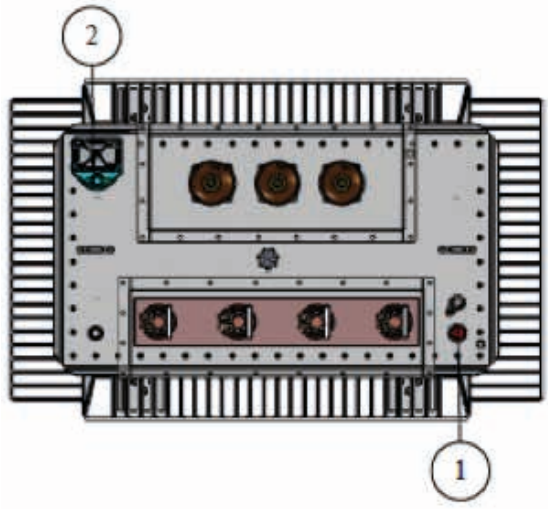
Rated frequency	Hz	As per request
Rated power	kVA	Up to 5000kVA (Requests greater than 5000kVA are evaluated on a project-by-project basis)
Rated voltages		
Average voltage winding	kV	Up to 36kV
Low voltage winding	V	As per request

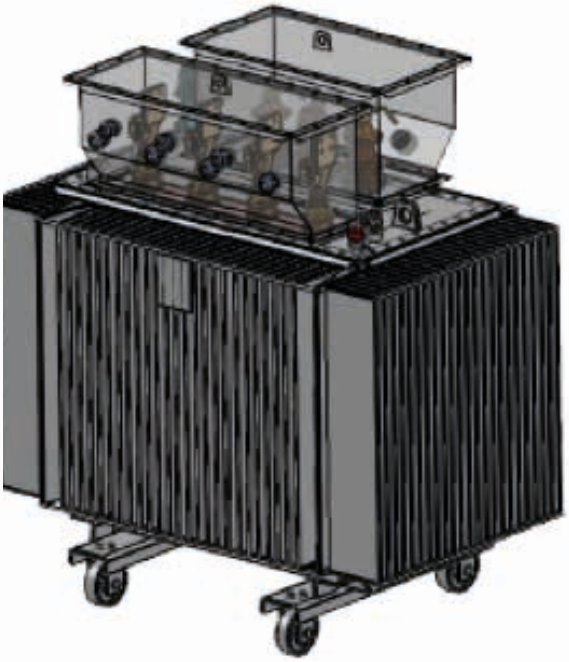
Parts

- **Hermetic Type Transformer**



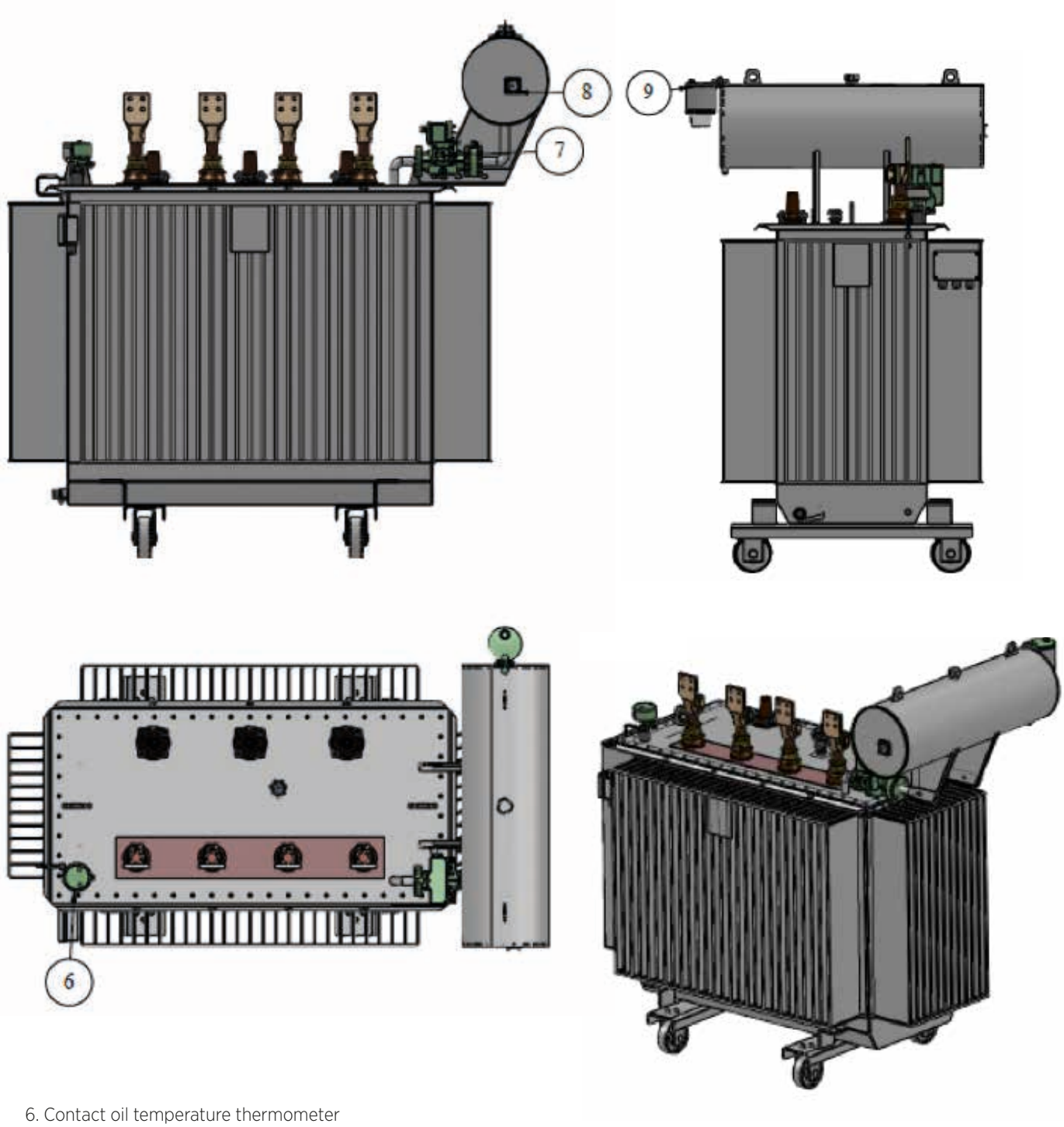






1. Pressure relief valve
2. Hermetic protection relay
3. Wheels
4. High voltage cable box
5. Low voltage cable box

• **Storage Type Transformer**



6. Contact oil temperature thermometer
7. Buchholz relay
8. Magnetic oil level indicator
9. Dehumidifier

Accessories

Pressure Relief Valve

A pressure relief valve is a preferred circuit element in hermetic designs. It protects the transformer tank in case of sudden pressure increase. It is mounted on the cover. If the tank is exposed to the internal pressure to which the valve is set, the valve opens and allows the oil to drain, compensates for the pressure, and prevents the body from rupturing. Contact use is optional.

Hermetic Protection Relay

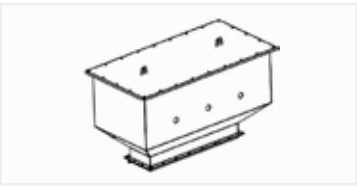
Hermetic protection relays are used in hermetic transformers. The relay shows gas discharge, oil temperature and internal pressure in the body. These relays are generally used in transformers larger than 500 kVA. There are two contacts on the relay for each of the following: gas discharge, boiler pressure and oil temperature. It provides alarm and trip warnings according to the set limit values.

Wheels

Wheels strong enough to bear the transformer weight are available in various diameters and shipped with the transformer as per customer request.

High Voltage Cable Box

This is a mechanical enclosure that protects the transformer's high voltage bushing connections from the environment. It can be designed in accordance with various IP classes as per customer request.



Low Voltage Cable Box

This is a mechanical enclosure that protects the transformer's low voltage bushing connections from the environment. It can be designed in accordance with various IP classes as per customer request.

Contact Oil Temperature Thermometer

There is an indicator showing the maximum temperature reached by the oil in the transformer. It can be reset with the button at the bottom. Oil temperatures of up to 120°C can be measured. It operates via a contact. The electrical value of micro switches can be set as 5A, 250 VAC or 0.2A, 250 VDC.

If the transformer's oil temperature needs to be measured without using a contact, a dial type thermometer should be used.

Buchholz Relay

The Buchholz relay is connected with pipes between the transformer tank and the oil expansion tank. It is used in the transformer to monitor gas and oil movements. It provides warnings in case of failures that cause small gas accumulations, sudden oil fluctuations and oil leaks within the transformer.

Magnetic Oil Level Indicator

The magnetic oil level indicator allows the oil level in the oil expansion tank to be monitored. The oil level is displayed with a magnetically coupled float to indicate when the transformer oil requires changing. Contact oil level indicators can be used as per customer request.

Dehumidifier

When the oil volume changes, the dehumidifier connected to the oil expansion tank traps moisture in the air that passes through it, preventing moisture from entering the oil. The size of the dehumidifier depends on the amount of oil.

Oil Type Transformer Manufacturing Technology

Windings

Windings are manufactured with the latest technology and fully automated machines. Electrolytic copper or aluminum conductors are used in low voltage and high voltage windings in accordance with standards and as per customer request. Windings are divided into low voltage and high voltage windings.

Types of conductors according to the voltage level and the load loss value:
-In low voltage coils: foil (sheet metal) or paper insulated rectangular section
-In high voltage coils: round or rectangular conductors with enamel or paper insulation.

Resin-coated DDP (Diamond Dotted Presspaper) with high-impact and electrical resistance and specially produced Kraft paper are used as insulation materials in windings. In high voltage windings, graded insulation is provided with edge strips and floor seals. This results in more compact coils with higher impulse resistance. Radial and axial clamps are applied to the coils to prevent short circuit forces.

Core

The transformer core is composed of cold rolled electrons with high magnetic permeability siliconized sheets (CRGO).

Sheet types are selected according to the desired idle loss value.

Sheet metal is cut quickly to avoid burrs on high precision machines and are stacked using the step-lap method to minimize losses and noise.

Active Part

The active part is created by placing the coils concentrically on the core legs and the upper core arrangement. Chocks and clamping devices hold the coils in place. Cover, terminal and tap changer connections should be made ready for the first preliminary tests.

Positioning of insulators, accessories and other equipment on the cover is in accordance with customer requests.

Tank — Paint

Tanks are available in two types: radiator and corrugated wall. The top and bottom of the tank bottom are made of mild steel. Corrugated walls that form the front and side surfaces of the tank also form the transformer cooling surface.

The front and side surfaces of the radiator tank type are also made of steel sheet metal.

Boiler welds are leak-proof. When tank production is complete, it is tested for leakage.

Tanks are cleaned and dried with sanding and special chemicals before painting. Top coat paint colors RAL7033 - RAL9006 are used (all RAL colors can be changed as per customer request). The inner surface of the tank can be covered with lacquer as per customer request.

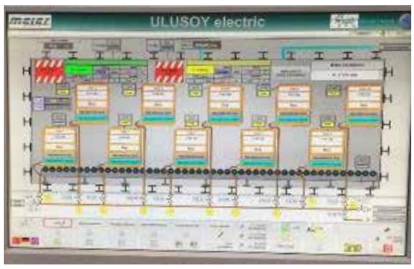
Corrosion classes are specified in the table on page 8. Transformers in the desired corrosion class can be produced as per customer request.

*Upon customer request, it can be hot-dip galvanized for use at the seaside and in humid climates.

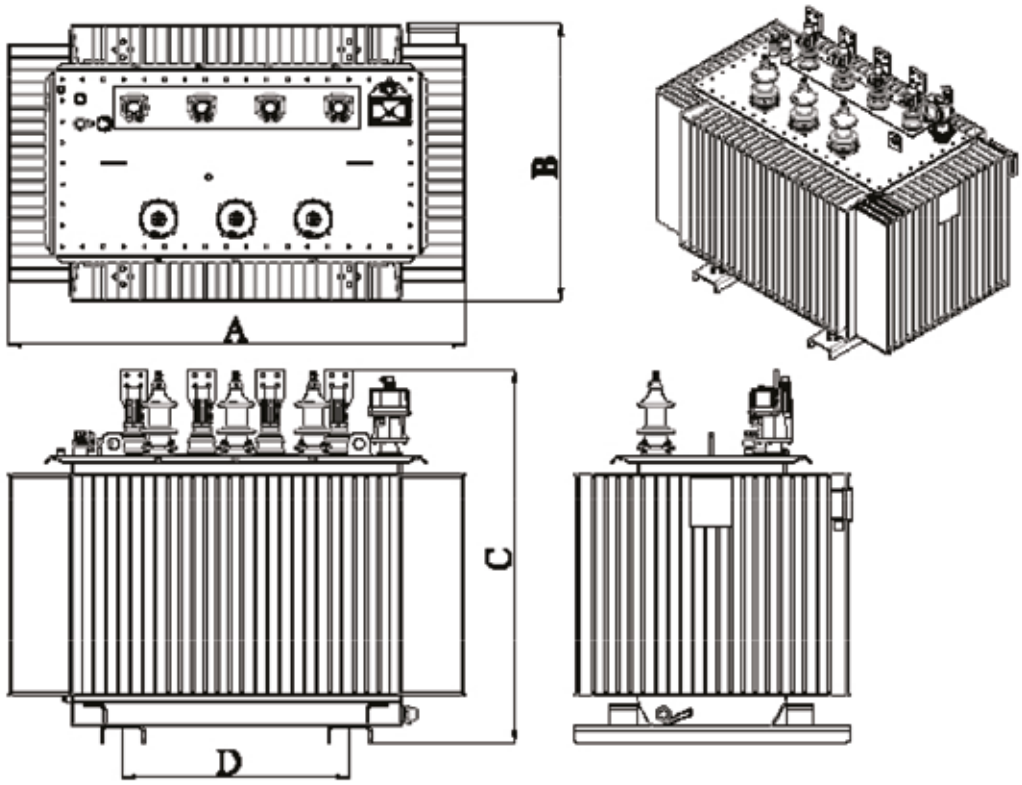
Corrosion Category	*Examples of Suitable Environmental Conditions in Temperate Climate (for Informational Purposes)*	
	Open Spaces	*Closed Spaces*
C1	-	Ventilated and heated buildings E.g.: offices, stores, schools, hotels, etc.
C2	Low pollution and mostly rural areas	Unheated buildings where condensation may occur. E.g.: warehouses, gyms, etc.
C3	Urban and industrial environments, areas where a certain degree of sulfur dioxide pollution is present, seaside areas with low salinity, etc.	Manufacturing rooms with a certain amount of air pollution and high humidity. E.g.: food production factories, laundries, breweries, dairy farms, etc.
C4	Industrial and marine areas with a certain degree of salinity, etc.	Buildings and areas with constant condensation and heavy pollution, etc.
C5-I	Industrial areas, etc., with aggressive atmospheric conditions and excessive humidity.	Buildings or areas with constant condensation and pollution, etc.
C5-M	Coastline and high sea areas with high salinity, etc.	Buildings and areas with constant condensation and heavy pollution, etc.

Drying and Oil Filling

In oil type transformers, the insulation materials used must be dried before oil filling. This drying process directly affects the quality of the transformer. Two drying methods are used for this process. The first is low frequency heating (LFH) vacuum drying where the drying and filling process occurs under a maximum vacuum pressure of 0.1mbar. The second is classical hot air drying. These processes reduce moisture to a minimum in both the tank's active part and in the oil.



Technical Information



Ecodesign EU No. 548/2014 (Tier 1) AL-AL.

Voltage (kV)	Power (kVA)	Idle Loss (W)	Load Loss (W)	Short Circuit (%)	Noise Level (dB)	Length A (mm)	Width B (mm)	Height C (mm)	Distance Between Wheels D (mm)	Oil Weight (kg)	Active Part Weight (kg)	Total Weight (kg)
7.2 - 12	25	70	900	4	37	830	610	1050	520	90	190	330
	50	90	1100	4	39	830	620	1090	520	110	280	440
	100	145	1750	4	41	910	650	1240	520	150	420	640
	160	210	2350	4	44	990	690	1240	520	180	530	790
	250	300	3250	4	47	1110	850	1240	520	240	740	1120
	315	360	3900	4	49	1130	870	1300	670	260	840	1260
	400	430	4600	4	50	1170	830	1490	670	290	950	1420
	500	510	5500	4	51	1210	870	1520	670	320	1070	1620
	630	600	6500	4	52	1270	890	1560	670	360	1260	1880
	800	650	8400	6	53	1390	930	1570	820	430	1410	2160
	1000	770	10500	6	55	1470	950	1680	820	520	1660	2550
	1250	950	1100	6	56	1570	970	1810	820	610	2150	3200
	1600	1200	14000	6	58	1590	990	1970	820	680	2310	3500
	2000	1450	18000	6	60	1650	1070	2010	1000	840	2660	4260
	2500	1750	22000	6	63	1930	1090	2090	1000	1040	3120	5120
	3150	2200	27500	6	64	2150	1070	2210	1070	1350	4100	6540

Dimensions and weights are approximate. May vary by order.

Voltage (kV)	Power (kVA)	Idle Loss (W)	Load Loss (W)	Short Circuit (%)	Noise Level (dB)	Length A (mm)	Width B (mm)	Height C (mm)	Distance Between Wheels D (mm)	Oil Weight (kg)	Active Part Weight (kg)	Total Weight (kg)
17.5 - 24	25	70	900	4	37	870	610	1140	520	100	200	350
	50	90	1100	4	39	850	620	1220	520	120	300	470
	100	145	1750	4	41	930	670	1290	520	160	440	660
	160	210	2350	4	44	1050	690	1290	520	200	600	890
	250	300	3250	4	47	1150	850	1350	520	250	770	1170
	315	360	3900	4	49	1170	830	1390	670	280	850	1280
	400	430	4600	4	50	1210	830	1590	670	310	980	1480
	500	510	5500	4	51	1230	890	1620	670	340	1150	1730
	630	600	6500	4	52	1290	910	1690	670	390	1350	1990
	800	650	8400	6	53	1410	950	1700	820	460	1500	2290
	1000	770	10500	6	55	1510	950	1780	820	530	1720	2640
	1250	950	1100	6	56	1610	990	1870	820	670	2200	3310
	1600	1200	14000	6	58	1730	1030	1940	820	720	2330	3580
	2000	1450	18000	6	60	1850	1090	2110	1000	900	2740	4450
	2500	1750	22000	6	63	1950	1110	2200	1000	1070	3180	5230
	3150	2200	27500	6	64	2150	1070	2320	1070	1370	4140	6610

Dimensions and weights are approximate. May vary by order.

Ecodesign EU No. 548/2014 (Tier 1) AL-AL.

Voltage (kV)	Power (kVA)	Idle Loss (W)	Load Loss (W)	Short Circuit Impedance (%)	Noise Level (dB)	Length A (mm)	Width B (mm)	Height C (mm)	Distance Between Wheels D (mm)	Oil Weight (kg)	Active Part Weight (kg)	Total Weight (kg)
36	25	80	990	4.5	46	910	610	1320	520	140	220	410
	50	103	1210	4.5	50	890	630	1360	520	150	290	490
	100	166	1925	4.5	54	950	670	1410	520	190	390	650
	160	241	2585	4.5	57	1050	730	1400	520	230	530	850
	250	345	3575	4.5	60	1130	870	1460	520	290	680	1110
	315	414	4290	4.5	61	1170	830	1530	670	320	790	1280
	400	494	5060	4.5	63	1230	890	1730	670	370	910	1470
	500	586	6050	4.5	64	1230	930	1740	670	390	1040	1670
	630	690	7150	4.5	65	1230	970	1820	670	430	1170	1890
	800	747	9240	6	66	1410	970	1830	820	510	1350	2210
	1000	885	11550	6	67	1550	970	1900	820	580	1570	2570
	1250	1092	12100	6	68	1630	1010	1940	820	680	1900	3040
	1600	1380	15400	6	69	1810	1130	2060	820	790	2180	3580
	2000	1667	19800	6	71	1810	1110	2150	1000	950	2390	4200
	2500	2012	24200	6	73	1950	1150	2290	1000	1130	2890	5090
	3150	2530	30250	6	75	2230	1170	2400	1070	1480	3800	6550

Dimensions and weights are approximate. May vary by order.

BS-EN 464-1:2007 E0Dk Loss + IEC Tolerance. AL-AL

Voltage (kV)	Power (kVA)	Idle Loss (W)	Load Loss (W)	Short Circuit Impedance (%)	Noise Level (dB)	Length A (mm)	Width B (mm)	Height C (mm)	Distance Between Wheels D (mm)	Oil Weight (kg)	Active Part Weight (kg)	Total Weight (kg)
7.2 - 12	25	150	900	4	51	830	620	970	520	80	160	290
	40	180	1150	4	53	910	620	960	520	100	190	340
	50	190	1350	4	55	870	620	1100	520	110	210	380
	63	240	1650	4	57	790	620	1110	520	100	220	380
	100	320	2150	4	59	790	650	1220	520	120	270	480
	160	460	3100	4	62	890	750	1140	520	150	360	630
	250	650	4200	4	65	1190	810	1130	520	200	500	860
	400	930	6000	4	68	1330	930	1350	670	260	670	1190
	630	1300	8400	4	70	1350	910	1490	670	350	930	1630
	800	1400	10500	6	71	1550	1050	1500	820	420	1000	1900
	1000	1700	13000	6	73	1590	1070	1630	820	500	1210	2270
	1250	2100	16000	6	74	1610	1070	1700	820	550	1370	2550
	1600	2600	20000	6	76	1750	1170	1790	820	770	1630	3400
	2000	3250	23750	6	78	1850	1190	1900	1000	870	1990	3970
	2500	3500	32000	6	81	1870	1170	2030	1000	1000	2320	4450
	3150	3600	34000	6	84	2250	1190	2120	1070	1310	3170	5860

Dimensions and weights are approximate. May vary by order.

Voltage (kV)	Power (kVA)	Idle Loss (W)	Load Loss (W)	Short Circuit Impedance (%)	Noise Level (dB)	Length A (mm)	Width B (mm)	Height C (mm)	Distance Between Wheels D (mm)	Oil Weight (kg)	Active Part Weight (kg)	Total Weight (kg)
17.5 - 24	25	150	900	4	51	870	620	1080	520	90	170	310
	40	180	1150	4	53	930	620	1080	520	110	200	360
	50	190	1350	4	55	910	620	1210	520	120	220	410
	63	240	1650	4	57	810	620	1230	520	110	230	400
	100	320	2150	4	59	830	710	1280	520	130	290	510
	160	460	3100	4	62	930	770	1230	520	170	390	670
	250	650	4200	4	65	1110	810	1270	520	210	520	900
	400	930	6000	4	68	1310	910	1490	670	270	680	1210
	630	1300	8400	4	70	1370	870	1600	670	360	940	1630
	800	1400	10500	6	71	1550	1030	1600	820	440	1030	1920
	1000	1700	13000	6	73	1550	1050	1730	820	520	1230	2270
	1250	2100	16000	6	74	1590	1090	1800	820	570	1410	2580
	1600	2600	20000	6	76	1750	1150	1900	820	780	1670	3380
	2000	3250	23750	6	78	1870	1190	1990	1000	880	2010	3960
	2500	3500	32000	6	81	1870	1190	2130	1000	1010	2340	4480
	3150	3600	34000	6	84	2270	1190	2220	1070	1350	3220	5960

Dimensions and weights are approximate. May vary by order.

BS-EN 464-1:2007 C0Ck Loss + IEC Tolerance. AL-AL

Voltage (kV)	Power (kVA)	Idle Loss (W)	Load Loss (W)	Short Circuit Impedance (%)	Noise Level (dB)	Length A (mm)	Width B (mm)	Height C (mm)	Distance Between Wheels D (mm)	Oil Weight (kg)	Active Part Weight (kg)	Total Weight (kg)
36	25	165	990	4.5	48	970	620	1220	520	140	200	390
	40	207	1265	4.5	50	990	630	1240	520	150	220	430
	50	230	1450	4.5	52	950	620	1330	520	160	240	460
	63	269	1684	4.5	54	850	620	1420	520	150	250	460
	100	380	2350	4.5	56	890	750	1420	520	180	310	580
	160	520	3350	4.5	59	990	810	1390	520	210	410	740
	250	780	4250	4.5	62	1130	850	1410	520	270	550	990
	400	1120	6200	4.5	65	1250	890	1630	670	330	720	1290
	630	1450	8800	4.5	67	1250	910	1740	670	410	1000	1710
	800	1700	10500	6	68	1470	990	1760	820	490	1110	2030
	1000	2000	13000	6	68	1610	1070	1860	820	590	1330	2450
	1250	2400	16000	6	70	1590	1050	1930	820	640	1530	2720
	1600	2800	19200	6	71	1730	1130	2030	820	830	1780	3490
	2000	3400	24000	6	73	1890	1170	2120	1000	970	2190	4170
	2500	4100	29400	6	76	1930	1230	2220	1000	1140	2410	4720
	3150	4500	32000	6	80	2250	1230	2390	1070	1480	3330	6240

Dimensions and weights are approximate. May vary by order.

Tests

Routine Tests

- Measuring winding resistances
- Measuring the voltage-to-turn ratio and checking the connection group
- Measuring short circuit impedance and loss under load
- Measuring idle losses and currents
- Dielectric routine tests
- Step-change tests under load
- Insulation resistance

Type Tests

- Temperature increase test
- Lightning impulse test
- Measuring noise levels

Special Tests

- Determining capacity between windings and ground and capacity between windings
- Measuring zero component impedance in three-phase transformers
- Short circuit resistance test (KEMA, Boğaziçi University, etc.)
- Measuring harmonics of idle current
- Measuring insulation resistance to earth of windings and/or measuring the loss factor (loss angle tangent) (Tan δ) of insulation system capacitances.

Packaging

After the corrugated wall corners of the transformers are covered with blue foam sponge, they are fixed to the transformer using cable ties, not tape. In addition, corrugated wall surfaces are covered with white Styrofoam and wrapped in stretch film. Tape is applied after stretch wrapping.

Different packaging types may be requested (e.g.: wooden crate packaging, stretch film and Styrofoam packaging, wooden crate packaging for protection of bushings).





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