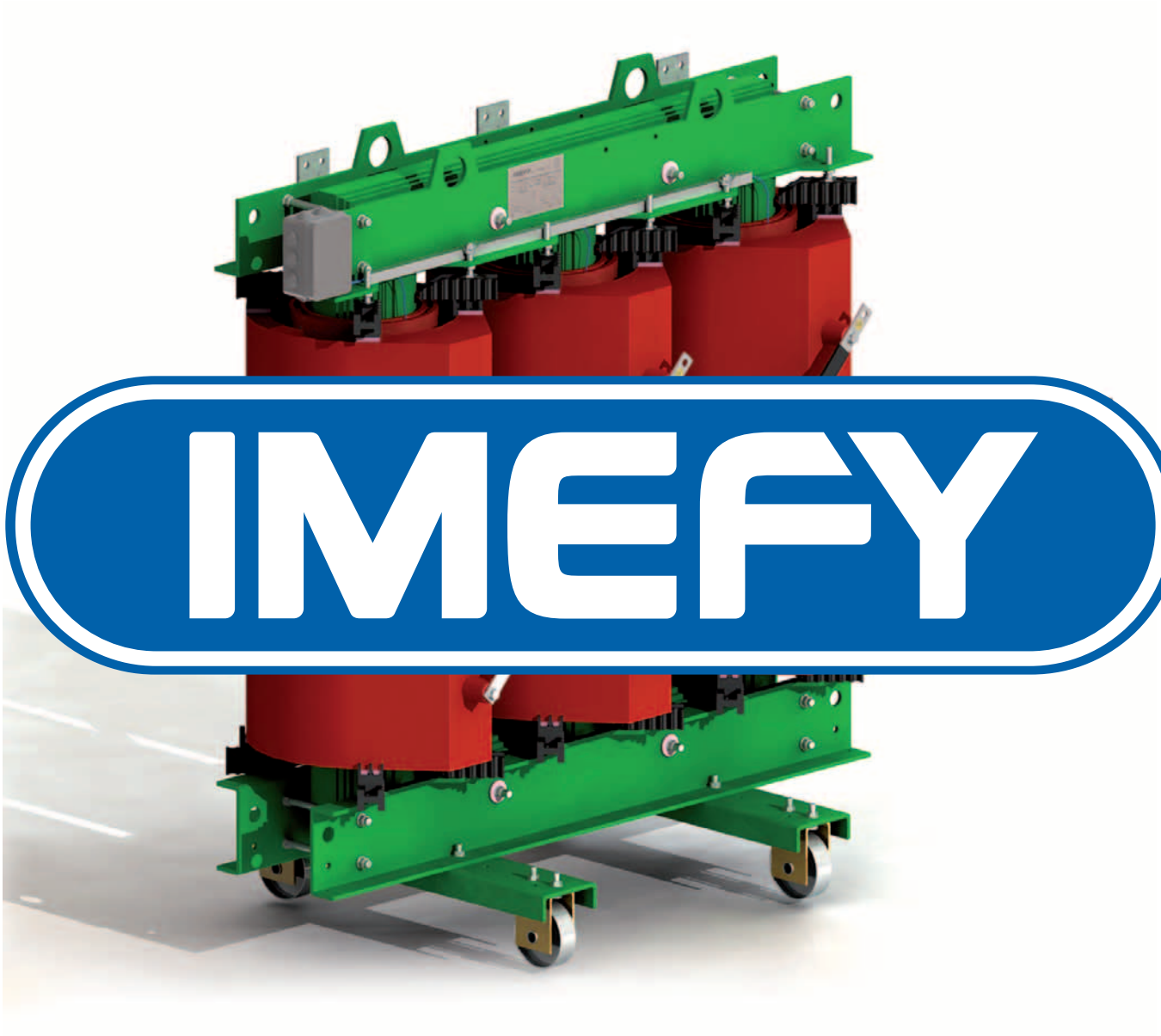
Cast Resin Transformers



ISO 9001

Cert N° 091054A

CESI

E2-C2-F1

Cert N° B0005487

ISO 14001

Cert N° 390037

IMEFY.IT

THE COMPANY

IMEFY spa arises from organizational and technical productive synergies of the best international level.

IMEFY SL, Spanish company having its headquarters near to Madrid, that since 1973 manufacture oil filled insulated and then epoxy resin insulated transformers, maintaining during the time an uninterrupted productive growth, capable to arrive to manufacture power transformers with power rating up to 250 MVA and voltage up to 150 kV.

IMEFY SL is the first Spanish company and the third in Europe for the numbers of transformers manufactured. The other partners offer a more than twenty-years experience in the Cast Resin Transformers field, from the first pioneer experiments to nowadays.

This experience is ensured by two technician, Mr. Maggini and Mr. Toscanini, that has worked for all this time in the medium voltage cast resin transformers designing and manufacturing field, indeed the headquarter of **IMEFY spa** is located in Tuscany in the city of Arezzo.

Start this way **IMEFY spa,** cast resin transformers manufacturing company, that thanks to the enormous know how at his disposal, is able to satisfy any kind of customer requirement.

10 MVA - 15.000 / 6.300 V / V

THE CHARACTERISTICS

The **IMEFY** cast resin transformers are designed and manufactured in accordance with the following norm:

IEC 60076-11 / IEC 726 / CEI EN 60076-11
CENELEC HD 464
CENELEC HD 528

And on demand in any other norm in force.

Main rated characteristics:

• Rated Power	up to 20.000 kVA
• Rated Frequency	50 - 60 Hz
• HV Rating	up to 36kV
• LV rating	up to 24 kV
• Short circuit impedance	4-10%
• HV-LV winding insulation class	F
• Max temperature rise	100K
• Resin color	RAL 3016
• Metalwork color	RAL 6001

IMEFY Transformers ensure:

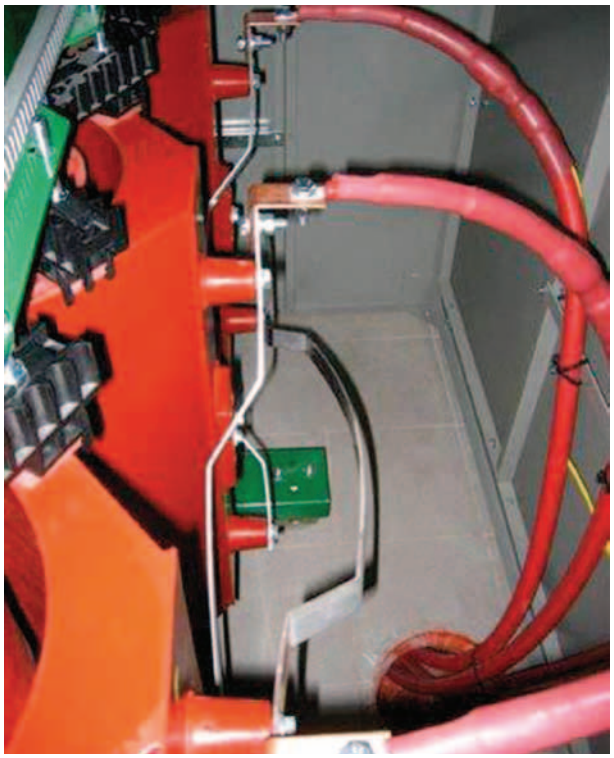
- Low losses
- Low noise level
- Environmental respect
- Recyclability
- Versatility and useful practicability

CHOICE OF THE TRANSFORMER

Very often the transformer must be installed as near as possible to the user source, for this reason, besides of other utilization and maintenance aspects that we miss out, it's often inadvisable the choice of transformers with mineral oil insulation, source in the plant where they are installed, of a big calorific power. The respect of safety and the autoestinguish property are the milestones of the choice, also for this reason it's preferable to install Cast Resin Transformers inside of department and/or areas with high fire risk.

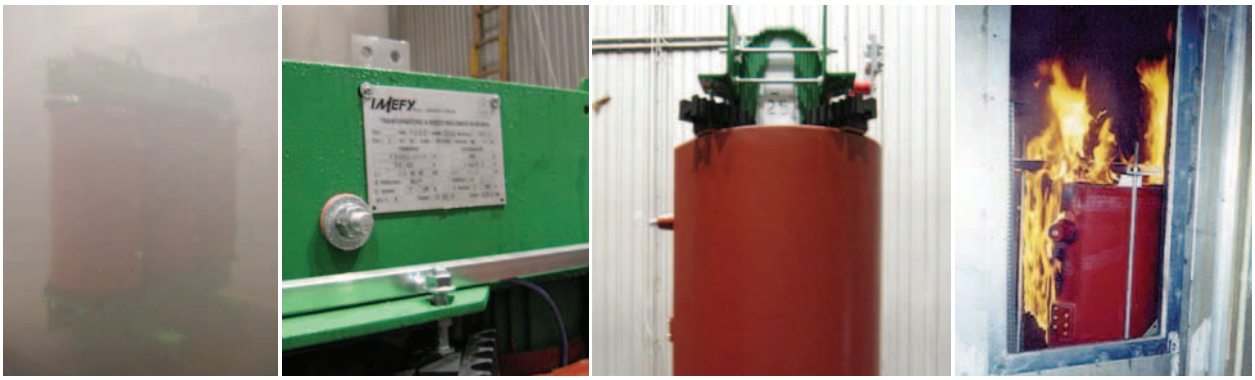
CAST RESIN TRANSFORMERS

The cast resin transformer is a special type of dry transformer (CEI EN 60076-11), that are transformers where the active parts are not immersed in an insulating liquid. When a transformers has one or more windings casted it's commonly known as Cast Resin Transformer. These special transformers thanks to the development reached on manufacturing techniques and used materials like epoxy resin, are finding an always larger utilization for the high service reliability, the practically no needed maintenance and the lower environmental impact compared to oil transformers, reducing to the minimum the fire risks and the environmental pollution. The medium voltage active parts of a cast resin transformers are casted with epoxy resin after being secured to a mould and preheated under vacuum to avoid the creation of bubbles of air or gas inside of insulating materials. This casting process gives to the medium voltage windings the possibility to have a perfect cylindrical and smooth surface minimizing the settle of pollution and or corrosive particles, to be mechanically strong and waterproof. The casted windings are divided in many tapes having only one turn for each layer, thanks to that the internal voltage stresses are reduced to the minimum with reduced possibility of sparking of partial discharge. The winding is usually made by aluminum foil. The material used is the aluminum because its coefficient of thermal expansion is very close to the one of the resin, so at the changes of transformers temperature the mechanical stresses are very limited. The low voltage windings are manufactured with a single foil of aluminum having same high as the one of medium voltage. This manufacturing characteristics, to have MV made by more strip of aluminum and LV in one single aluminum foil minimize the axial stresses in case of a possible short-circuit. The insulation between turns is ensured by a foil of a material pre-impregnated by epoxy resin that by a heat treatment and also during the service match with the secondary conductor making the winding solid and strong but at the same time free to move with a certain flexibility. The windings so manufactured are very resistant against condensation and pollution.molto resistenti alla condensa e all'inquinamento.



CLIMATIC, ENVIRONMENTAL AND FIRE BEHAVIOUR CLASSES

The Cenelec technical committee for cast resin transformer has defined the minimum requirements for the utilization of transformer in particularly bad ambient condition like the presence of damp, industrial/marine pollution and high fire risk. These documents elaborated by CENELEC, are inserted in CEI EN 60076-11, including the required qualifications and the test procedures to verify them.
In the followings table are listed the different classifications that underline what above mentioned.



Our transformer during E3 - E2 - C2 - F1 tests

ENVIRONMENTAL CLASSES	
E0	No condensation occurs on the transformers and pollution is negligible. This is commonly achieved in a clean, dry indoor installation.
E1	Occasional condensation can occur on the transformer (for example, when the transformer is de-energised). Limited pollution is possible.
E2	Frequent condensation or heavy pollution or combination of both, with conductivity of water in the range between 0.5 S/m and 1.5 S/m.
E3	Nearly total condensation or heavy pollution or combination of both, with conductivity of water in the range between 3.6 S/m and 4 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	Transformers subject to a fire hazard, it's required: • 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 extent from halogen composite and give only a limited thermic energy input at an external fire.

All IMEFY transformers are certified : E2 – C2 – F1

According to standard IEC 60076-11

Certificate CESI B0005487

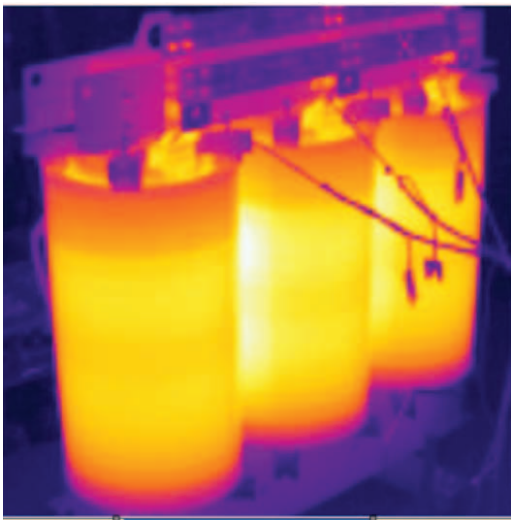
IMEFY E3-E2-C2-F1

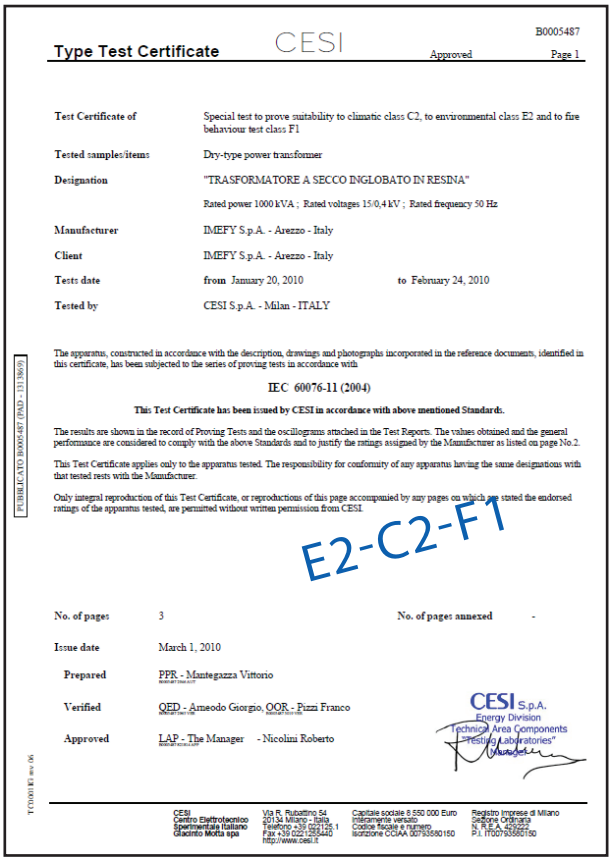
On February 2010 IMEFY has passed the E2-C2-F1 certification on a 1000 KVA transformer in CESI – Milano under test procedure according to IEC 60076-11 standards.
Already on 1997 and later on 2001 IMEFY achieved the same certificate on transformers with different power ratings.
Contextually to the last test procedure IMEFY have completed, on the same 1000 KVA transformer, the test for the new ambiental class E3 (IEC 60076-16 standards).

E3-E2-C2-F1

IMEFY

Once again IMEFY lead for timeliness and quality, faithful to the vocation of feeling firsts.





Type Test Certificate CESI B0005487 Approved Page 1

Test Certificate of	Special test to prove suitability to climatic class C2, to environmental class E2 and to fire behaviour test class F1
Tested samples/items	Dry-type power transformer
Designation	"TRASFORMATORE A SECCO INGLOBATO IN RESINA" Rated power 1000 kVA ; Rated voltages 15/0,4 kV ; Rated frequency 50 Hz
Manufacturer	IMEFY S.p.A. - Arezzo - Italy
Client	IMEFY S.p.A. - Arezzo - Italy
Tests date	from January 20, 2010 to February 24, 2010
Tested by	CESI S.p.A. - Milan - ITALY

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in the reference documents, identified in this certificate, has been subjected to the series of proving tests in accordance with

IEC 60076-11 (2004)

This Test Certificate has been issued by CESI in accordance with above mentioned Standards.

The results are shown in the record of Proving Tests and the oscillograms attached in the Test Reports. The values obtained and the general performance are considered to comply with the above Standards and to justify the ratings assigned by the Manufacturer as listed on page No.2.

This Test Certificate applies only to the apparatus tested. The responsibility for conformity of any apparatus having the same designations with that tested rests with the Manufacturer.

Only integral reproduction of this Test Certificate, or reproductions of this page accompanied by any pages on which are stated the endorsed ratings of the apparatus tested, are permitted without written permission from CESI.

E2-C2-F1

No. of pages 3 No. of pages annexed -

Issue date March 1, 2010

Prepared PPR - Mantegazza Vittorio

Verified QED - Ameodo Giorgio, QOR - Pizzi Franco

Approved LAP - The Manager - Nicolini Roberto

CESI S.p.A. Energy Division Technical Area Components "Testing Laboratories"

CESI Centro Elettrotecnico Sperimentale Italiano Giacinto Motta spa — Via R. Rubattino 54 20134 Milano - Italia Telefono +39 0221251 Fax +39 0221258440 http://www.cesi.it — Capitale sociale 8.550.000 Euro interamente versato Codice fiscale e numero iscrizione CCIAA 00793580150 — Registro imprese di Milano Sezione Ordinaria N. R.E.A. 429222 P.I. IT00793580150

Certificate E2-C2-F1

Fax - Prot. B0013241 CESI pag. 1/1

Milan	May 11, 2010	Pages	1
From	Franco Pizzi	Tel.	+39 02 2125 5327
Dept.	Energy Division – Component Technical Area Laboratory Unit	Fax	+39 02 2125 5491
To	IMEFY S.p.A. - Via Aretina, 194 – 52043 Castiglion Fiorentino (Arezzo)		
Fax	+39 0575 657856	Tel.	+39 0575 680701
Attention	Mr. Bruno Maggini		
Subject	tests on your 1000 kVA dry-type transformer		
Your Ref.	e-mail message dated May 11, 2010		
C.C.		Fax	

Dear Sirs,
following your request in reference we confirm that your three-phase dry-type transformer with the following main ratings:

A) **1000 kVA (AN), 15±2x2.5%/0.4 kV, Dyn11, 50 Hz, insulation class as in compound F**

has been subjected to:
- special climatic test C2 class,
- special environmetal test E2 class,
- special fire behaviour test F1 class

with positive results as per CESI Type Test Certificate B0005487 dated January 20, 2010.

E3-C2-F1

In addition, the same transformer unit withstood also (with positive result) special environmental test E3 class as per IEC document 14/618/CDV dated August 7, 2009, clause 7.5.2: see relevant CESI Test Report B0004832.

Best regards.

F. Pizzi.

CESI S.p.A. Energy Division Technical Area Components Unit Laboratories

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CESI S.p.A. Via Rubattino 54 I-20134 Milano - Italia Telefono +39 0221251 Fax +39 0221258440 www.cesi.it — Capitale sociale 8.550.000 Euro interamente versato Codice fiscale e numero iscrizione CCIAA 00793580150 — Reg. Imprese di Milano Sezione Ordinaria N. R.E.A. 429222 P.I. IT00793580150

Test Report E3-E2-C2-F1

RATED POWER IN CONTINUOUS LOADING

It's the value of power rating expressed in kVA.
The active power that can be taken by a two winding transformer is given by the product of rating power and power factor (cosφ).
In our example:
1600 kVA and load with cosφ= 0.9
we have a deliverable active power of 1440 kW.

RATED FREQUENCY

It's the frequency of the electrical net where the transformer will be installed. Usually this value can be 50Hz or 60Hz.

RATED PRIMARY VOLTAGE

It's the voltage of the electric net or of the plant where the transformer will be installed, usually it's the higher value between the two nominal voltage (HV).

PRIMARY REGULATION

It's a tapping system, that change the turns relationship, it balance line voltage drops or voltage sudden changes on the line. Usually it's a five position of ± 2x2.5% of the rated voltage. The regulation is made changing the position of the link bars on all the three windings, compulsorily with the transformers out of service.

RATED NO LOAD SECONDARY VOLTAGE

It's the value of output no load secondary voltage, usually the lowest value of the two nominal voltages (LV).

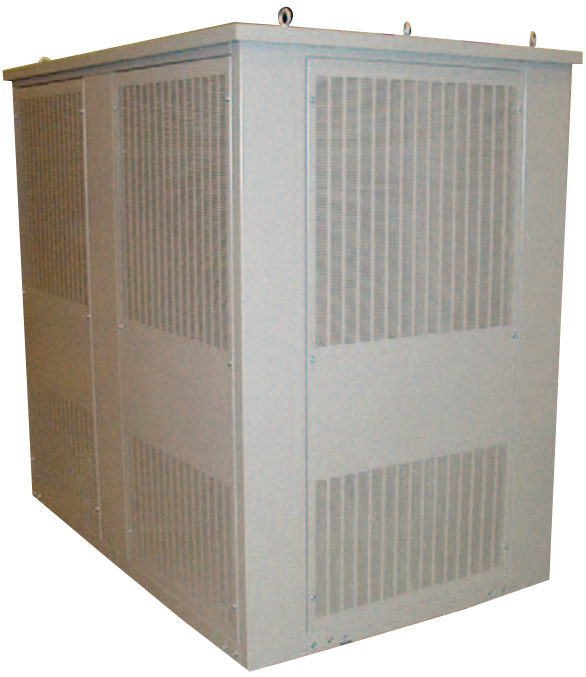
INSTALLATION

The cast resin transformer cannot be installed directly outdoor, but can be used outdoor if properly protected against atmospheric agents like rain, snow and hail. This can be obtained putting the cast resin transformer inside of appropriate metallic enclosures commonly known as box. Usually it's installed indoor with or without protective box. In any case it's important to maintain the correct insulating and safety distance from any energized point of the transformer and any other grounded point that surround it, here follows some tables that can give an idea of such distances.
In the following table we show the indicated minimum distance for insulation that CEI 11-18 to be maintained between the energized parts of the transformers and the surrounding metallic parts or elements of our energized installations.
When the transformer is inside the enclosure there's no need to keep these distances because they are already maintained from the enclosure. During installation you

Max voltage (Um) (kV)	Withstand voltage		Insulating distance (cm)
	FI (kV)	Implulse (kV)	
3.6	10	20 - 40	6
7.2	20	40 - 60	6 - 9
12	28	60 - 75	9 - 12
17.5	38	75 - 95	1 - 16
24	50	95 - 125	16 - 22
36	70	145 - 170	27 - 32

must avoid the risk of accidental contacts by people with the active parts, resin included. The minimum safety distance protection for people against accidental contacts according to CEI 11-18 and the D.P.R. 547 are listed in the following table.

Max voltage (Um) (kV)	Withstand voltage		Safety distance (cm)
	FI (kV)	Impulse (kV)	
3.6	10	20 - 40	15
7.2	20	40 - 60	15
12	28	60 - 75	15
17.5	38	75 - 95	18 - 20
24	50	95 - 125	22 - 28
36	70	145 - 170	34 - 40



TYPE OF COOLING

The cast resin transformers are usually cooled with natural cooling by air (AN), sometimes special needs require the use of fans for cooling with forced air (AF). At all times concerning the installation of a transformer we must always pay attention to keep the ventilation openings clear to allow the natural dissipation of heating produced from the transformer because of Joule effect. For a correct installation and a longer life of the transformer it is necessary to dissipate the heat produced by the magnetic core and by the windings depending of Joule effects paying attention not to exceed the limit of over temperature in compliance of the thermal class of the transformer.

We must ensure proper cooling through circulation of natural air, the same should flow through the transformers surfaces with a natural flow from the bottom to the top. For this reason there should be created,

in the room where the transformer is installed, some proper openings so that for every kW of losses there could be an air flow of 3,5 cubic meters per minute. In the transformer room there should be created openings at the bottom for the entry of cooling air and at the opposite side of the top for the exit of the thermal loaded air (Ex Picture 1).

The theoretical formula for the calculation of openings to be done depending on losses to be dissipated is the following:

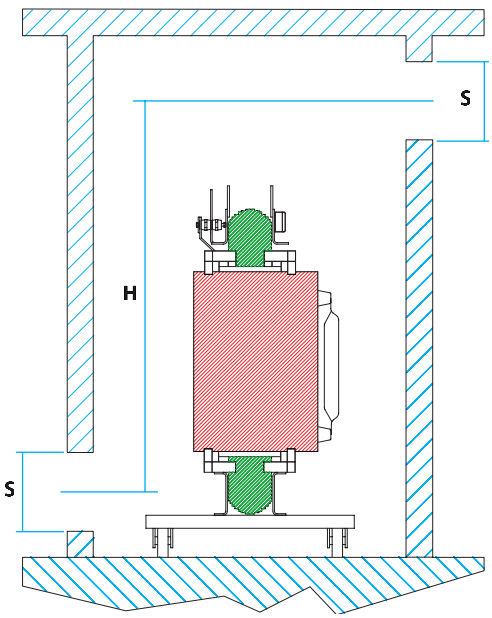
$$S = (0{,}188 \times P) / \sqrt{H}$$

(Ref. Picture1)

S = Open surface (mq)

P = Addition of no load losses and load losses at 120°C (kW)

H = Height of the two open surfaces (m)



Picture 1

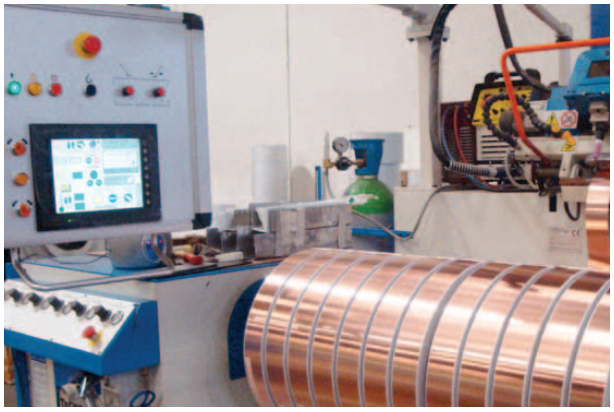
INSULATION CLASS

The insulation level and the corresponding class for each winding is in compliance with the maximum Voltage of the system.

FI is the test at industrial frequency for one minute.

The impulse test have two values for each class (CEI EN 60076-11).

Max voltage (Um) (kV)	Withstand voltage	
	FI (kV)	Impulse (kV)
3.6	10	20 - 40
7.2	20	40 - 60
12	28	60 - 75
17.5	38	75 - 95
24	50	95 - 125
36	70	145 - 170



THERMAL CLASSES, AMBIENT TEMPERATURE, MAXIMUM OVERTEMPERATURE, ALTITUDE

In compliance with the thermal insulation classes, in the following table are listed the limit of over temperature that the transformer's windings can withstand with 40°C of maximum ambient temperature.

Thermal classes	Maximum over temperature (K)
B	80
F	100
H	125

These values are decreased in case the transformers are projected to be installed over 1000 meters of altitude, they are tested at standard altitudes , by 2.5% for each 500m in case of natural cooling.
Each transformer is supplied with three thermo probe (PT100 Ω), if not differently specified by the customer, located one on each LV winding to be connected at an electronic microprocessor with two level (alarm and trip), for which calibration we suggest the following values:

Thermal classes	Alarm temperature (°C)	Trip temperature (°C)
B	120	140
F	130	150
H	150	170

VECTOR GROUP

The windings of each single phase can be connected star, delta or zig-zag. In the different solutions that we can obtain the system of induced voltage on low voltage is out of phase of a certain angle against the the same obtained by medium voltages and this angle is a multiple of 30°. This group is identified with an alphanumeric code where the letter show the type of connection.

Y = star D = delta Z = zig-zag

One of our transformer during the measurement of sound level at CESI (MI)

The capital letter character refers to the winding with the higher voltage and the lowercase character refer to the winding with lowest voltage, the star connection is usually followed by the letter "n" that means that the neutral must be available.
After the letters we can find a number that identifies the group, so the coefficient that we must multiply to 30° to obtain the angle displacement between the delta of the primary concatenate voltages and the delta of the secondary voltage, depending by the connection type of the windings. For example the Dyn11 group identifies a transformer with the primary medium voltage winding with delta connection and the secondary low voltage winding star connected with available neutral and an angle displacement of 330°.

NO LOAD LOSSES

Also called iron losses, as they are localized in the magnetic core. It is the active power takeover by the transformer when it is energized at nominal voltage and frequency. It's understandable that these losses are always present in the transformers also without the load. The current absorbed in these operating conditions is the no-load current.

LOAD LOSSES

Also called short circuit losses because they are measured during the short circuit test being localized in the windings. It's the active power absorbed for Joule effect from the windings with the load connected at nominal voltage.
They are referred at the temperature of 75°C or more properly at 120°C.

SHORT CIRCUIT VOLTAGE

It's the value of voltage that should be applied to the primary winding connections to allow the flow of nominal current with the secondary winding closed on short circuit (percentage expression of nominal voltage). It's very important when is planned the installation of transformers in parallel condition because the relative values of short circuit voltage (Vcc%) set the partition of the load. At changes of short circuit voltage, the short

circuit current at the secondary windings connections change as well, according to: Icc = (100/Vcc) x I2n
Where I2n is the secondary rated current.
In big systems, to reduce the short circuit currents is frequently the choice of transformers with Vcc= 8-10%.

NOISE LEVEL

The noise produced by a cast resin transformer comes from the vibration of the magnetic sheets
subjected to a magnetic field variable in the time. The Standard CEI 14-12 / HD 538.2 indicates
the maximum level of sound power at rated frequency and voltage according to the existing laws and regulations. For handiness are rather warranted levels of acoustic pressure at 1 meter. The walls and the ceiling where the transformer is installed cause for reflection an increase of the buzz in the air. The noise produced by the transformer, usually a buzzing spread to walls also through the supports of the machine to the floor, for this reasons the utilization of insulating materials, like rubber supports, decrease this spread so that it's not necessary to insulate the walls and the ceiling of the room.

OVERLOADS

The cast resin transformers, using air flow for cooling, require a longer time to warm-up their temperature, for this reasons they are more over loadable than oil transformers. Cast resin transformers can be overloaded as long as the windings over temperature won't keep long above of accepted values. For the easiness of installation it's very widespread the use of radial flow fans on-board mounted.

The use of these fans allows to overload the transformer on average at 125% also permanently, taking into account that the load losses increase with the square of the current so with 125% they increase of 1.56 time the rated value. For this reason the utilization of fans is advised only to deal with particular emergency situations or to have more power in some times. The IMEFY transformers have anyway the followings overload levels allowed as well in standard product with ambient temperature at 30°C:

- 105% continuously
- 110% for 2 hours only one time in 24 hours
- 120% for 1 hour only one time in 24 hours
- 130% for 30 minutes only one time in 24 hours

TEMPERATURE CONTROL

In their life the transformers are characterized from high operating temperatures that must be constantly
controlled. Over-heating are not depending only on the load and/or overcurrent but also on environmental
aspects such as inefficient movement of both natural and forced air, increased ambient temperature essentially due to a bad ventilation of the installation chamber. For this reason are always provided some controllers for the three phase and sometimes also core temperature measurement.
All transformers, unless otherwise specified, have a set of PT100 thermo-probes, one for each low voltage
column of the machine, through these thermo probes with the support of an electronic microprocessor is possible to read the temperatures values and also to set the alarm and trip values of the transformers from the electrical line. The recommended values for the different climatic classes are stated on the page n°8 of our Utilization and Maintenance Manual.

INRUSH CURRENT

The medium voltage transformers, at the inrush time, have a magnetization current, high but with short duration, that can be the reason of an unexpected action of the electrical protections on the MV side.
The international standards don't deal this topic and the values are usually given from the manufacturer that has took these values empirically in the course of the time.

Rated power (kVA)	Peak value of inrush current x In
250	12
400	11
630	10
1000	9
1600	7
2500	5

10 MVA - 15.000 / 6.300 V / V

EVALUATION OF COSTS DEPENDING BY THE ISTALLATION OF A CAST RESIN TRANSFORMER:

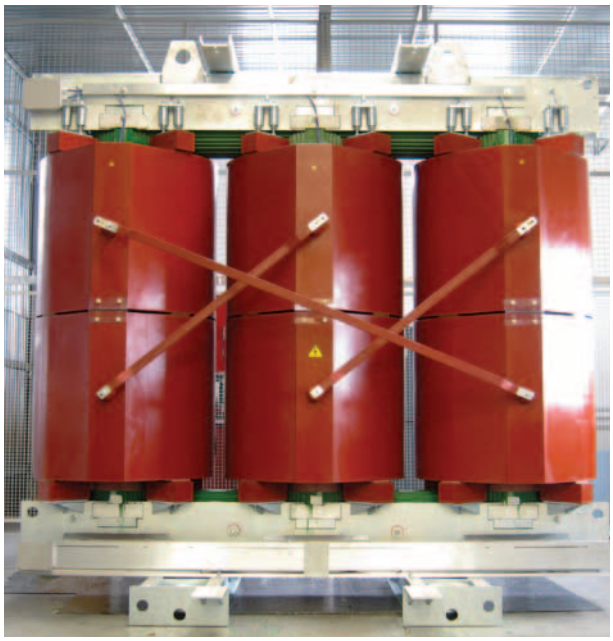
Total costs = Ccap + Cpo + Cpcc + Cmn (€/year)

Cost of economic capital
Ccap = (Pt + Pin) x {[(1+ti)n x ti] / [(1+ti)n - 1]}
Pt = price of the transformer
Pin = installation costs (connection, civil works...)
ti = interest rate n = number of years
No load losses cost
Cpo = Ce x P0 x h
Ce = cost of electric energy (€/ kWh)
Po = no load lasses (kW)
h = hours of operation (8.760 for trasformer every connected to the electrical net)
Cost of load losses with a costant load
Cpcc = Ce x Pcc x h x k
Ce = cost of electric energy (€/ kWh)
Pcc = load losses (kW)
h = hours of operation (8.760 for trasformer every connected to the electrical net)

k = loading = effective kVA / rated kVA

Mantainence costs = Cmn = 0 for IMEFY spa transformers

Our test room for impulse test



TESTS

All IMEFY transformers are tested following the procedures and according to IEC 60076-11 routine tests:

- Separate source AC withstand voltage test
- Induced AC withstand voltage test
- Measurement of Partial discharge test
- Measurement of No-load losses and no-load current
- Measurement of voltage ratio and check of phase displacement
- Measurement of Winding resistance
- Measurement of Load losses
- Measurement of short-circuit impedance.

All the other type or special test have to be agreed separately.

POWER FACTOR CORRECTION

A big part of the energy dissipated from the transformers is reactive energy being magnetizing energy. The compensation of this energy can be obtained through appropriate battery of capacitors power factor correction permanently connected to the secondary windings of the transformers. The power of this battery should be chosen depending on the magnetizing no load power of the transformers, here follows the simple rule for the calculation of the battery power factor correction size for the no load current of the transformer:

$$Q = (I_0\% \times Pn) / 100 \text{ (kVAR)}$$

Example for a 630 kVA transformer.

$$Q = (0.73 \times 630) / 100 = 4.6 \text{ kVAR}$$

For unification it will be necessary a battery of 5 kVAR.

TRANSFORMER'S PARALLEL

A frequent condition in transformer's installation is the parallel between two or more machineries, they are in parallel when they are powered by the same MV line and they give power to the same LV line. The necessary conditions to be able to do a parallel are the followings:

- same voltage ratio
- same vector group
- same short-circuit voltage (in limits of tolerances ± 10%)
- relationship between rating must be included between 0.50 and 2.

The last two conditions are about the load allocation, indeed the currents are divided with opposite relationship of Vcc and proportionately to respective rating powers.

ELECTROMAGNETIC COMPATIBILITY

The cast resin transformers have to be considered for the noise caused by the magnetic field that creates the missing flux produced by the current of secondary connections.

The magnetic field issued by windings is reduced and anyway lower than the one is issued by LV connections, the values of the same furthermore decrease quickly at the growth of the distance from the transformer. As previously mentioned the resin transformers are often installed in metallic cases or in properly screened rooms that reduce three to four times the dimension of the produced magnetic field.

CE MARKING

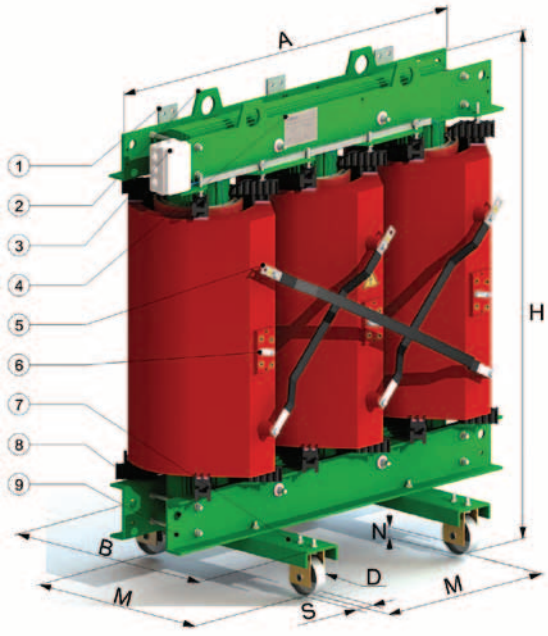
The instruction 89/336/EEC issued by the European DG III Industry board about the subject of electromagnetic compatibility, suggest the "high voltage inductors" and the "high voltage transformers", as machineries excluded from application field of the same instruction.

For this reason there is no obligation to put on transformers the CE marking.

Lightning impulse test at CESI (MI)

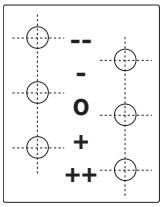
Short circuit test at CESI (MI)

Lightning impulse test at CESI (MI)



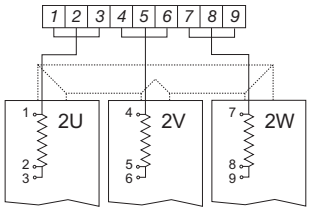
1 - Low voltage terminal
2 - Lifting lugs
3 - Connection Box IP55 for PT100
4 - Rating plate
5 - High voltage terminal
6 - Tap-changer
7 - Trolley for shifting
8 - Couplers
9 - Earthing terminal

TAP - CHANGER ± 2 X 2,5%

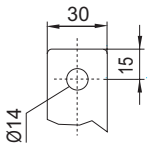


Variation	Position
+ 5%	++
+ 2,5%	+
0	0
- 2,5%	–
- 5%	– –

CONNECTION OUTLINE PT 100 ohm



HIGH VOLTAGE TERMINAL



100 : 3.150 KVA

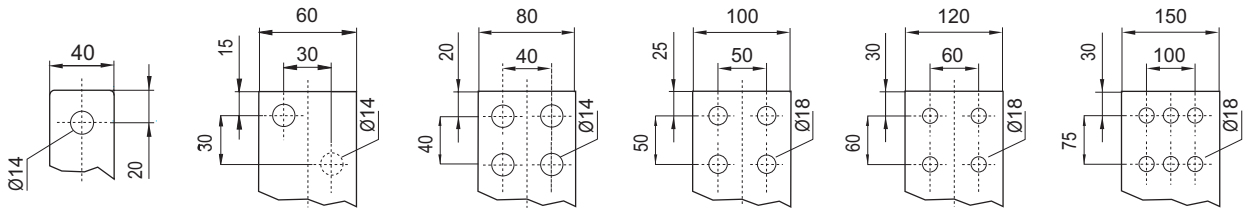
EXAMPLE OF RATED CARACHTERISTICS
Three phases cast resin Transformer

Decription			A
Quantity		N°	1
Code Art.			1600 - C
Envir.clim.& fire classes (CESI cert. B0005487)			E2 - C2 - F1
Rated Power		kVA	1.600
Rated Frequency		Hz	50
HV rating		kV	20
HV tapping adjustment		%	± 2 x 2,5
No - load LV rating		V	400
Material Conductor	HV / LV		Al / Al
Protection windings	HV / LV		Casted / Painted
Installation			Indoor
Cooling system			AN
HV Winding insulation level		kV	24-50-95 /
LV Winding insulation level			1,1 - 3/
Vector group			Dyn11
HV connection			Delta
LV connection			Star + Neutral
HV - LV winding insulation class			F - F
Maximum ambient temperature		°C	40
Max temperature rise	HV-LV-Core	K	100 - 100
Height above sea level		m	/
Technical guarantees are referred ratio		kV	20 / 0,4
No - load losses at Vn		W	3.100
Load losses	(120°C)	W	16.100
Short circuit impedance	(120°C)	%	6
No - load current at Vn		%	0.7
Sound pressure (LpA)		dBA	64
Dimensions	(L x W x H)	mm	1770 x 1000 x 2120
Weight		Kg	3.500

STANDARD ACCESSORIES

N° 3 PT100 Ω - Connections plates for HV and LV terminals - Lifting lugs - Bi-directional rollers for lengthways or sideways travel - Rating plate - N° 2 Earthing terminal - Tow attachement - Auxiliary terminal box IP 55 clamp.

LOW VOLTAGE TERMINAL

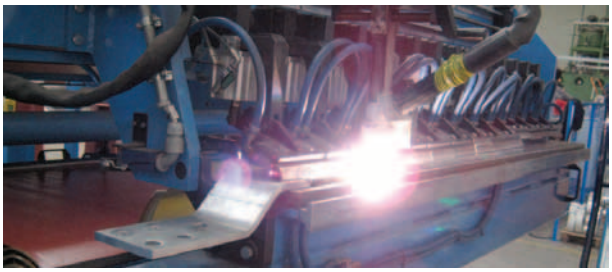


100 : 250 KVA | **315 : 500 KVA** | **630 : 800 KVA** | **1.000 : 1.250 KVA** | **1.600 : 2.000 KVA** | **2.500 : 3.150 KVA**

RATED TECHNICAL CHARACTERISTICS

Rating (kVA)	Vcc (%)	I0 (%)	Lpa (dBA)	SERIE 12KV NORMAL LOSSES							SERIE 12 KV LOW LOSSES							SERIE 24 KV NORMAL LOSSES							SERIE 24 KV LOW LOSSES							SERIE 36 KV											M (mm)	D (mm)	S (mm)	N (mm)
				P0 (W)	PCC (75°) (W)	PCC (120°) (W)	A (mm)	B (mm)	H (mm)	Weight (Kg)	P0 (W)	PCC (75°) (W)	PCC (120°) (W)	A (mm)	B (mm)	H (mm)	Weight (Kg)	P0 (W)	PCC (75°) (W)	PCC (120°) (W)	A (mm)	B (mm)	H (mm)	Weight (Kg)	P0 (W)	PCC (75°) (W)	PCC (120°) (W)	A (mm)	B (mm)	H (mm)	Weight (Kg)	Vcc (%)	I0 (%)	Lpa (dBA)	P0 (W)	PCC (75°) (W)	PCC (120°) (W)	A (mm)	B (mm)	H (mm)	Weight (Kg)				
100	6 *4*	2,30	51	400 *440*	1900 *1700*	2200 *1950*	1060 *1110*	700	1.150	550 *650*	340	1900 *1700*	2200 *1950*	1060 *1110*	700	1.150	550 *650*	480	1.950	2.250	1.100	700	1.150	550	380	1.950	2.250	1.100	700	1.150	550											520	125	40	35
160	6 *4*	2	52	580 *610*	2700 *2300*	3100 *2650*	1070 *1130*	700	1200 *1180*	650 *750*	460	2700 *2300*	3100 *2650*	1070 *1130*	700	1200 *1180*	650 *750*	650	2600	3000	1120	700	1200	650	500	2600	3000	1120	700	1200	650														
250	6 *4*	1,70	53	800 *820*	3300 *3000*	3800 *3450*	1230 *1200*	700	1.280	900 *980*	600 *620*	3300 *3000*	3800 *3450*	1230 *1200*	700	1.280	900 *980*	880	3.300	3.800	1.260	700	1.250	1.000	670	3.300	3.800	1.260	700	1.250	1.000														
315	6 *4*	1,40	54	900 *980*	4200 *3700*	4800 *4250*	1280 *1230*	800	1280 *1370*	1050 *1100*	700 *740*	4200 *3700*	4800 *4250*	1280 *1230*	800	1280 *1370*	1050 *1100*	1.000	4.000	4.600	1.330	800	1.270	1.100	800	4.000	4.600	1.330	800	1.270	1.100	6	1,30	56	1.450	4.100	4.700	1.730	800	1.520	1.700	670			
400	6 *4*	1,20	55	1050 *1150*	5000 *4300*	5750 *4950*	1300 *1320*	800	1350 *1400*	1200 *1350*	820 *880*	5000 *4300*	5750 *4950*	1300 *1320*	800	1350 *1400*	1200 *1350*	1.200	4.800	5.550	1.350	800	1.380	1.250	940	4.800	5.550	1.350	800	1.380	1.250	6	1,30	57	1.650	4.800	5.500	1.750	800	1.600	1.850				
500	6 *4*	1,10	56	1200 *1350*	6000 *5300*	6900 *6100*	1340 *1320*	800	1440 *1480*	1350 *1500*	960 *1010*	6000 *5300*	6900 *7100*	1340 *1320*	800	1440 *1480*	1350 *1500*	1.400	5.900	6.800	1.370	800	1.460	1.400	1.100	5.900	6.800	1.370	800	1.460	1.400	6	1,20	58	2.000	5.600	6.400	1.760	800	1.700	2.100				
630	6 *4*	1,00	57	1450 *1500*	7200 *6400*	8300 *7350*	1410 *1370*	800	1550 *1580*	1600 *1800*	1050 *1150*	7200 *6400*	8300 *7350*	1410 *1370*	800	1550 *1580*	1600 *1800*	1.650	6.900	7.950	1.440	800	1.560	1.700	1.270	6.900	7.950	1.440	800	1.560	1.700	6	1,10	60	2.200	6.950	8.000	1.850	800	1.790	2.500				
800	6	0,90	58	1.650	8.000	9.200	1.460	800	1.630	1.900	1.330	8.000	9.200	1.460	800	1.630	1.900	2.000	8.200	9.450	1.470	800	1.660	2.000	1.500	8.200	9.450	1.470	800	1.660	2.000	6	1,10	61	2.650	8.600	9.900	1.880	800	1.870	2.800		150	60	40
1.000		0,85	60	2.000	8.800	10.150	1.500	1.000	1.860	2.200	1.560	8.800	10.150	1.500	1.000	1.860	2.200	2.300	9.600	11.050	1.560	1.000	1.860	2.300	1.750	9.600	11.050	1.560	1.000	1.860	2.300	6	1	63	3.100	10.000	11.500	1.930	1.000	2.110	3.300	820			
1.250		0,80	63	2.400	10.400	12.000	1.620	1.000	1.960	2.700	1.870	10.400	12.000	1.620	1.000	1.960	2.700	2.700	11.800	13.600	1.660	1.000	2.030	2.900	2.000	11.800	13.600	1.660	1.000	2.030	2.900	7	0,90	64	3.500	12.000	13.750	2.000	1.000	2.230	3.800				
1.600		0,70	64	2.800	12.700	14.600	1.730	1.000	2.100	3.400	2.200	12.700	14.600	1.730	1.000	2.100	3.400	3.100	14.000	16.100	1.770	1.000	2.120	3.500	2.400	14.000	16.100	1.770	1.000	2.120	3.500	7	0,80	66	4.200	14.800	17.000	2.060	1.000	2.350	4.300				
2.000		0,60	65	3.800	15.400	17.700	1.830	1.300	2.220	4.100	2.800	15.400	17.700	1.830	1.300	2.220	4.100	4.000	17.000	19.550	1.890	1.300	2.300	4.400	3.000	17.000	19.550	1.890	1.300	2.300	4.400	7	0,70	67	4.700	18.000	20.700	2.230	1.300	2.450	5.400	1.070	200	70	50
2.500		0,55	66	5.000	20.000	23.000	2.020	1.300	2.290	5.000	3.300	20.000	23.000	2.020	1.300	2.290	5.000	5.000	20.000	23.000	2.020	1.300	2.370	5.250	3.800	20.000	23.000	2.020	1.300	2.370	5.250	7	0,60	69	5.800	21.000	24.150	2.360	1.300	2.500	6.250				
3.150	7	0,50	67	6.000	22.000	25.300	2.130	1.300	2.430	6.000	4.500	22.000	25.300	2.130	1.300	2.430	6.000	6.000	23.000	26.450	2.230	1.300	2.450	6.200	4.800	23.000	26.450	2.230	1.300	2.450	6.200	8	0,50	70	6.900	23.000	26.450	2.510	1.300	2.570	7.300				

We reserve ourselves to bring modifications to the data without no warming - you can find always the correct data in our web site: www.imefy.it



LOW VOLTAGE WINDING

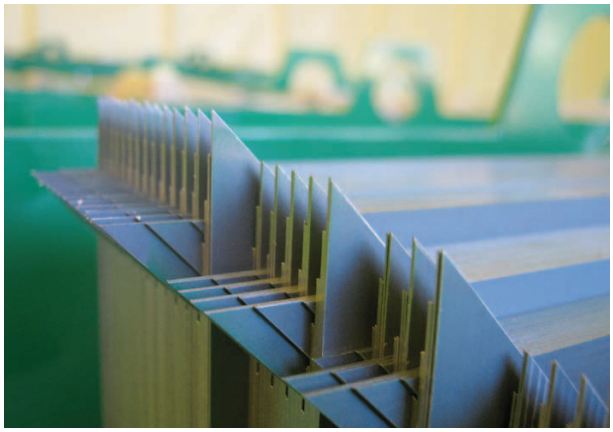
It's usually manufactured by a single foil of aluminum because the dielectric stresses are very low. This construction allows to obtain a strong resistance against short-circuit stress. The insulation between the turns is ensured by the use of pre impregnated Class F insulating materials. The winding's terminals are TIG welded into the winding all the way through, they are in aluminium rigid alloy in way not to compromise the dynamic strength of the winding.

MEDIUM VOLTAGE WINDING

It consists of a series of sub-winding made of aluminium foil, the insulation between turns is ensured by proper materials with a high insulation degrees. The winding is manufactured completely in automated machineries and after putting the connections it is pull down inside a mould and inside of an oven for the pre heating stage. The casting is done under vacuum, with a resin which is a mixture of quartz flour and epoxy resin properly weigh-out by an automated vacuum plant.
This type of winding have considerable advantages, indeed, the voltage difference between the turns is always the same having always only one turns for layer it permit to achieve higher impulse voltage withstand capability and a lower risk to have partial discharge. IMEFY Cast Resin Transformer have a level of partial discharge lower than 5pC, testing did frequently also in CESI laboratories.
The choice of aluminium in the casting reduces to the minimum the dynamic stresses due to heating because the coefficient of expansion of aluminium is very close to the one of the epoxy resin.

MAGNETIC CORE

The magnetic core is manufactured with high permeability, low-loss grain-oriented steel sheets. The characteristics of these material minimizes losses due to stray currents. The joints are 45° step–lap type to minimize stray-flux losses and noise of the transformer. The surface of the magnetic core is also covered by a special paint that protects the core against oxidation and corrosion, and meanwhile reduce the noise.



CERTIFIED QUALITY

IMEFY, on the evidence of the high quality of his products, has achieved during the last years the higher reputation national and international certifications and approvals in the field of Cast Resin Transformers:

ISO 9001

ISO 14001

CESI E2-C2-F1

GOST CERTIFICATE - RUSSIA

KAHRAMAA APPROVAL - QATAR

L.R. Grafiche - Arezzo - ITALY

IMEFY

IMEFY s.p.a.
Zona Ind.le Rigutino Ovest
52100 - AREZZO - ITALIA
tel. +39 0575 680701
fax. +39 0575 657856
imefy@imefy.it
www.imefy.it