



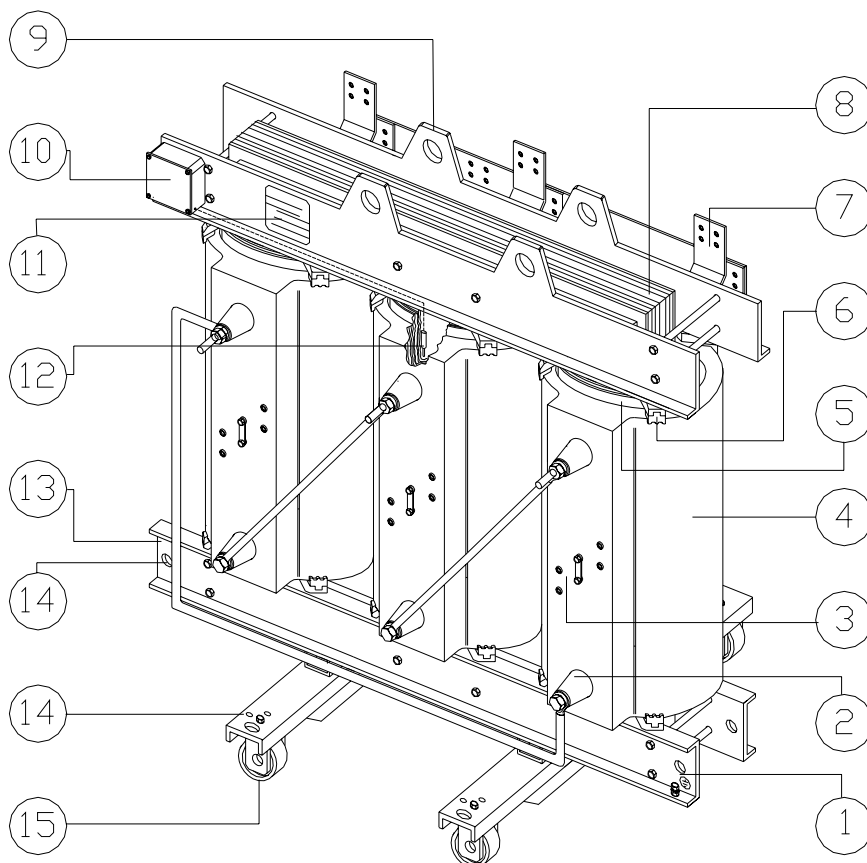
s.r.l

Cast-Resin Transformers



Working & Maintenance

Technical Characteristics



Standard Accessories

1. Earthing Terminal
2. High Voltage Output Insulator
3. Primary Voltage Regulating Tapping
4. High Voltage Windings
5. Low Voltage Windings
6. Windings Pressure Plugs
7. Low Voltage Output Bars
8. Magnetic Core
9. Lifting Eyebolts
10. Centralization Auxiliary Box
11. Data Plate
12. Thermal Sensor
13. Lamination Holder
14. Eyebolts for Horizontal Movement
15. Orthogonal Revolving Wheels

Accessories as Require

- Encapsulated Triangle
- Bushing for Connectors Plug
- Connectors Plug
- Protection Encloser
- Tangential fans for Forced Ventilation
- Antivibrating Kit System
- Thermometers with Exchange Contacts

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ITEM I - INTRODUCTION

1.1. Preface

This manual intends to supply all the needed explanations in order to assure a correct use of our electric transformers as well as the maintenance and control operations.

Modern environmental necessities and the consequent legal requirements which prohibit the use of poly-chlorodiphenyl dielectric fluids such as Askarel or Pyrochlor have given rise to the development of products that are not only non-inflammable but also have dielectric strength properties enough to support working voltages of 20 to 30 kV.

Epoxy resin has just "non inflammability" features - as we'll explain later - when suitable treated and mixed with other components - in combination with certain other very interesting technical-physical properties which enable the design of transformers that are smaller than the standard oil-insulated type ones.

Dry type transformers have demonstrated their considerably improved resistance to transient overloads, network short circuits and impulsive voltages. They behave extremely well in damp environments and have a very low average noise level. This features of non-inflammability, limited sizes, etc., mean a reduction in the plant's general costs and therefore make this kind of transformer competitive and advantageous compared to the traditional solutions.

1.2. Reference rules

- Norme IEC 60076 Standard Power Transformers;
- Norme IEC 60726 Dry Power Transformers;
- Norme IEC 61378 Conversion transformers

ITEM II - INSTALLATION


2.1. Packages and transport

The packages must be done with all the necessary expedients in order to care each single aspect for a sure transport without damages.

According to the products dimensions you can adopt different types of packing.

Wooden palets are utilized for the little transformers in order to facilitate the relevant loading and unloading meanwhile for the great ones it's used polystyrene or cardboard to avoid eventual damages due to the external agents. .

However sturdily, resin-encapsulated and dry type transformers cannot withstand violent shocks or excessive tugging of the lifting eyebolts. They are protected on the outside with a shrinking polyethylene film which safeguarde them from rain, dust or excessive dampness.

	<p>It's well advised to grant a good fastening on the means of transport by ropes or fixed frames taking off the wheels from the transformer, in case it's provided with</p>
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They must be handled with care and stored in a dried rooms.

2.2. Lifting and displacement of transformers

When shipped ex factory the transformers are always transported by truck, where as the buyer is charged for unloading.

A suitable length of top must be used during unloading operations.

The figure 01 hereunder clearly illustrates how the height of B must be greater than A.

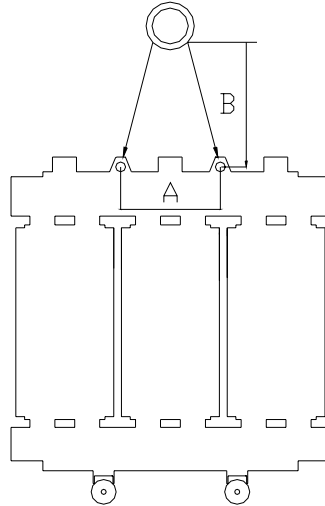


figure 01

The transformers are equipped with 90° revolving sliding wheels as illustrated in the figure 02. Special eye-bolts are provided near the wheels for moving the transformer.

Before setting up, check up that the high voltage coils have not been damaged during transport or storage.

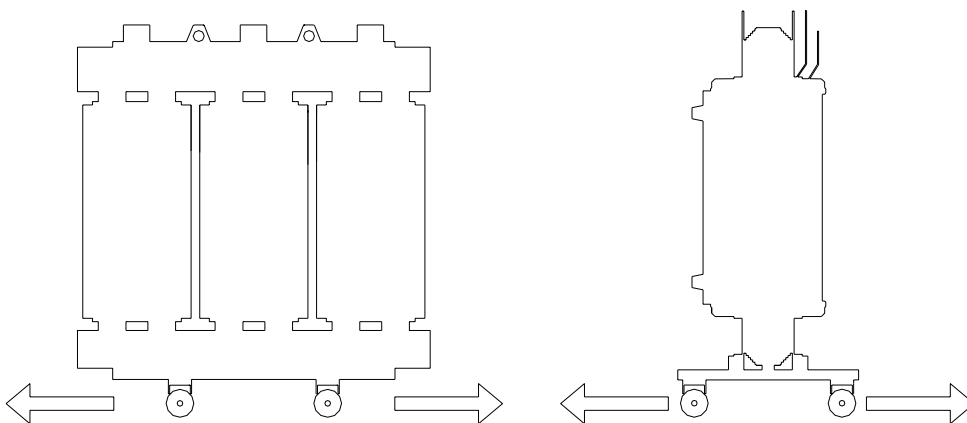


figure 02

The hereunder figure 03 shows how to exactly use the fork-lift truck without damaging the machine.

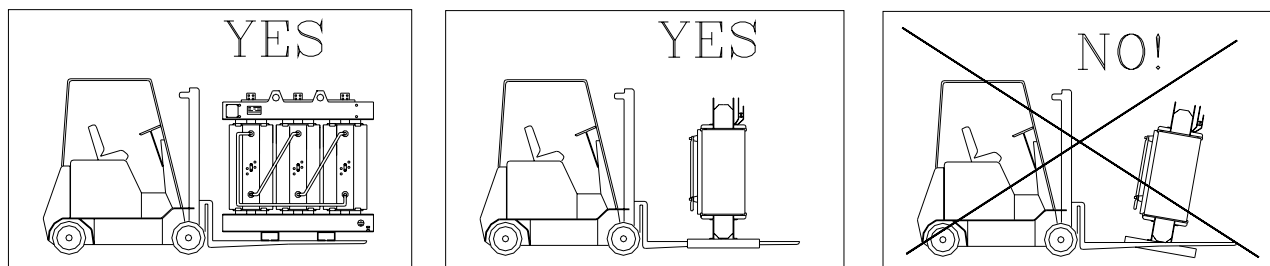
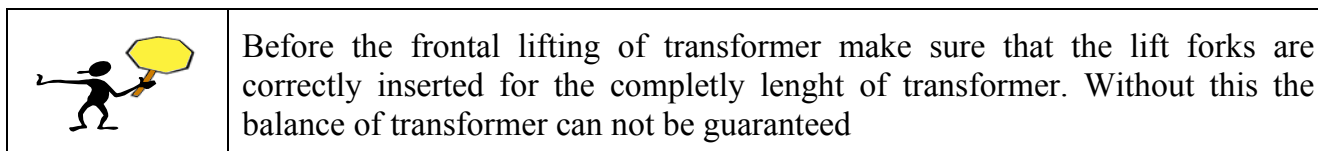


figure 03

Before starting the transformer, make sure that the high voltage coils have not been damaged during transport or storage.

2.3. Information about the protection devices

The check of temperature is made according to the diagram. Our company can supply three different types of control devices, allowing the visive and acoustic inspection and the possibility to trip.

For normal application the tripping temperature for alarm is according to the STANDARDS and specifically indicated in this handbook.

The devices illustrated are:

- Dial thermometer with two contacts;
- Electronic device with thermocontacts or PTC;
- Electronic device with control by PT100 sensors.

Thermometer with electrical contacts

This is the more simple way to control for temperature monitoring and measuring on cast transformers. The thermometer can be supplied with electrical contacts normally opened or closed as per wiring diagram figure 04.

Max load 2,5 A - 250 v. This thermometer is extremely reliable.

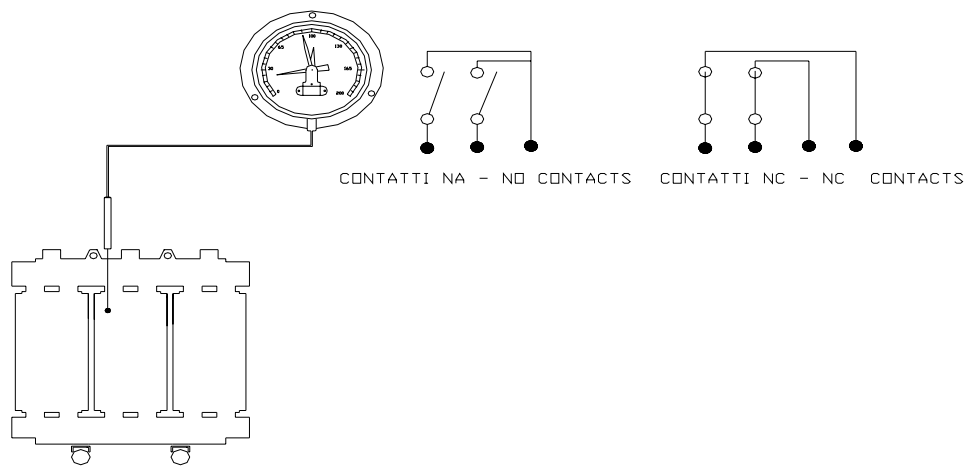


figure 04

Electronic device for thermocontacts or PTC

The electronic device for thermocontacts, consents the visualization of the temperature of central phase allowing at the same time to control the temperatures of the winding, by means of 3+3 thermal contacts, normally opened or closed and setted for alarm and for trip intervention. Electronic device for temperature control with thermal contacts figure 05 and electronic device for PTC sensors figure 06:

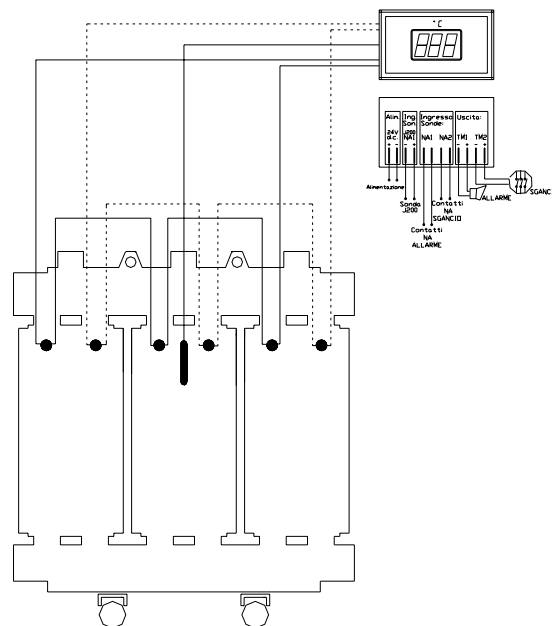


figure 05

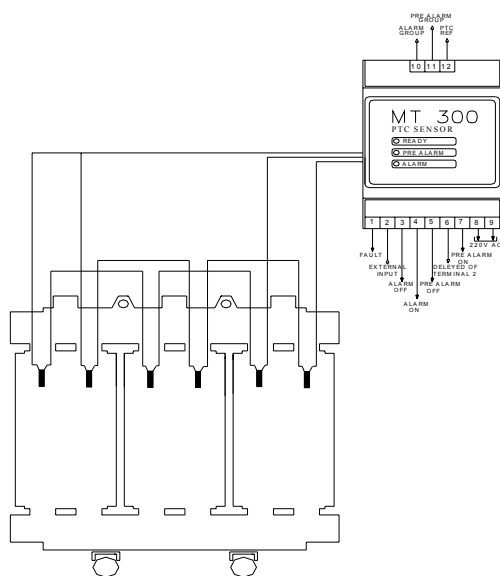


figure 06

Electronic device for PT100

This device has the function to control the temperatures of all the three phases and, if require, of the core. The electronic control of temperature is obtained by means of PT100 sensors -100 Ohm at 0°C-. The electronic device shows the highest temperature of the transformer, anyway the operator can search the temperature of the control of all phases. The function warning and tripping is obtained by means of electrical output contatcs -Opening/Closing- according to the diagram figure 07. The operation temperatures can be setted from operator, but normally we set 140°C for warning and 150°C for tripping. On the electronic device it's also installed one output contact for signalling sensor's faults and for starting possible cooling fans (5A-250V).

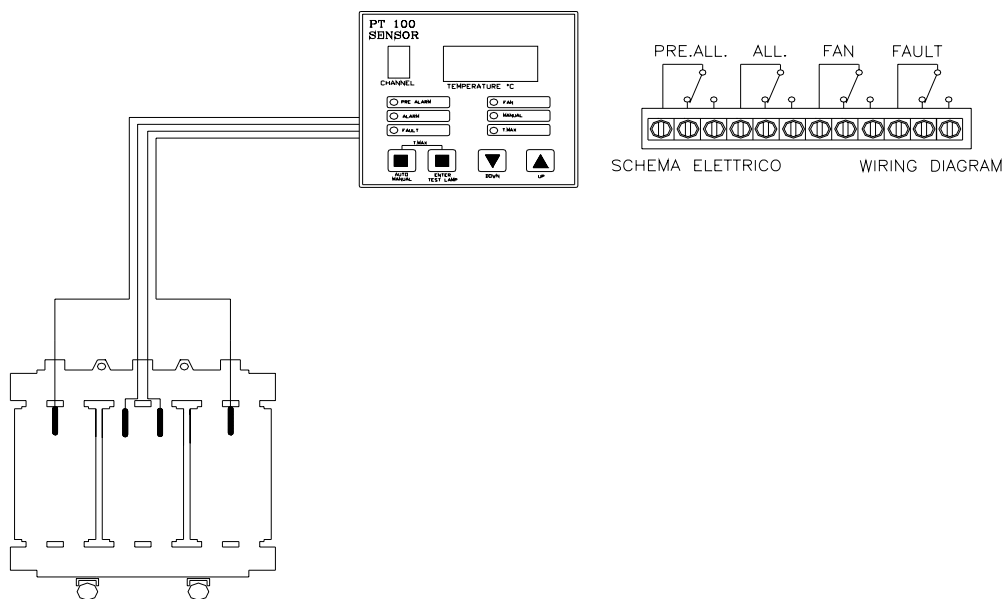


figure 07

2.4. Overload and working conditions

During special working conditions or special applications for which a temporary power augmentation is required, it should be helpful to know all the essential features of the cast transformer. The cast transformer has a big thermal inertia and can manteing large overloads for short time. Here under (figure 08) is indicated the state of the overloads in function of the time in minutes or hours.

OVERLOAD CAPACITY AND TIME ACCORDING THE OVERLOAD, THE PRE-LOAD AND THE ENVIRONMENT TEMPERATURE OF 20 °C

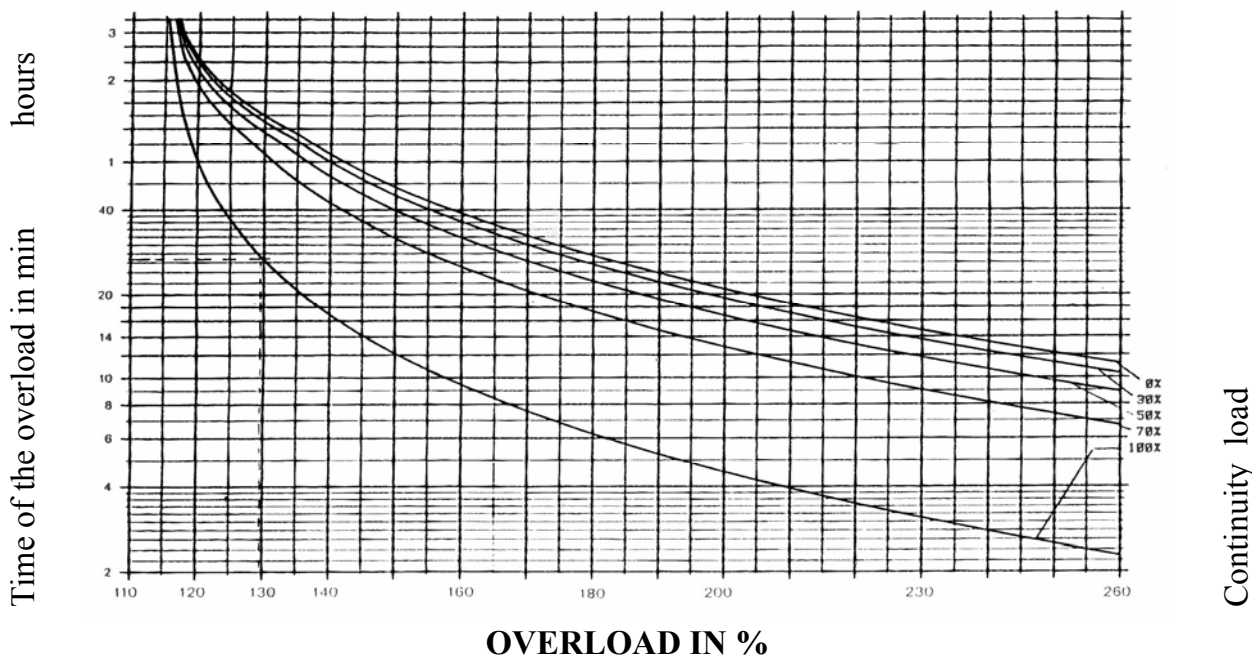


figure 08

2.5 Working temperatures

The working temperature of the machines are changing according to the insulation class and the climatic class as per IEC 60076-3 (CEI 14-4/3) and are indicated in the following schedule:

Table I

INSULATION CLASS	SERVICE RANGE C1 CLASS	SERVICE RANGE C2 CLASS
B	da - 5 a 120 °C	Da -25 a 120 °C
F	da - 5 a 140 °C	Da -25 a 140 °C
H	da - 5 a 140 °C	Da -25 a 140 °C

Each transformer has three thermal contacts, one for each winding and a contact in the core -if foreseen-.


	<p>In order to carry out a thermometrical control it's necessary to connect these thermal contacts to the protection central peripheral unit, equipped with two intervention levels.</p> <p>For the relevant gauging we advice you the following values Table II:</p>
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Table II

INSULATION CLASS	ALARM	TRIPPING
B	120°C	130°C
F	140°C	150°C
H	160°C	170°C

2.6. Insulation distances

It's necessary to observe a minimum distance among the under voltage working parts of transformer, the surrounding metal masses and other elements of the device during working, according to the IEC 60076-3 (CEI 14-4/3) standards.

The following table III shows the minimum insulation distances to respect:

Table III

MAX. INSULATION VOLTAGE	NOMINAL VOLTAGE AT SERVICE INDUSTRIAL FREQUENCY (KV)	NOMINAL VOLTAGE AT CREST VALUE ATMOSPHERICAL PULSES	AIR MINIMUM DISTANCE
3,6	10	20	6
		40	6
7,2	20	40	7
		60	9
12	28	60	9
		75	12
17,5	38	75	12
		95	16
24	50	95	16
		125	22
36	70	145	30
		170	36

2.7. Safety distances

The transformer must be placed and installed in such a way to avoid any risk of fortuitous contact of people with the under voltage parties and at the same time to allow the evacuation of the produced heat and to maintain the maximum winding temperature under the values indicated on the paragraph 2.5.

For the safety and protection of people against the fortuitous events and contacts, observe the distances as indicated in the following table IV.

Table IV

MAX. INSULATION VOLTAGE	NOMINAL VOLTAGE AT SERVICE INDUSTRIAL FREQUENCY (KV)	NOMINAL VOLTAGE AT CREST VALUE ATMOSPHERICAL PULSES (KV)	SAFETY DISTANCE (CM)
3,6	10	20	15
		40	15
7,2	20	40	15
		60	15
12	28	60	15
		75	15
17,5	38	75	15
		95	20
24	50	95	20
		125	28
36	70	145	34
		170	40

2.8. Overvoltage

When transformers are overvoltage because of atmospheric conditions and displacement, arrange a protection by some gauged dischargers in connection with the needed insulation gauge.

Note that, at any rate, the following condition, which is statistically the worst, i.e. a transformer which is directly or by a normal length wirings to the air lines is absolutely to avoid.

2.9. Mechanical fastenings and electrical connections

All the external wirings, - in the Low voltage side, in the High voltage side and in the earth points -, must be properly performed and considering the insulation distances, the wires sections and positions.

The locking and/or the gripping of electrical connections and of mechanical fastenings will be carried out according to the here under diagram (table V e table VI).

Table V

SCREWS	TIGHTENING Mechanical Connection	COUPLES (Nm)* <i>Electrical Connection</i>
M 6	10	/
M 8	23	23
M 10	50	40
M 12	85	50
M 14	130	80
M 16	205	125

For the bolts and screw-nuts auto-locked of the yoke pressure profiles, the couples have to be lower according the form as followed:


Table VI


SCREWS	TIGHTENING COUPLES (Nm)* Mechanical Connection Yoke
M 8	8
M 10	9
M 12	11
M 14	17
M 16	21

* Valid for screws in steel 8,8 Type. Divide the values by 10 for kgm gauged dynamometrical keys.

2.10. Installation measures for the heat evacuation produced by the transformer

It's necessary to evacuate the heat which is produced in the magnetic circuit in order to assure a properly duration of the transformers and to avoid the temperature limits overcoming.

	<p>The cooling surfaces must be touched by the circulating air through suitable intakes (approx 4 M3/min. per kW losses)</p>
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	<p>The air circulation shortage causes an abnormal overheat that in the serious case can require the thermal protection relays intervention</p>
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The installation room must be properly ventilated. Arrange some grates opening on the floor for the fresh air intake and some openings in the opposite direction in relation to the longitudinal level of the transformer for outlet of the hot air.

The ventilation will be more efficient as there is great difference H in height between the thermal axis of the transformer and the outlet opening middle.

ITEM III - STARTING


3.1. Information

The transformer will be delivered with wheels on the upper side of the carriage, differently fastened, or otherwise.

3.2. Machine unloading inspections

Before the machine unloading verify that the transformer has had any damage during the transport.

-For example: low voltage plates defective, the insulator broken, the connections among the high voltage phases weakened or lacerated, the coils composing the single winding will be concentric with the core axis.-

	<p>In case of problems and damages, take note of the carrier and describe the damage or problem on the carrier papers and inform as soon as possible the manufacturer. Otherwise the compensation of damage will be not recognized by carrier</p>
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In order to have a right reference with the technical department of company, communicate the following data:

- **Type;**
- **Power;**
- **Matriculation Number;**
- **Manufacturing Year;**
- **Voltages.**

3.3. Visual inspections

Before starting it's necessary to verify that any foreign material has been forgotten in the machine as it should cause serious damages during the setting up.

In fact it's possible that during the operations of installation and connection, or during storage, bolts, nuts, washers or other material coming from the surrounding equipments, remain stopped in the winding channels.

	<p>It's well advised that after a storing or a stoppage, to clean the HT and LV windings, eliminate each dusty trace, condensation and dirt by dried compressed air castings or by dried wipers.</p>
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3.4. Mechanical and electrical controls

Before starting, it should be carry out an inspection in order to assure a properly installation and connection of the transformer.

The following points must be carefully examined:

- a) cleaning of the average and low voltage windings and of the relevant channels from dusties and from the dirty by means of low pressure dried compressed air castings and dried wipers.
- b) preheating of the transformer in case of condensate by an oven or a short circuit functioning;
- c) check the exact functioning of the probes; in this connection it' s enough to measure the probe resistance on the centralization box of the machine.

The obtained value in the special conversion schedule in C degree must confirm the

Environment temperature;

- d) check the good tightening of the average and low voltage wirings, of the relevant outlet connections and of the adjustment plates;
- e) check the connector terminals of the transformer on the floor - if foreseen;
- f) inspection of the windings of high and low voltage on the magnetic core; insulation inspection of windings among them and towards the mass by a megahmeter type Megger with a voltage over 3 KVolt;
- g) check of the tie rods to the core or to the mass;
- j) check all the protection devices of transformer against eventual overvoltages.
- k) check the correctness of connections for the specific feeding voltage with the help of the machine diagram;
- l) check the position of the small bar on the terminal board. This must be the same on the three HT wirings and must coincide with the specified feeding and loading voltages. In case the voltage is over to the one allowed by the adjustment intake, the vacuum losses and the noise are raising.
- m) check the circuits of fans, if the same are included in the transformer;
- n) mass putting of the points in the transformer;
- o) after assembly carrying out, verify the connection and the adjustment of the protection adjustment box - see the information of this manual -.
- p) in case the transformer is working parallel together with the other ones, carefully check the right correspondance through voltmeters_- in order to make paralle coupling remember that for the choise of voltmeter in case of parallel mistake can be the double of the phase voltage and that the nominal features are the same or compatible, otherwise it should be impossible to make the parallel coupling -
- q) check the eventual metallic parts as frame, wool or channels, that must be placed to the insulation distances as indicated in this manual;
- r) it's seriously prohibited to locate the low/and high voltage wirings, metallic parts or other to the external windings.
- s) check the good tightening of the bolts, nuts and tie rods in case the transport should be characterized from continuous loadings and unloadings -for an exact mechanical tightening see the information included in this manual-
- t) check carefully the high voltage cast alluminium windings have not been damaged during transport or installation
- u) check that the cooling duct of the windings for low voltage and high voltage are free from packages residues, such as nylon, paper, adhesive tape or cobwebs.
- v) Check carefully the cooling duct between low and high voltage, indicated by the letter C in the drawing. Check the thick of the duct is enough symmetric, because the high voltage windings are assembled on a system of rubber stopper, letter R of the drawing, and a fortuitous blow could have moved the coils.
- w) In case of extreme non-simmetries in the duct C, and if the windings should have to be arranged it will be necessary to get some lifting means; we suggest you the presence of one of technicians before starting this operation.
Check carfefully the transformers before their running.

ITEM IV - WORKING AND MAINTENANCE

4.1. Generality

A carefully check of the machine during working allows to obtain a prevention of defects and a more long duration of the material.


So the client can:

- perform the controls he retains more suitable in the needed times;
- adjust the results of these controls;
- arrange a maintenance and intervention programm of the transformer to analyze and to follow the machine during time.

4.2. Voltage change operation - if foreseen -

Pay special attention when a change of voltage is required in the double primary voltage transformers.

In this connection carefully read as indicated on the connection plate of the machine.

	<p>Soon realized the new connection - whether a doubt exists - check through the test here under</p>
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- Feed the primary voltage with a low available voltage on place - usually are always 380 Volts
-
- By a manual tester - a high precision class is not required and furthermore the measure to perform is about few volts - the voltage is concentrated on the low part of transformer.
- Calculate the ratio among the voltages and compare it with the required transformation ratio.

It's obviously well advised to avoid to make tests using a low voltage.

4.3. Transformation ratio adjustment

When necessary to adapt the transformation ratio to the feeding voltage proceed according to the following indications (figure 09):

1. Put the machine out working from the average and low voltages and connect the machine on the floor.
2. Set the wiring plates in the more suitable position to the feeding voltage as per the following instructions.
3. Reset the transformer under voltage.

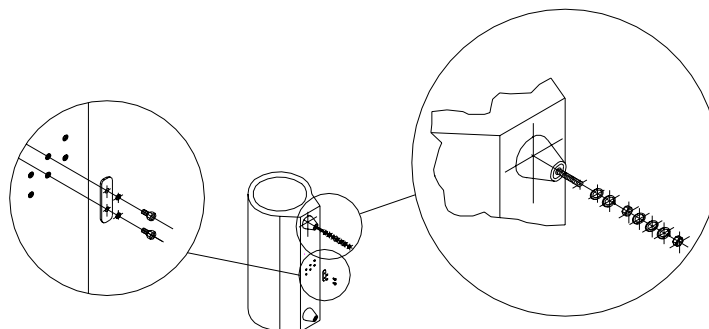


figure 09

HV winding adjustment with a single voltage

In order to obtain the secondary voltage change act on the primary winding adding or taking off lups. For a primary voltage the electrical diagram usually by us performed is the one as per the following figure 10.

The plate shown on the right is applied on the transformer to point out the properly position +5% of the primary voltage correspond a variation of -5% in the secondary voltage and that the choosen positions must be identical in all the three phases.

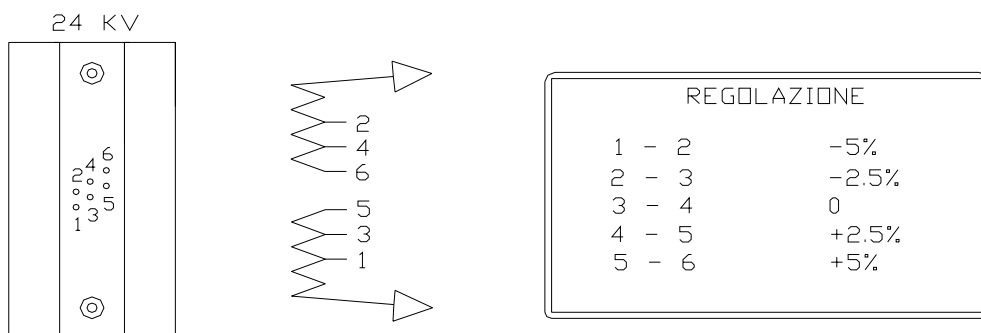


figure 10

HV two voltages adjustment windings

In case of two primary voltages - for example 10-20 kV -, two adjustment units are requested. The voltages variation is obtained putting the windings in line or parallel as shown in the figure 11.

Special attention must be paid wether the two primary voltages are 8.4-20 kV; in this case it's necessary an attentive examination of an exact connection of the change voltage terminals.

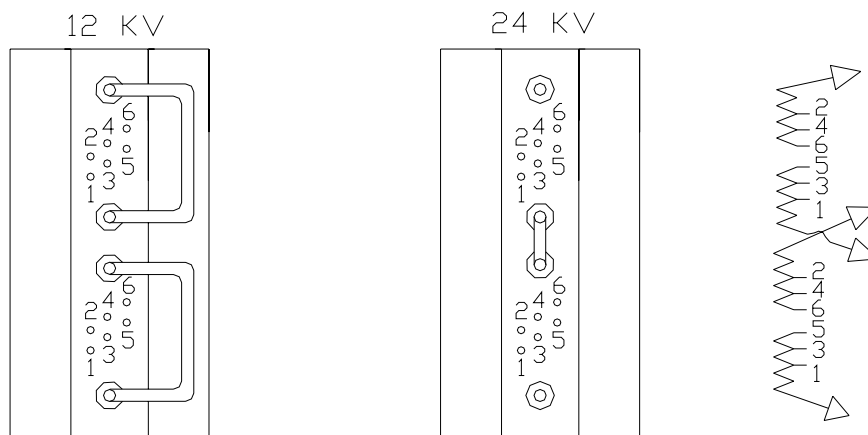


figure 11

4.4. Periodical checkings

Periodically - every six months in relation to the installation room or after stoppages clean the average and low voltage windings from dusty and dirty.


These operations must be carried out by low pressure dried compressed air castings and some droid wipes.

Especially it's well advised to make sure of the cleaning of the cooling channels in the windings.

It's well understood that for a good service of the transformer we advice to make all the inspections which are mentioned in the previous chapter.

4.5. Warranty

All the machines are guaranteed for the period time according to the agreement from the delivery date.

	<p>The warranty is limited to the machine replacement or repairing placed ex our Works Vicenza-Italy. All type of damages due to breakdowns are excluded.</p>
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