

# IMEFY

## GROUP



## Liquid immersed distribution transformers

Up to 3.150 kVA | Up to 36 kV

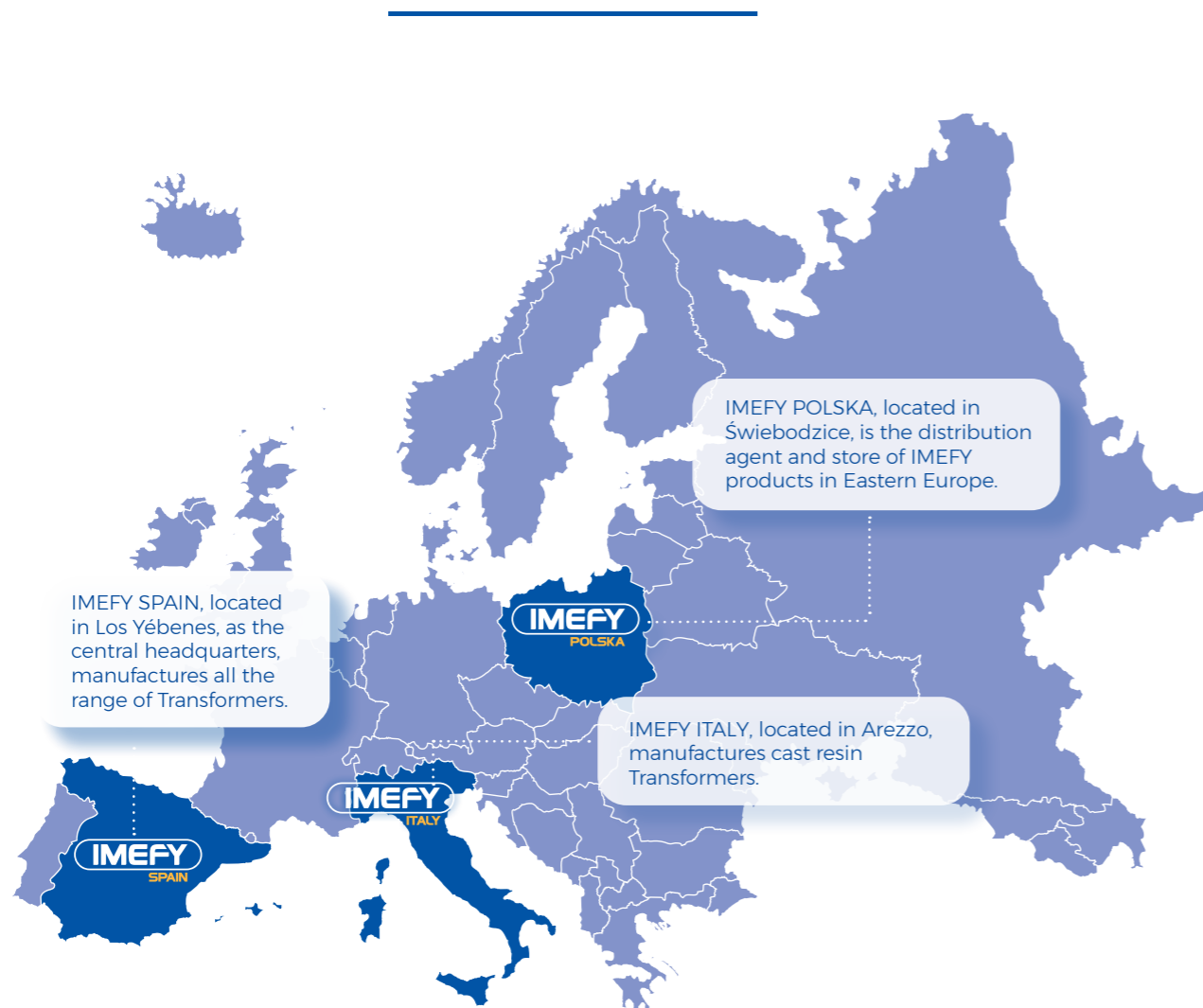
**We transform energy**

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# Liquid immersed

## distribution transformers

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### Introduction

Since IMEFY was founded in 1973 as a company dedicated to the manufacture of liquid-immersed distribution transformers, it has followed a path of continuous development, in terms of technology as well as expansion, becoming one of the world's leading manufacturers of a wide range of transformers, including:

- Medium-sized liquid-immersed power transformers, with power ratings from 10kVA to 3150kVA and insulation levels from 1.1kV to 36kV.
- Large liquid-immersed power transformers, with power ratings from 3150kVA to 160 MVA and an insulation level of 245kV.
- Epoxy-resin encapsulated transformers (dry-type), with power ratings from 10kVA to 3150kVA and insulation levels from 1.1kV to 36kV.
- Large epoxy-resin encapsulated transformers (dry-type) with power ratings from 3150 KVA to 6 MVA and insulation levels up to 36 KV.

This range of products meets the legal requirements established by Regulation (EU) No. 548/2014 of the European Commission of May 21, 2014, as well as Regulation (EU) 2019/1783 of the European Commission of October 2019 that modifies the Regulation (EU) No. 548/2014.

These legal requirements are applicable when the transformers are marketed within the scope of the Regulation, that is, all the countries of the European Union that ratify it.

One of IMEFY's hallmarks is the high standard of quality and reliability of its entire product line, which is achieved thanks to the company's qualified staff, cutting-edge technology for the design, manufacture, and control of the processes and finished products in its test laboratories, and its post-sale service to track customer satisfaction.

All of this, in combination with an internal Environmental and Sustainability policy, and the prioritization of the well-being and occupational health of our workers, has helped the IMEFY to gain the recognition and trust of its customers, allowing it to expand its operations around the world.

Lastly, IMEFY, in keeping with the Strategic Plan of its organization, maintains its quality and management system based on ongoing improvement, supported on the pillars of the customer's voice, analysis and improvement of processes, and development of new products (R&D&I).

In terms of the different types of power transformers, IMEFY has the capacity, resources, and experience to manufacture a wide variety of transformers and autotransformers, including single-phase to two and three columns, as well as three-phase to three and five columns, intended for applications such as:

- Distribution.
- Generation.
- Traction.
- Rectifiers.
- Furnaces.
- Voltage dips, etc.

All of these types of transformers or autotransformers can be equipped with:

- No-load tap changer (linear or rotating).
- On-load tap changer, using vacuum or oil switching technologies and positive configuration (fine regulation or coarse fine regulation) or inversion configuration.

Some of Our Customers:



Our Certificates:







## Construction Features

This brochure describes liquid immersed medium power transformers (mineral oil, synthetic esters and vegetable esters) both with no-load tap changer and on-load tap changer, up to corresponding powers from 10 KVA to 3150 KVA, and insulation level from 1, 1 KV up to 36 kV.

\*(Note: For higher power and insulation level, please consult IMEFY).

These transformers have different fields of application, such as:

- Distribution, pole mounted, indoor and substation.
- Generation, such as wind farms, solar plants, thermal and hydraulic power.
- Special applications, as engine power, railway applications, rectifiers, etc...

For this, we use the most advanced technological means both for the calculation and design as production means, processes and manufacture treatments. The main characteristics of our standard manufacture are:



“ Our transformers are designed and manufactured to meet the highest Quality Standards.”

- Automatic cutting and stacking of magnetic cores.
- Step-lap core.
- Copper or aluminium windings, both cylindrical and oval.
- Elastic tanks hermetically sealed or with an oil conservator.
- With different accessories as:
  - HV and LV bushings.
  - Off-load tap changer.
  - Overpressure valve.
  - R.I.S. Device (protection and filling device).
  - Lifting lugs.
  - Oil Vertical level.
  - Magnetic oil level indicator.
  - Buchholz relay.
  - Dehydrating breather.
  - Thermometer.
  - Oil drain valve.
  - Rating plate
  - Orientable wheels.
  - Earthings.

- Different options and accessories are:
  - Polymeric or plug-in H.V. bushings.
  - Busbar L.V. bushings.
  - HV and LV terminal box.
  - Galvanized tanks o with different paint processes for adverse environmental or highly corrosive conditions.
  - Forced cooling.
  - On-Load Tap-Changers.

As a differentiating mention, state that IMEFY develops within its constructive characteristics, liquid-immersed medium power transformers with on-load tap changer, attending to market trends, and always considering the regulatory requirements that are being developed by different Clients and Utilities.

Materials used to manufacture our transformers pass strict quality controls before their use to ensure the maximum reliability and security of the end product.

All the above is verified by the “N” Quality AENOR Certificate, Quality, Environmental and Safety and Health at Work Management Systems, according to ISO 9001:2008, ISO 14001:2004 and ISO 45001:2018 respectively.

Apart from these certificates, IMEFY transformers are qualified by many Electric Utilities around the world, and tested by Independent Official Laboratories as CESI, KEMA, TECNALIA, LCOE....

To get all these approvals and certifications IMEFY has made significant investments in ELECTRIC LABORATORIES, with all the necessary equipment to perform routine tests on each transformer, as defined in IEC 60076, as well as all the Special and Type tests also included in the Standard, which are made upon request according to requirements agreed with the customer.

In the same way, with the Standard change (low level of noise in transformers) also has an ACOUSTIC LABORATORY, which provides a reduction of background noise around 20-25 dB thanks to its technology and innovation, using absorbent material which covers the walls and ceiling of the chamber.

“ IMEFY also has a CHEMICAL LABORATORY that allows to test raw materials, operational processes and final tests which are necessary to verify the high quality required.”

This material consists of a glass fiber preform with an average coefficient of sound absorption  $\alpha_m=0,84$  (class C).



## Transformers for photovoltaic application

This constructive development is applicable to submerged transformers for renewable energy centers. Specifically, for photovoltaic applications, electrostatic screens have to be introduced, since normally the windings connected to the inverter circuit are not connected to earth. The electrostatic shield connected to earth and placed between the primary and secondary windings, is placed to prevent the capacitive coupling of these windings.

The main advantage of this screen is to minimize the possible transfer of high frequency disturbances (harmonics, pulses, overvoltages that occur in the inverter) from the primary winding (H.V.) to the secondary (L.V.) and in the power grid.

The other advantage of the electrostatic shield is to reduce the transfer of high voltage transient surges to the primary windings (H.V.) and the inverter connected to this primary winding. Without the electrostatic shield a high percentage of high voltage transients in the secondary winding (L.V.) could be transferred to the primary winding (H.V.) of the transformer.

In addition, the electrostatic screen acts as an additional dU / dt filter. The electrostatic screen can be made of both aluminum and copper and when placed on transformers it must be grounded at only one point. Upon Customer's request, an isolator can be placed on the cover with the shield connected internally to ground through this isolator, rather than internally.



## i-Trafo

Normally, in distribution networks, unregulated transformers are used which cannot react under load to voltage changes. With the help of on-load changers, these rigid distribution network transformers become regulating transformers that maintain stable voltage in public, industrial and private distribution networks. These compensate for fluctuations in the medium voltage and react dynamically to changes in the supply and load at the low voltage level.

Thanks to this, new possibilities are open not only for electricity supply companies, but also for industrial companies or wind and solar plant operators also benefit from distribution network transformers that are regulated with on-load tap changers (which can be manufactured with up to 17 positions).



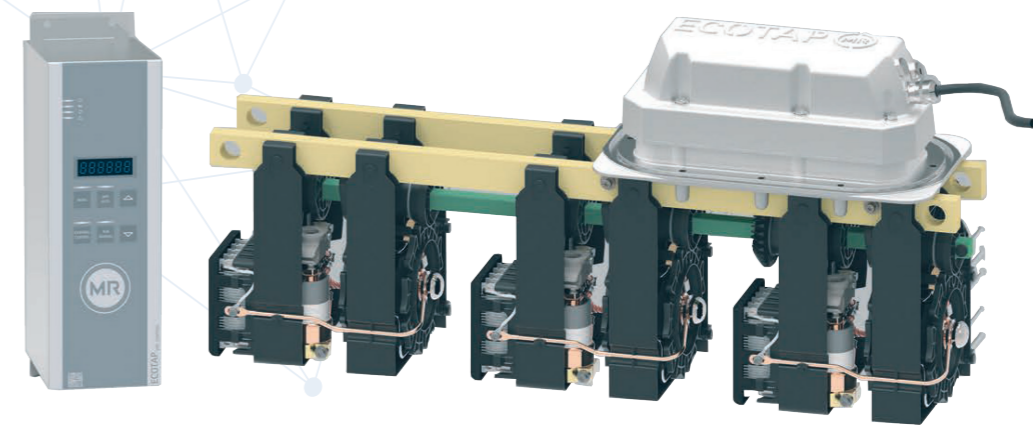
Transformers for smart grids



I-Trafo OLTC



ECOTAP VPD Control Pro



ECOTAP VPD



## Ecodesign Transformers

Due to new trends regarding Legislation, focused on Energy Efficiency and Sustainable Development, IMEFY has created a research team to perform development studies, continuous improvement and energy efficiency of liquid immersed medium power transformers, from the beginning to the end of their useful life.

This R&D team researches and develops mechanism to achieve increasingly efficient products, from:

- Raw materials procurement (vegetable oils, high-quality magnetic steel, etc...)
- Processes Development to reduce potential CO2 equivalent emissions and development of an Energy Plan.
- Greater Energy Efficiency throughout the useful life of transformers, which means an increase of this useful life.
- Recycling of materials at the end of life of transformer.

All these studies and investigations, some of them in collaboration with Spanish government, allow IMEFY to offer low-losses transformers according to the European Regulation 548/2014 dated on 21th, May, 2014 and N° 1783/2019, which is mandatory from 1st July 2015 for all states of the European Union.

These low losses, which can involve at first an increase in the cost of the transformer due to the special used materials, entail an increased energy efficiency, reduced operating costs and hence in a return on short term investment, according to existing evidence based on mathematical formulas, throughout the lifetime of the transformer.

According to the European Regulation (UE) 1783/2019 and the standard UNE-EN 50708-2-1, the EcoDesign II losses levels are:

Power (kVA)	EcoDesign losses Um <=24kV		EcoDesign losses Um <=36kV		Short-circuit impedance %
	Load Losses Pk (W)	No Load Losses PO (W)	Load Losses Pk (W)	No Load Losses PO (W)	
50	750	81	825	93	4
100	1.250	130	1.375	150	
160	1.750	189	1.925	217	
250	2.350	270	2.585	311	
400	3.250	387	3.575	445	
630	4.600	540	5.060	621	
630	4.600	540	5.060	621	6
800	6.000	585	6.600	673	
1000	7.600	693	8.360	797	
1250	9.500	855	10.450	983	
1600	12.000	1.080	13.200	1.242	
2000	15.000	1.305	16.500	1.501	
2500	18.500	1.575	20.350	1.810	
3150	23.000	1.980	25.300	2.277	



## Losses Levels

IMEFY can also provide other levels of losses according to the following tables:

Load Losses and No load Losses (W) Um ≤ 24 kV									
Power	Load Losses Pk (W) a 75°C			No Load Losses PO (W)					Short-circuit impedance %
	Ck	Bk	Ak	EO	DO	CO	BO	AO	
50	1100	875	750	190	145	125	110	90	4
100	1750	1475	1250	320	260	210	180	145	
160	2350	2000	1750	460	375	300	260	210	
250	3250	2750	2350	650	530	425	360	300	
400	4600	3850	3250	930	750	610	520	430	
630	6500	5400	4600	1300	1030	860	730	600	
630	6750	5600	4800	1200	940	800	680	560	6
800	8400	7000	6000	1400	1150	930	800	650	
1000	10500	9000	7600	1700	1400	1100	940	770	
1250	13500	11000	9500	2100	1750	1350	1150	950	
1600	17000	14000	12000	2600	2200	1700	1450	1200	
2000	21000	18000	15000	3100	2700	2100	1800	1450	
2500	26500	22000	18500	3500	3200	2500	2150	1750	

Load Losses and No load Losses (W) Um = 36 kV							
Power	Load Losses Pk (W) a 75°C			No Load Losses PO (W)			Short-circuit impedance %
	Ck36	Bk36	Ak36	C036	B036	A036	
50	1450	1250	1050	230	190	160	4,5
100	2350	1950	1650	380	320	270	
160	3350	2550	2150	520	460	390	
250	4250	3500	3000	780	650	550	
400	6200	4900	4150	1120	930	790	
630	8800	6500	5500	1450	1300	1100	
800	10500	8400	7000	1700	1500	1300	6
1000	13000	10500	8900	2000	1700	1450	
1250	16000	13500	11500	2400	2100	1750	
1600	19200	17000	14500	2800	2600	2200	
2000	24000	21000	18000	3400	3150	2700	
2500	29400	26500	22500	4100	3800	3200	

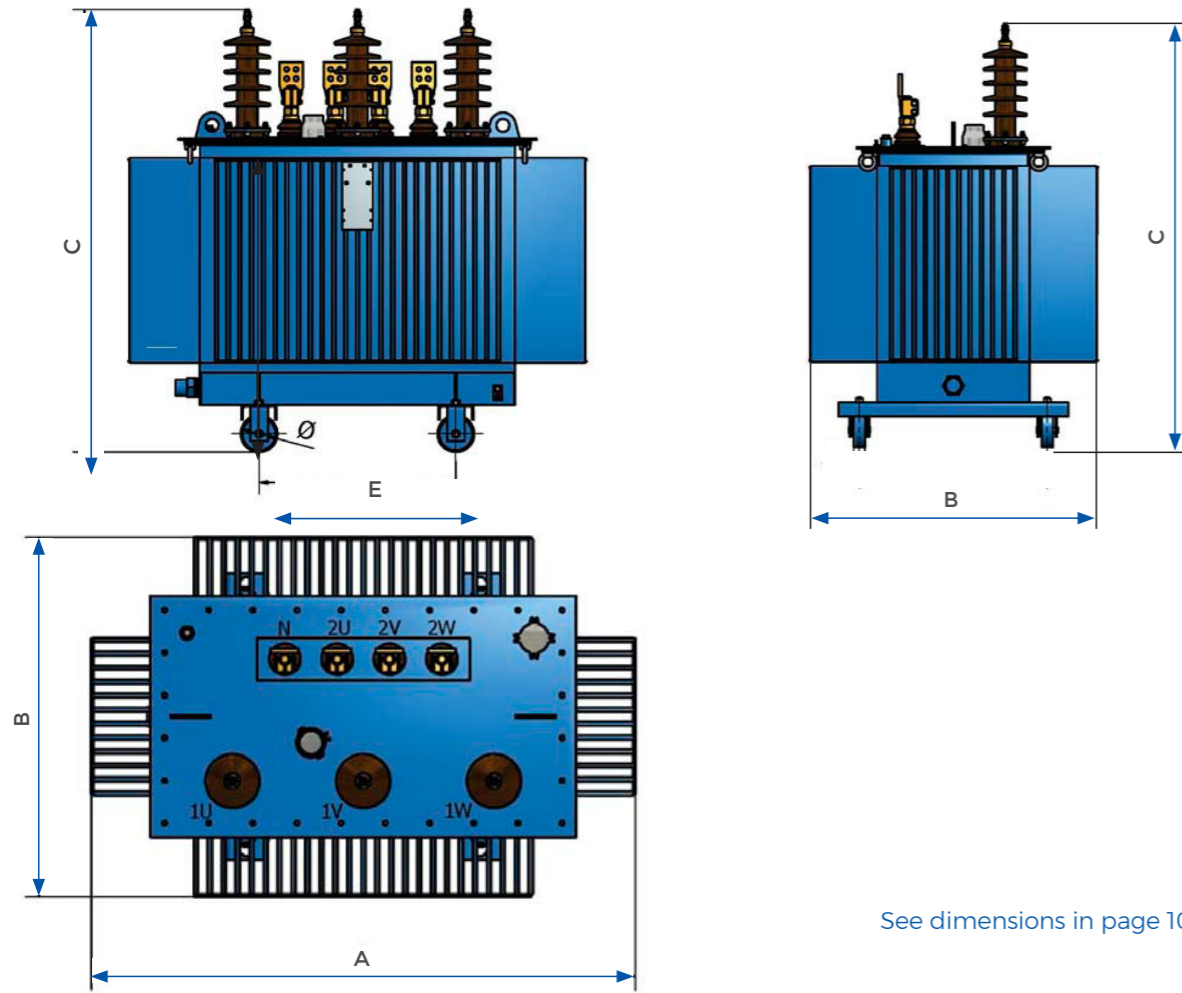
\* For another short-circuit impedance, please consult the Technical Department.

POWER (kVA)	HIGHEST VOLTAGE FOR MATERIAL (kV)	SHORT-CIRCUIT IMPEDANCE (%)	LOSSES (W)	APPROXIMATE DIMENSIONS (mm)						WEIGHTS (kg)				NOISE LEVEL dB (A) SOUND PRESSURE	
				COPPER			ALUMINIUM			COPPER		ALUMINIUM		0,3m	1m
				Length(A)	Width(B)	Height(C)	Length(A)	Width(B)	Height(C)	Oil	Total	Oil	Total		
50	24	4	CkEO	870	670	1250	960	670	1280	100	420	150	550	46	41
			CkDO	910	670	1200	980	670	1290	110	460	160	590	44	39
			BkB0	920	730	1050	1080	710	1270	100	450	170	600	36	31
			CkAO	940	680	1150	1030	670	1230	110	510	135	590	39	25
			Ak AA0*	950	700	1350	950	700	1350	180	790	180	790	39	25
	36	4,5	Bk36C036	910	670	1300	1010	670	1350	110	450	170	590	46	41
			Bk36B036	870	670	1300	1010	670	1350	110	450	170	595	46	41
			Ak36A036	950	670	1280	1110	700	1340	100	440	190	590	44	39
			Ck(+10%)AO(+15%)	940	680	1200	1100	700	1280	110	490	160	620	39	25
			Ak (+10%) AA0 (+15%)*	1000	720	1400	1000	720	1400	190	800	190	800	39	25
100	24	4	CkEO	1050	670	1260	1070	690	1340	140	600	200	720	50	45
			CkDO	1050	670	1260	1090	690	1320	140	610	190	730	48	43
			BkB0	990	730	1110	1120	760	1320	130	630	200	750	38	33
			CkAO	1020	720	1240	1090	720	1280	150	780	160	750	41	27
			Ak AA0*	1050	750	1400	1050	750	1400	200	950	200	950	41	27
	36	4,5	Bk36C036	1050	670	1310	1120	700	1420	140	590	190	730	50	45
			Bk36B036	1050	670	1310	1070	690	1400	140	600	195	720	50	45
			Ak36A036	1120	670	1290	1170	750	1370	160	620	200	740	48	43
			Ck(+10%)AO(+15%)	1020	720	1290	1120	730	1330	150	750	180	790	41	27
			Ak (+10%) AA0 (+15%)*	1100	770	1420	1100	770	1420	205	850	205	850	41	27
160	24	4	CkEO	1190	710	1260	1230	730	1360	170	810	210	840	53	48
			CkDO	1190	710	1300	1200	730	1370	180	820	220	900	51	46
			BkB0	1130	730	1190	1220	770	1360	180	900	240	990	41	36
			CkAO	1100	760	1280	1180	760	1360	180	1000	220	160	44	30
			Ak AA0*	1100	800	1450	1100	800	1450	210	1100	210	1100	44	30
	36	4,5	Bk36C036	1170	710	1340	1190	730	1450	170	800	240	860	53	48
			Bk36B036	1180	720	1350	1190	730	1430	190	810	245	890	53	48
			Ak36A036	1140	670	1400	1220	760	1410	180	810	240	960	51	46
			Ck(+10%)AO(+15%)	1100	760	1330	1180	760	1410	185	980	220	1080	44	30
			Ak (+10%) AA0 (+15%)*	1150	830	1480	1150	830	1480	230	1100	230	1100	44	30
250	24	4	CkEO	1270	820	1280	1340	820	1420	200	980	270	980	56	51
			CkDO	1150	820	1280	1330	820	1410	200	970	270	1090	54	49
			BkB0	1190	820	1320	1290	820	1450	230	1110	300	1220	44	39
			CkAO	1130	820	1360	1220	820	1420	220	1360	250	1420	44	39
			Ak AA0*	1150	820	1450	1150	820	1450	290	1350	290	1350	47	33
	36	4,5	Bk36C036	1150	820	1360	1330	820	1420	220	1300	250	1330	47	33
			Bk36B036	1150	820	1310	1330	820	1460	220	1000	270	1080	56	51
			Ak36A036	1220	820	1450	1280	820	1480	220	1000	300	1130	54	49
			Ck(+10%)AO(+15%)	1150	820	1430	1220	820	1470	235	1290	260	1300	47	33
			Ak (+10%) AA0 (+15%)*	1200	820	1400	1200	820	1400	300	1300	300	1300	47	33
400	24	4	CkEO	1440	950	1300	1460	820	1470	240	1230	360	1370	58	53
			CkDO	1440	950	1300	1440	820	1510	250	1270	360	1460	56	51
			BkB0	1250	820	1400	1400	820	1580	280	1460	410	1750	46	41
			CkAO	1260	820	1460	1290	820	1540	315	1860	340	1850	50	36
			Ak AA0*	1300	850	1600	1300	850	1600	360	1950	360	1950	50	36
	36	4,5	Bk36C036	1380	950	1460	1460	820	1520	270	1230	350	1380	58	53
			Bk36B036	1380	950	1460	1460	820	1520	270	1270	330	1380	58	53
			Ak36A036	1320	870	1470	1400	820	1630	260	1340	400	1700	56	51
			Ck(+10%)AO(+15%)	1310	820	1510	1300	820	1590	310	1780	370	1720	50	36
			Ak (+10%) AA0 (+15%)*	1300	850	1650	1300	850	1650	370	1750	370	1750	50	36
630	24	4 ó 6	CkEO	1570	1050	1400	1580	850	1630	325	1680	470	1890	60	55
			CkDO	1570	1050	1400	1610	850	1630	340	1770	480	2010	58	53
			BkB0	1410	860	1460	1490	840	1670	370	1970	530	2100	48	43
			CkAO	1420	880	1480	1470	870	1690	380	2360	480	2560	52	38
			Ak AA0*	1350	900	1700	1350	900	1700	480	2650	480	2650	52	38
	36	4,5	Bk36C036	1570	1050	1490	1610	850	1700	340	1760	470	1900	60	55
			Bk36B036	1570	1050	1480	1610	850	1690	330	1790	475	2020	60	55
			Ak36A036	1540	880	1640	1500	840	1720	430	2090	530	2050	58	53
			Ck(+10%)AO(+15%)	1500	900	1530	1500	870	1740	390	2250	490	2350	52	38
			Ak (+10%) AA0 (+15%)*	1400	920	1750	1400	920	1750	490	2400	490	2400	52	38

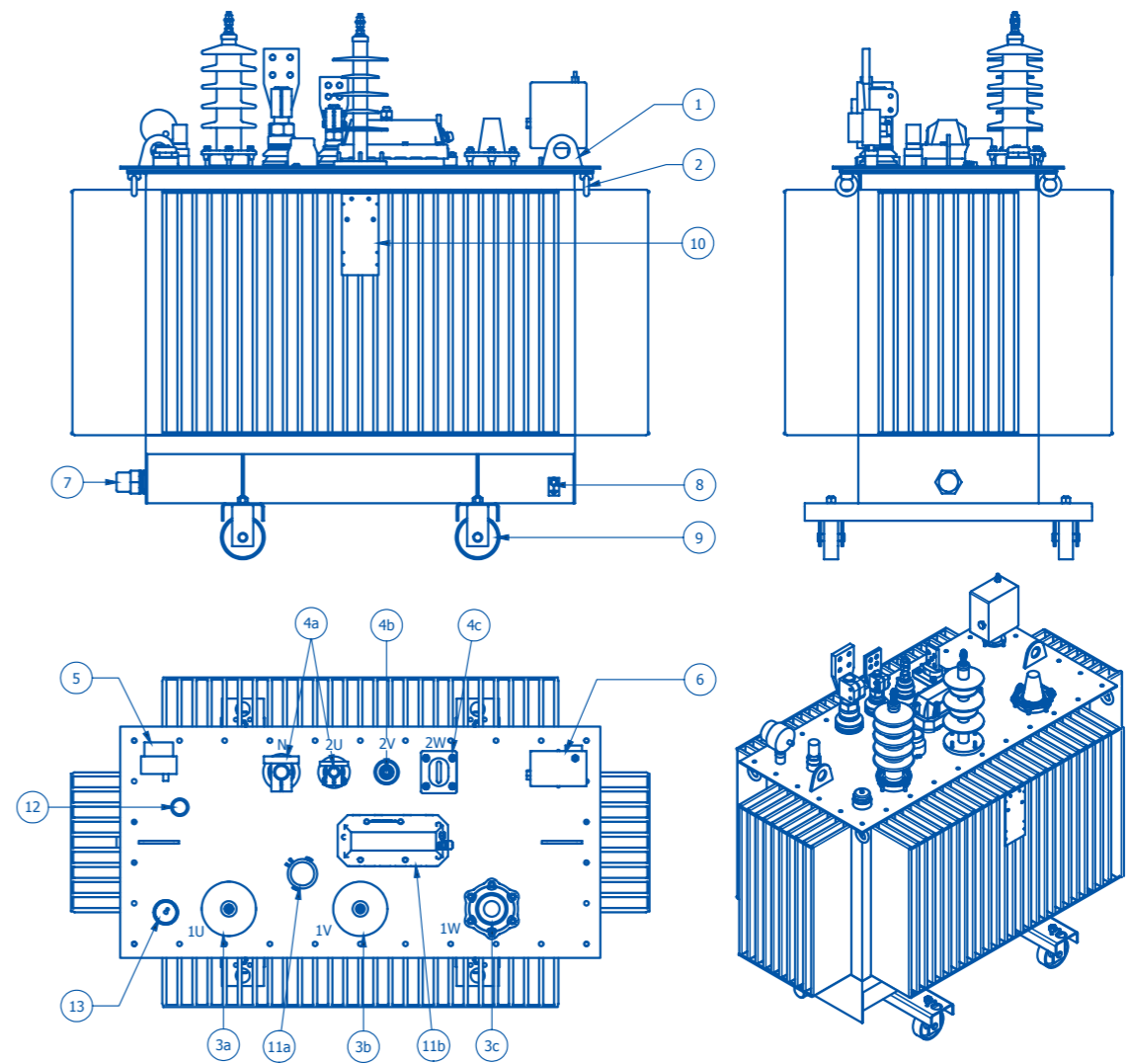
(\*) Ecodesign II.

POWER (kVA)	HIGHEST VOLTAGE FOR MATERIAL (kV)	SHORT-CIRCUIT IMPEDANCE (%)	LOSSES (W)	APPROXIMATE DIMENSIONS (mm)						WEIGHTS (kg)				NOISE LEVEL dB (A) SOUND PRESSURE	
				COPPER			ALUMINIUM			COPPER		ALUMINIUM		0,3m	1m
				Length(A)	Width(B)	Height(C)	Length(A)	Width(B)	Height(C)	Oil	Total	Oil	Total		
800	24	6	CkEO	1740	1190	1410	1740	910	1640	400	2050	540	2140	61	56
			CkDO	1860	1290	1410	1760	910	1660	440	2160	520	2360	61	56
			BkB0	1650	990	1530	1720	920	1740	500	2390	720	2730	49	54
			CkAO	1520	940	1540	1640	920	1720	490	2730	500	2900	53	39
			Ak AA0*	1400	920	1800	1400	920	1800	600	3100	600	3100	53	39
	36	6	Bk36C036	1860	1290	1550	1760	910	1710	440	2090	510	2300	61	56
			Bk36B036	1860	1290	1550	1760	910	1710	440	2150	510	2350	61	56
			Ak36A036	1810	1130	1650	1720	940	1770	440	2210	710	2560	59	54
			Ck(+10%)AO(+15%)	1640	970	1610	1660	920	1780	500	2700	500	2700	53	39
			Ak (+10%) AA0 (+15%)*	1450	950	1850	1450	950	1850	620	3000	620	3000	53	39
1000	24	6	CkEO	1940	1340	1500	1910	1070	1670	540	2540	650	2570	61	56
			CkDO	1920	1320	1530	1960	1100	1690	510	2600	665	2670	61	56
			BkB0	1760	1090	1580	1750	960	1780	510	2650	800	2870	50	45
			CkAO	1690	1050	1610	1690	1030	1740	510	3030	510	3300	55	41
			Ak AA0*	1500	950	1850	1500	950	1850	700	3500	700	3500	55	41
	36	6	Bk36C036	1920	1320	1590	1910	1070	1730	510	2510	650	2380	61	56
			Bk36B036	1920	1320	1590	1910	1070	1730	510	2590	650	2380	61	56
			Ak36A036	1870	1180	1680	1750	1000	1790	500	2610	790	2980	59	54
			Ck(+10%)AO(+15%)	1700	1060	1680	1700	1040	1800	510	2900	510	3000	55	41
			Ak (+10%) AA0 (+15%)*	1550	980	1950	1550	980	1950	710	3000	710	3000	55	41
1250	24	6	CkEO	1970	1300	1570	2100	1230	1840	630	3050	790	3330	62	57
			CkDO	1970	1300	1570	2100	1230	1840	630	3050	790	3330	62	57
			BkB0	2010	1090	1890	2020	1000	1860	810	4090	1020	4040	51	46
			BkAO	1760	1060	1750	1800	1040	1900	670	3800	840	4150	56	42
			Ak AA0*	1600	1000	1850	1600	1000	1850	750	3900	750	3900	56	42

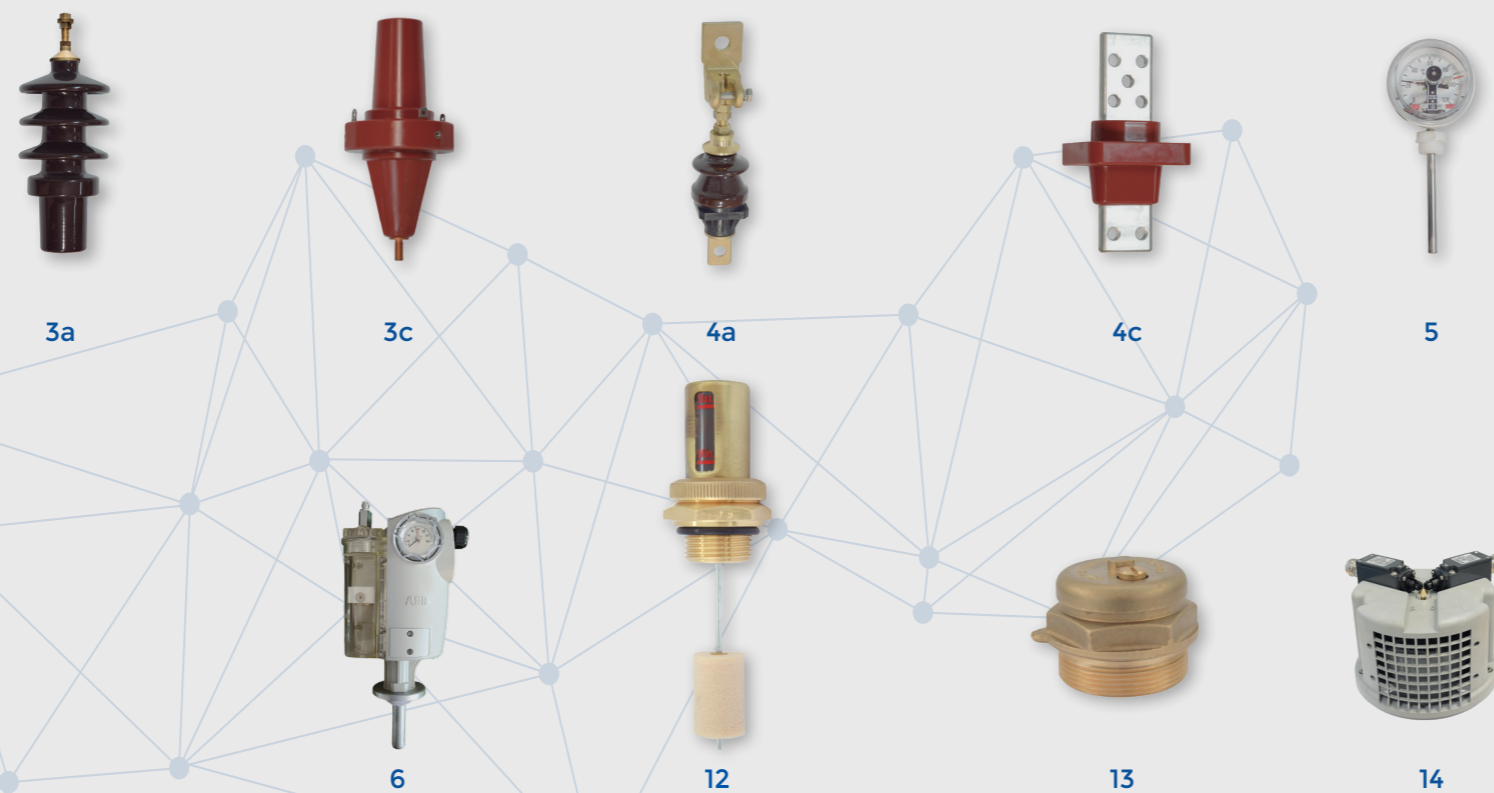
General Drawings



See dimensions in page 10 y 11.



Standard Accessories



- 1 Lifting lugs
- 2 Pull eyebolts
- 3a HV bushings (porcelain)
- 3b HV bushings (polymeric)
- 3c HV bushings (Plug-in)
- 4a LV bushings (porcelain with connection plate)
- 4b LV bushings (porcelain without connection plate)
- 4c LV bushings (busbar)
- 5 Thermometer
- 6 Filling and protection device
- 7 Oil drain valve
- 8 Earthings
- 9 Orientable wheels 90°
- 10 Rating plate
- 11a Off-load tap changer
- 11b On-load tap changer
- 12 Oil level indicator
- 13 Overpressure valve 50VG
- 14 Overpressure valve 50T



## Tests

### Routine tests

- Measurement of winding resistance.
- Measurement of voltage ratio and check of phase displacement.
- Measurement of short-circuit impedance and load losses.
- Measurement of no-load losses and current at 100% of rated voltage.
- Dielectric routine tests.
- Test on on-load tap changers, if necessary.
- Leak testing with pressure for liquid immersed transformers.
- Check of core, frames and tank insulation.

### Type tests

- Temperature rise test.
- Dielectric type tests.
- Determination of the noise level for each cooling method for which it is specified a guaranteed noise level.
- Measure of power taken by the fan and liquid pump motors.
- Measurement of no-load losses and current at 90% and 110% of rated voltage.

### Special Tests

- Special dielectric tests.
- Windings hot spot temperature-rise measurements.
- Measurement of capacitances windings-to-earth and between windings.
- Measurement of dissipation factor ( $\tan \delta$ ) of the insulation system capacitances.
- Determination of transient voltage transfer characteristics.
- Measure of zero-sequence impedance.
- Short-circuit withstand test (performed in Independent Laboratory).
- Measurement of d.c. insulation resistance between each winding to earth and between windings.
- Measurement of frequency response (FRA).
- Vacuum deflection test.
- Pressure deflection test.
- Vacuum tightness test on site for liquid immersed transformers.
- Check of external coating.
- Measurement of dissolved gasses in dielectric liquid.
- Measurement of partial discharges.
- Mechanical test or assessment of tank for suitability for transport.
- Determination of weight with transformer arrange for transport.







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