



We
Transform
energy



Cast resin distribution transformers

Up to 20 MVA | Up to 36 kV

Cast resin distribution transformers



Introduction

■ Since its founding in 1973 as a Company dedicated to the manufacture of liquid immersed distribution transformers, IMEFY, has developed a continuous growth, both technological as expansion, becoming a world leader as a manufacturer of a wide range of transformers, including:

- Liquid immersed distribution transformers up to 5000 kVA and 72,5 kV
- Power transformers up to 160 MVA and 245 kV
- Cast resin transformers up to 20 MVA and 36 kV
- Instrument transformers up to 36 kV and 2000 A
- IMGS Line, integration service of our transformers in electric rooms, enclosures for photovoltaic inverters and transformation centers

To this wide range of products, it is joined now transformers designed and manufactured according to the European Regulation n. 548/2014 of the Commission on May 21, 2014 (ECODESIGN), thus offering our customers high-efficiency transformers with low losses according to IMEFY commitment regarding Energy Efficiency, Sustainable Development and Reducing Gas Emissions Greenhouse gas (GHG).

The high standards of quality and reliability of our transformers is one of the hallmarks of IMEFY. This feature, along with the satisfaction and confidence of our customers, and the technological means of the latest generation, have allowed IMEFY develop a global expansion, with our transformers installed all over the world.

To do this, we count on the following Companies which comprise IMEFY GROUP:

- IMEFY SPAIN, located in Los Yébenes, as the central headquarters, manufactures all the range of Transformers
- IMEFY ITALY, located in Arezzo, manufactures cast resin Transformers.
- IMEFY POLSKA, located in Świebodzice, is the distribution agent and store of IMEFY products in Eastern Europe.
- IMEFY CHILE, located in Santiago de Chile, provides service to the emerging renewables sector, with the IMGS Line.
- EUROMATEL, located in Oporto is the distributor and representative of IMEFY transformers to cover Portugal and Portuguese-speaking African countries.

All this technology and international coverage allows IMEFY GROUP cover any requirement of customers, being able to adapt our transformers to particular specifications or standards of the country or specific customer.

Construction features

■ This catalogue describes transformers encapsulated in epoxy resin up to 20MVA and 36kV.

(Note: For higher power ratings and insulation series consult IMEFY).

Transformers encapsulated in epoxy resin are a special type of dry transformer (CEI EN 60076-11) with active parts not immersed in insulating liquid.

Where a transformer has one or more encapsulated windings it is commonly known as a transformer encapsulated in resin.

This type of transformer, thanks to advances in manufacturing techniques and the materials used (such as epoxy resin), are being increasingly used due to their high reliability and limited need for maintenance plans, as well as their added value of lesser environmental impact compared to other types of transformer (immersed in dielectric liquids).

Transformers encapsulated in epoxy resin have this name as the M.T. winding is encapsulated in resin, for which impregnation techniques are used, thermal and no-load treatment and a very specific and controlled jellification and polymerisation process which makes possible a fundamental dielectric and mechanical consistency.

An important way of ensuring the quality of M.T. windings is the partial discharge test (individual tests defined in national and international regulations) which concerns both the operational process referred to above and the design know-how.

B.T. windings are manufactured with a band of copper or aluminium. M.T. windings are also manufactured in bands of copper or aluminium. This design similarity makes it possible to minimise the axial force in the event of possible short-circuits.

All of the insulators used, both in M.T. and in B.T. windings, have thermal characteristics which make it possible to work on the transformer continuously at temperatures of 155°C, i.e. class F. They also have dielectric and mechanical characteristics which give the transformer a useful life of 25-30 years.

The windings made in this way are highly resistant to condensation and contamination

Loss levels

Under European Regulation (EU) 548/2014 loss levels may be classified as:

	Normal	Reduced	Ecodesign
24kV	BkC0	AkB0	BkA0 (< 630 kVA)
			AkA0 (≥800 kVA)
36kV	CkC0	AkB0	Bk+10%A0+15% (< 630 kVA)
			Ak+10%A0+15% (≥800 kVA)

Note: See the loss values in the tables given in page 8 of this catalogue.

■ The materials used in manufacture exceed the quality controls planned before use in order to ensure the reliability and safety of the final product.

All of this is backed by Quality and Environmental Management Systems in accordance with ISO 9001:2008; ISO 14001:2004 respectively. As a Health and Safety at Work system we are certified by OSHAS 18001:2007.

In addition to these certificates IMEFY transformers are recognised by numerous electrical companies throughout the world, and backed by tests in official independent laboratories such as CESI, KEMA, TECNALIA, LCOE...

Achieving all of these recognitions and certificates over the course of IMEFY's history has meant important investments in laboratory equipment. Thus IMEFY has ELECTRICAL LABORATORIES with all of the equipment necessary to carry out individual tests on each transformer as defined in rule IEC 60076 as well as all of the type and / or special tests contained in that rule, made on demand and following agreement with the customer.

IMEFY also has a CHEMICAL LABORATORY which makes it possible to carry out the following tests: receiving of material, operational controls of final processes and tests, which without doubt support and demonstrate the quality of the product.

In the same way and in line with regulatory changes (low level of noise emitted by transformers), it also has a recently created ACOUSTIC LABORATORY which thanks to its technology and innovation contributes a reduction of background noise of around 20-25 dB, using absorbent material which covers the walls and ceiling of the inside of the chamber, consisting of a prefabricated glassfibre material with an average sound absorption coefficient of $\alpha_m=0,84$ (Class C).



Climatic, Environmental and Fire Behaviour Requirements

■ The technical committee CENELEC for Transformers Encapsulated in Resin has laid down the minimum requirements for the use of transformers in particularly unfavourable environmental conditions, such as the presence of humidity, industrial and sea pollution and high risk of fire. These documents prepared by CENELEC are contained in the CEI EN 60076-11, including the classifications required and the test procedures for their verification.

The following table sets out the various classifications which underline the above:

ENVIROMENTAL CLASSES	
E0	There is no condensation in the transformers and contamination is negligible. This is normally achieved in a clean and dry installation interior.
E1	Occasional condensation may occur in the transformer (for example, when the transformer is turned off). Contamination is possible.
E2	Frequent condensation, heavy contamination or a combination of both; with water conductivity in a range between 0,5 s/m and 1,5 s/m.
E3	Close to total condensation, heavy contamination or a combination of both; with water conductivity in a range between 3,6 s/m and 4,0 s/m.

CLIMATIC CLASSES	
C1	The transformer is suitable for operation at ambient temperature not below -5°C but may be exposed during transport and storage to ambient temperatures down to -25°C.
C2	The transformer is suitable for operation, transport and storage at ambient temperatures down to -25°C.

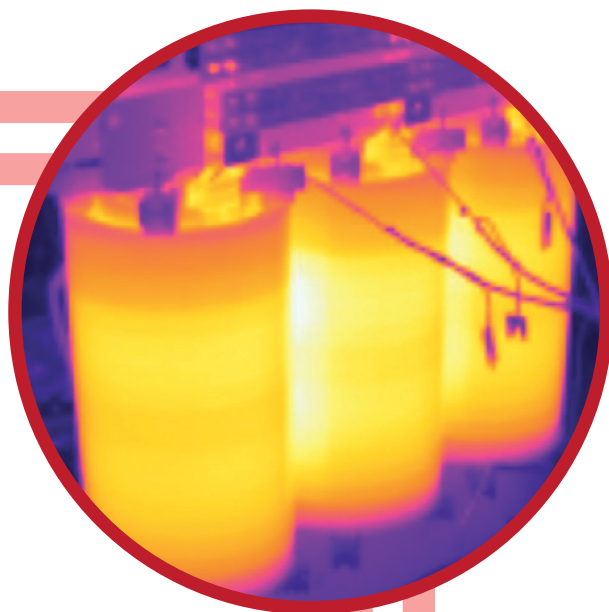
FIRE BEHAVIOUR CLASSES	
F0	There is no special fire risk to consider. Except for the characteristics inherent in the design of the transformer, no special measures are taken to limit flammability.
F1	<ul style="list-style-type: none">• Restricted flammability.• Within a fixed time the fire should auto-extinguish• Minimized emission of toxic substances and opaque smokes.• Materials and combustion products must be practically exempt from halogen composite and give only a limited thermic energy input at an external fire.

All IMEFY transformers are certified: E2-C2-F1 (in accordance with rule CEI 60076-11, Certificate CESI B0005487)

■ In 1997 and later in 2001 IMEFY achieved certificate E2-C2-F1 in transformers with various power ratings.

In February 2010 IMEFY obtained the same certificate in a transformer of 1000kVA at the CESI (Milan) test centre under the test procedure for rule CEI 60076-11.

And in the last test procedure IMEFY also completed the test for the new environmental class E3 (rule CEI 60076-16) in a transformer of 1000kVA, thus obtaining the classification E3-C2-F1.



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 distribution 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 CO³ 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, 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.

Losses table

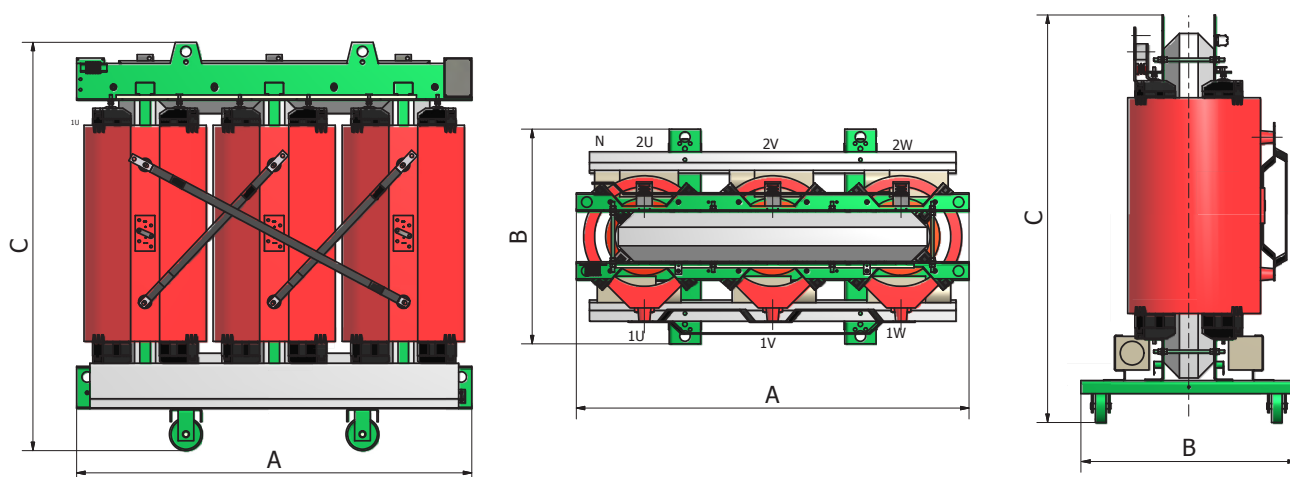
Load Losses and No load Losses (W) Um ≤ 24 kV						
Power	Load Losses Pk (W)		No Load Losses P0 (W)			Rated Impedance Voltage (%)
	Bk	Ak	C0	B0	A0	
100	2050	1800	460	340	280	6
160	2900	2600	650	480	400	
250	3800	3400	880	650	520	
400	5500	4500	1200	940	750	
630	7600	7100	1650	1250	1100	
800	9400	8000	2000	1500	1300	
1000	11000	9000	2300	1800	1550	
1250	13000	11000	2800	2100	1800	
1600	16000	13000	3100	2400	2200	
2000	18000	16000	4000	3000	2600	
2500	23000	19000	5000	3600	3100	
3150	28000	22000	6000	4300	3800	

NOTE: The ecodesign losses are BkA0 <630kVA y AkA0 ≥800kVA.

Load Losses and No load Losses (W) Um = 36 kV							
Power	Load Losses Pk (W)			No Load Losses P0 (W)			Rated Impedance Voltage (%)
	Ck	Bk	Ak	C0	B0	A0	
160	2900	2700	2500	960	900	850	6
250	4000	3800	3500	1280	1100	1000	
400	5700	5400	5000	1650	1300	1200	
630	8000	7500	7000	2200	1600	1400	
800	9600	9000	8400	2700	1900	1650	
1000	11500	11000	10000	3100	2250	1900	
1250	14000	13000	12000	3600	2600	2200	
1600	17000	16000	14000	4200	3000	2550	
2000	21000	18500	17000	5000	3500	3000	
2500	25000	22500	20000	5800	4200	3500	
3150	30000	27500	25000	6700	5000	4100	

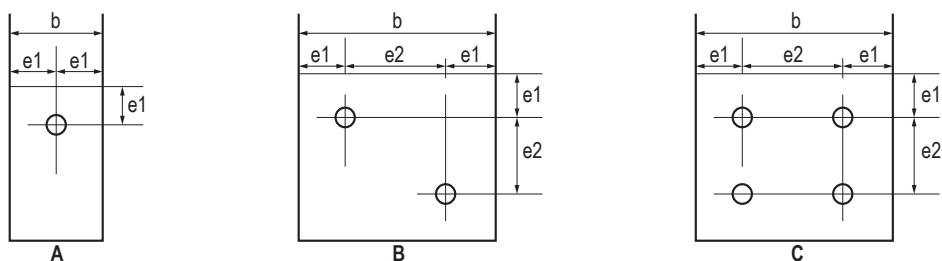
NOTE: The ecodesign losses are Bk+10%A0+15% (< 630 kVA) y Ak+10%A0+15% (≥800 kVA).

General Drawings



See dimensions in page 10 and 11.

Plans of low tension terminals



Type	A	B	C	C	C	
Power	$I \leq 400A$	$400A < I \leq 1000A$	$1000A < I \leq 1600A$	$1600A < I \leq 2000A$	$2000A < I \leq 3600A$	
width (b)	30	60	80	100	120	>120
e1	15	14	20	25	30	Subject to agreement between supplier and purchaser
e2	-	32	40	50	60	
N° holes	1	2	4	4	4	
Ø holes	14	14	14	14	18	



Dimensions and weights

POWER (kVA)	INSULATION LEVEL (kV)	RATED IMPEDANCE VOLTAGE (%)	LOSSES (W)	APPROXIMATE DIMENSIONS (mm)			WEIGHTS (kg)	NOISE LEVEL dB (A) SOUND PRESSURE	
				Length (A)	Width (B)	Height (C)		0,3m	1m
100	24	6	BkC0	1450	700	1160	800	59	53
			AkB0	1500	760	1170	1000	51	45
			BkA0*	1500	760	1230	1050	51	37
	36		Bk(+10%)A0(+15%)*	1600	830	1500	1250	51	37
160	24	6	BkC0	1300	740	1170	850	62	56
			AkB0	1400	760	1280	1100	54	48
			BkA0*	1400	760	1300	1150	54	40
	36		CkC0	1500	800	1450	1200	66	60
			AkB0	1500	800	1500	1300	62	56
			Bk(+10%)A0(+15%)*	1700	860	1650	1580	54	40
250	24	6	BkC0	1350	820	1230	950	65	59
			AkB0	1400	820	1290	1150	57	51
			BkA0*	1400	820	1350	1200	57	43
	36		CkC0	1800	930	1550	1800	67	61
			AkB0	1800	940	1600	2000	64	58
			Bk(+10%)A0(+15%)*	1700	940	1650	2050	57	43
315	24	6	BkC0	1400	820	1350	1130	67	60
			AkB0	1500	840	1360	1580	59	52
			BkA0*	1500	840	1460	1600	58	44
	36		Bk(+10%)A0(+15%)*	1800	950	1700	2350	58	44
400	24	6	BkC0	1400	820	1360	1150	68	61
			AkB0	1500	840	1380	1600	60	53
			BkA0*	1600	860	1560	1800	60	46
	36		CkC0	1800	930	1650	2100	69	62
			AkB0	1900	940	1750	2500	65	58
			Bk(+10%)A0(+15%)*	1800	960	1700	2600	60	46
500	24	6	BkC0	1450	820	1530	1550	69	62
			AkB0	1600	850	1550	2010	61	54
			BkA0*	17100	870	1600	2100	61	47
	36		Bk(+10%)A0(+15%)*	1900	980	1800	2900	61	47
630	24	6	BkC0	1500	820	1550	1600	70	63
			AkB0	1700	870	1570	2200	62	55
			BkA0*	1700	870	1630	2300	62	48
	36		CkC0	1800	940	1750	2400	71	64
			AkB0	1900	950	1850	3050	68	61
			Bk(+10%)A0(+15%)*	1900	980	1850	3100	62	48
800	24	6	BkC0	1550	820	1650	1850	72	65
			AkB0	1700	870	1670	2400	64	57
			AkA0*	1700	890	1700	2600	64	50

(*) Ecodesign

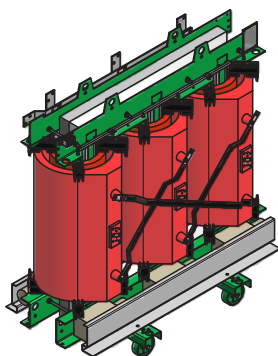
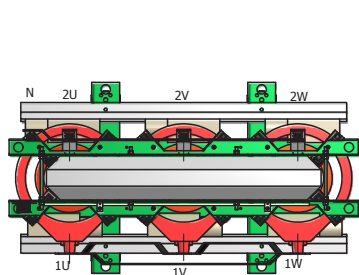
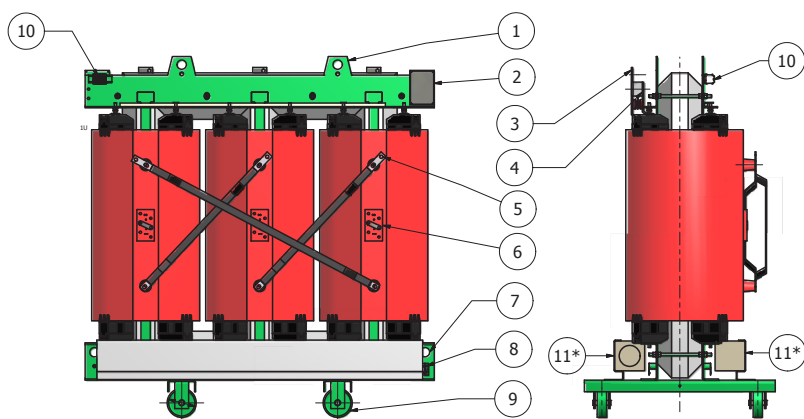
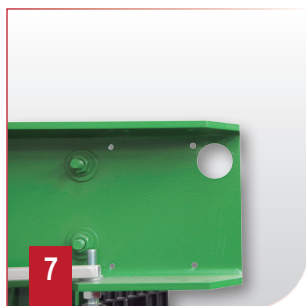
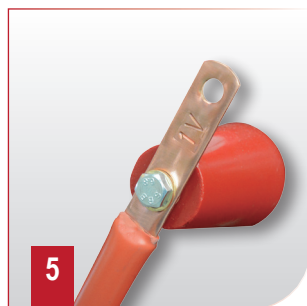
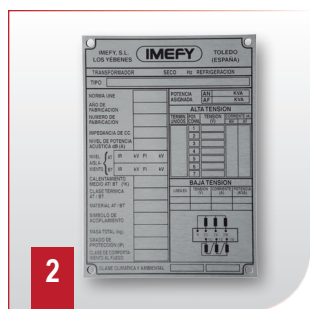


POWER (kVA)	INSULATION LEVEL (kV)	RATED IMPEDANCE VOLTAGE (%)	LOSSES (W)	APPROXIMATE DIMENSIONS (mm)			WEIGHTS (kg)	NOISE LEVEL dB (A) SOUND PRESSURE	
				Length (A)	Width (B)	Height (C)		0,3m	1m
800	36		CkC0	1900	960	1900	2800	72	65
			AkB0	2000	970	1950	3450	69	62
			Ak(+10%)A0(+15%)*	1900	990	2000	3500	64	50
1000	24	6	BkC0	1600	820	1760	2200	73	66
			AkB0	1800	900	1800	3100	65	58
			AkA0*	1800	900	1900	3200	65	51
	36		CkC0	2000	960	2000	3200	73	66
			AkB0	2000	970	2100	3800	70	63
			Ak(+10%)A0(+15%)*	2000	1050	2150	4000	65	51
1250	24	6	BkC0	1700	1000	1980	2750	75	67
			AkB0	1900	1000	2000	3800	67	59
			AkA0*	1900	1020	2050	3900	67	53
	36		CkC0	2000	1050	2200	3800	75	67
			AkB0	2000	1050	2250	4350	72	64
			Ak(+10%)A0(+15%)*	2100	1120	2400	4800	67	53
1600	24	6	BkC0	1800	1060	2080	3300	76	68
			AkB0	2000	1060	2100	4300	68	60
			AkA0*	2000	1060	2150	4400	68	53
	36		CkC0	2100	1150	2270	4500	76	68
			AkB0	2200	1150	23350	5500	73	65
			Ak(+10%)A0(+15%)*	2200	1150	2450	5600	68	53
2000	24	6	BkC0	1900	1060	2180	3900	78	70
			AkB0	2000	1060	2200	4800	70	62
			AkA0*	2100	1060	2350	5400	70	54
	36		CkC0	2200	1200	2350	5100	78	70
			AkB0	2200	1200	2350	5700	74	66
			Ak(+10%)A0(+15%)*	2300	1200	2550	6900	70	54
2500	24	6	BkC0	2200	1420	2260	5100	81	73
			AkB0	2300	1420	2280	6350	71	63
			AkA0*	2300	1420	2400	7200	71	55
	36		CkC0	2300	1420	2400	6700	81	73
			AkB0	2400	1420	2450	7500	78	70
			Ak(+10%)A0(+15%)*	2500	1430	2650	8700	71	55
3150	24	6	BkC0	2300	1420	2390	7200	83	75
			AkB0	2500	1420	2430	9060	73	65
			AkA0*	2600	1420	2550	9500	74	58
	36		Ak(+10%)A0(+15%)*	2800	1490	2700	11000	74	58

(*) Ecodesign



Parts of the transformer



1	Eye bolt
2	Characteristics plate
3	B.T. terminal
4	Neutral terminal
5	A.T. terminal
6	Tension regulator
7	Pulling device
8	Ground connection
9	Guidable wheels
10	Probes PT-100 connection
11	Forced ventilation (*optional)

On-Load Tap-Changers

Increasing power and voltage is beginning to set a trend for this type of transformer. This means that there is increasing demand for transformers with on-load regulation (normally in cases of transformers of high power rating and high primary voltage) due to the fact that they are being installed in transformation centres which do not allow frequent stops to adjust the fluctuating voltages of the grid. For this type of application the incorporation of an "On-Load Tap-Changer" is needed, which in turn means a specific design of transformer as regulation windings have to be incorporated.

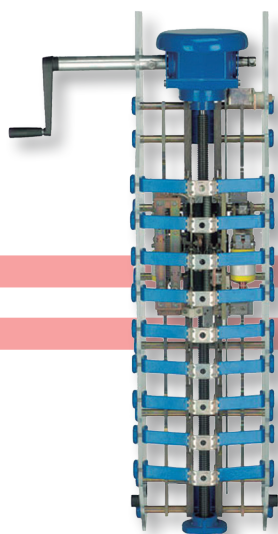
The VACUTAP VT on-load tap-changer is one of the world's leading oil-free on-load tap-changers, for adjustment of uninterrupted voltage of on-load dry transformers. It is designed as a single-phase module directly assigned to the transformer limb. Having a motorised unit, a single-pole or three-pole 3 x VT I 500 system for star or delta change-over may easily be built.

Vacuum interrupters function as load-switching contacts in the VT. The direct assignment of a tap-changer module to the limb of the transformer makes connection easy.

The VACUTAP VT has a maximum through current of 500 A and a maximum step voltage of 900 V for linear voltage adjustment in nine operating positions.

With its insulation against ground of $U_m=40,5kV$ it can be used in dry transformers for interior installations up to high power levels.

Each VT module contains a tap selector and diverter switch for high-speed resistor-type tap change operation in a compact design. The movable tap selector contact system, the diverter switch and the spring-energy accumulator are incorporated in a switching element which is centrally driven by a screw spindle. Vacuum interrupters are used as load-switching contact elements. They guarantee excellent electrical and mechanical properties over an extremely long lifespan. The motor drive unit is supplied as standard and functions in accordance with the step-by-step switching principle in order to mechanically operate the on-load tap-changer. It contains all devices for local and remote control, for remote display of operating positions and the electrical and mechanical end position limits. Its protective housing makes the motor drive unit suitable for outdoor installation, in dry transformers with encapsulated design



On-Load Tap-Changers

Thermal monitoring

Monitoring is the best tool available to you for increasing protection and reducing the risk of breakdown of your transformers.

A monitoring system should be safe, reliable, easy to use and profitable. Our range of control points has all of these characteristics, whether as part of a panel or separately.

Control and Ventilation switchboard: this is a control unit designed to control the temperatures of M.T. transformers, dry or encapsulated in resin, and the feeding of the ventilation system. Its use is recommended in combination with ventilation systems as it is equipped with two ventilation outlets with a maximum capacity of 16A.

4 PT 100 entrances allow reading the temperature of 3 windings, and possibly of the core or of the room temperature. There are 2 outlets for controlling the ventilators which provide energy directly to the motors.

In this way with a forced ventilation system the transformer can bear power greater than the power rating and maintain an optimal temperature, thus increasing power. The installing of the ventilators in the transformer is helped by the aluminium bar which allows quick and easy assembly. A digital RS485 Modbus outlet can also be fitted as an option.

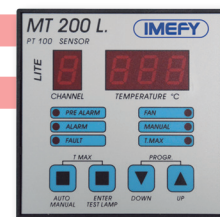
Control switchboard: this is an electronic device with microprocessor for controlling the temperature of dry M.T. transformers and those encapsulated in resin. The unit provides high levels of protection against electromagnetic fluctuations and is very easy to use. Available for the control of 3 + 1 temperature (three channels for the phases plus an optional fourth for the core or room temperature).

PT 100 probe: a platinum braid gives linear and reliable precision in readings received. Using the best systems various parameters can be monitored: temperature, alarms and ventilation.

In this way with our control switchboards it is possible to monitor the state of the transformer at all times in a safe manner.



Control and Ventilation Switchboard



Control Switchboard

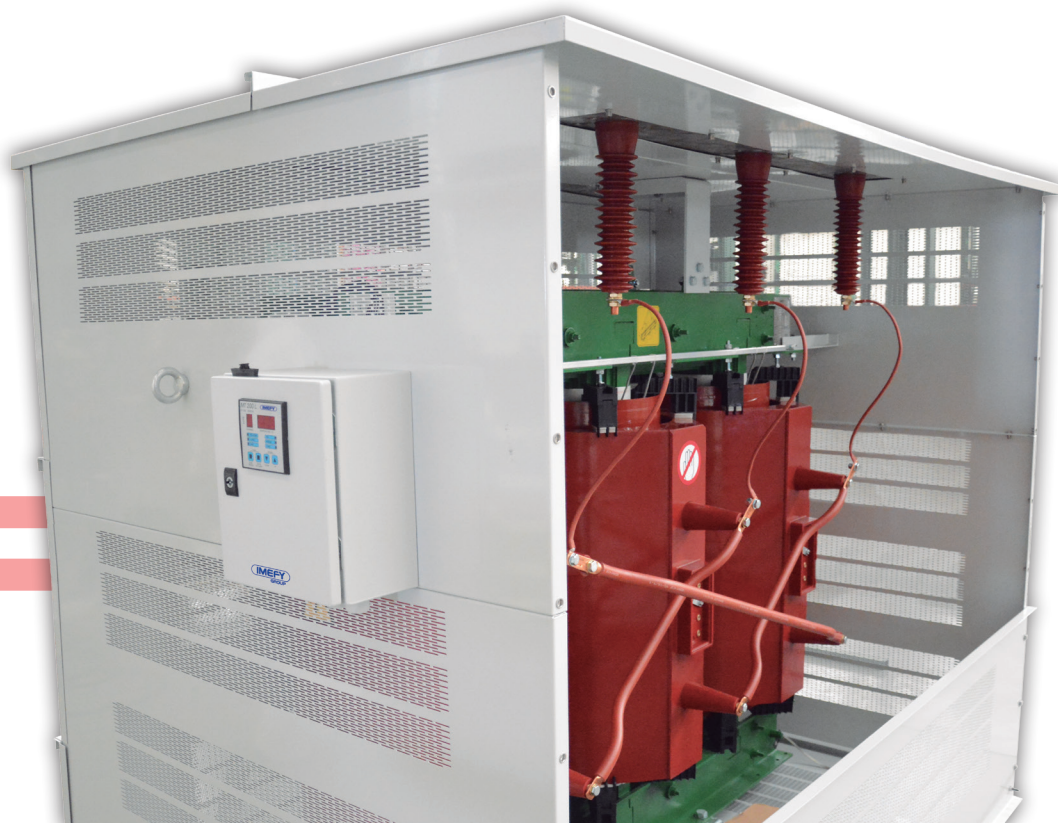
IP enclosures

■ All parts of resin transformers have voltage and it is common to use IP enclosures of different levels to protect against accidental contact. With these enclosures the transformer can be installed almost anywhere as the transformer is completely protected with a ground connection.

It should be stressed that there are different levels of protection. These levels affect the refrigeration of the transformer and therefore its size and price. The greater the level of protection, the more difficult it is to reduce heating due to losses, and care must therefore be taken with the design of the IP enclosures.

Table with Levels of Protection (IP)

ELEMENT	NUMBER	PROTECTION OF MATERIAL	PROTECTION OF PERSONS
First protection figure	0	no protection.	no protection.
	1	against penetration by solid objects of $\varnothing \geq 50$ mm	against ingress by back of hand (involuntary)
	2	against penetration by solid objects of $\varnothing \geq 12$ mm	against ingress by one finger of the hand
	3	against penetration by solid objects of $\varnothing \geq 2,5$ mm	against ingress with a tool of $\varnothing 2,5$ mm
	4	against penetration by solid objects of $\varnothing \geq 2,5$ mm	against ingress with a tool of $\varnothing 2,5$ mm
	5	against penetration by solid objects of $\varnothing \geq 1,0$ mm	against ingress with a wire of $\varnothing 1,0$ mm
	6	against dust.	against ingress with a wire of $\varnothing 1,0$ mm
Second protection figure	0	no protection.	-
	1	against the vertical falling of drops of water, condensation	
	2	against the falling of drops of water of 15% inclination.	
	3	against rain water up to 60% inclination.	
	4	against splashing of water in any direction.	
	5	against jets of water from any direction.	
	6	against powerful splashing of water from a hose.	
	7	against the effects of temporary immersion.	
	8	against the effects of prolonged immersion.	



Tests

Individual tests in accordance with rule UN-EN 60076-1

Measurement of resistance of windings.

Measurement of relation of transformation and verification of discrepancy.

Measurement of impedance of short-circuit and losses due to the load.

Measurement of losses and of no-load current.

Individual dielectric tests (voltage induced at industrial frequency, voltage applied at industrial frequency).

Tests of the on-load tap-changers, if necessary.

Measurement of partial discharges.

Type tests in accordance with rule UNE-EN 60076-1

Type tests of heating.

Dielectric type tests (lightning impulse).

Determination of noise level.

Special type tests in accordance with rule UNE-EN 60076-1

Short-circuit resistance test (in Official Laboratory).

Verification of outer covering.

Determination of weight of transformer ready for transport.

Climatic (C2)

Environmental (E3 - E2)

Fire behaviour (F1)





IMEFY follows a continuous improvement policy, and reserves the right to modify this Handbook without prior notice, not acquiring any responsibilities for it. The content of this catalogue is to provide information, it does not imply any commitment. Please, contact IMEFY for information.



IMEFY S.L.
Transformadores / Transformers
 Polígono Industrial "La Cañada"
 Avenida Siglo XXI s/n
 E-45470 Los Yébenes, Toledo (Spain)
 T.: +(34) 925 32 03 00
 F.: +(34) 925 32 10 00
www.imefy.com



IMEFY SPA
Transformatori / Transformers
 Zona Industriale Rigutino Ovest, 259
 52100 - Arezzo (Italy)
 T.: +(39) 0575 680701
 F.: +(39) 0575 657856
www.imefy.it



IMEFY POLSKA Sp. Z o.o.
Transformatory / Transformers
 Ul. Walbrzyska 33, 58 - 160
 Świebodzice - Poland
 T.: +(48) 74 664 0552
 F.: +(48) 74 664 5224
www.imefy.com



IMEFY CHILE
 Napoleón 3565, Of. 202
 Las Condes,
 Santiago (Chile)
 T.: +(569) 66035512
 +(34) 677925130
www.imefy.com



EUROMATEL IMEFY GROUP
 Zona Industrial de Aveleda
 Rua do Bairro, nº 325
 4485-010 Aveleda
 Vila do Conde - Portugal
 T.: +(351) 252 637295/6/7
 F.: +(351) 252 637290
www.euromatel.com

