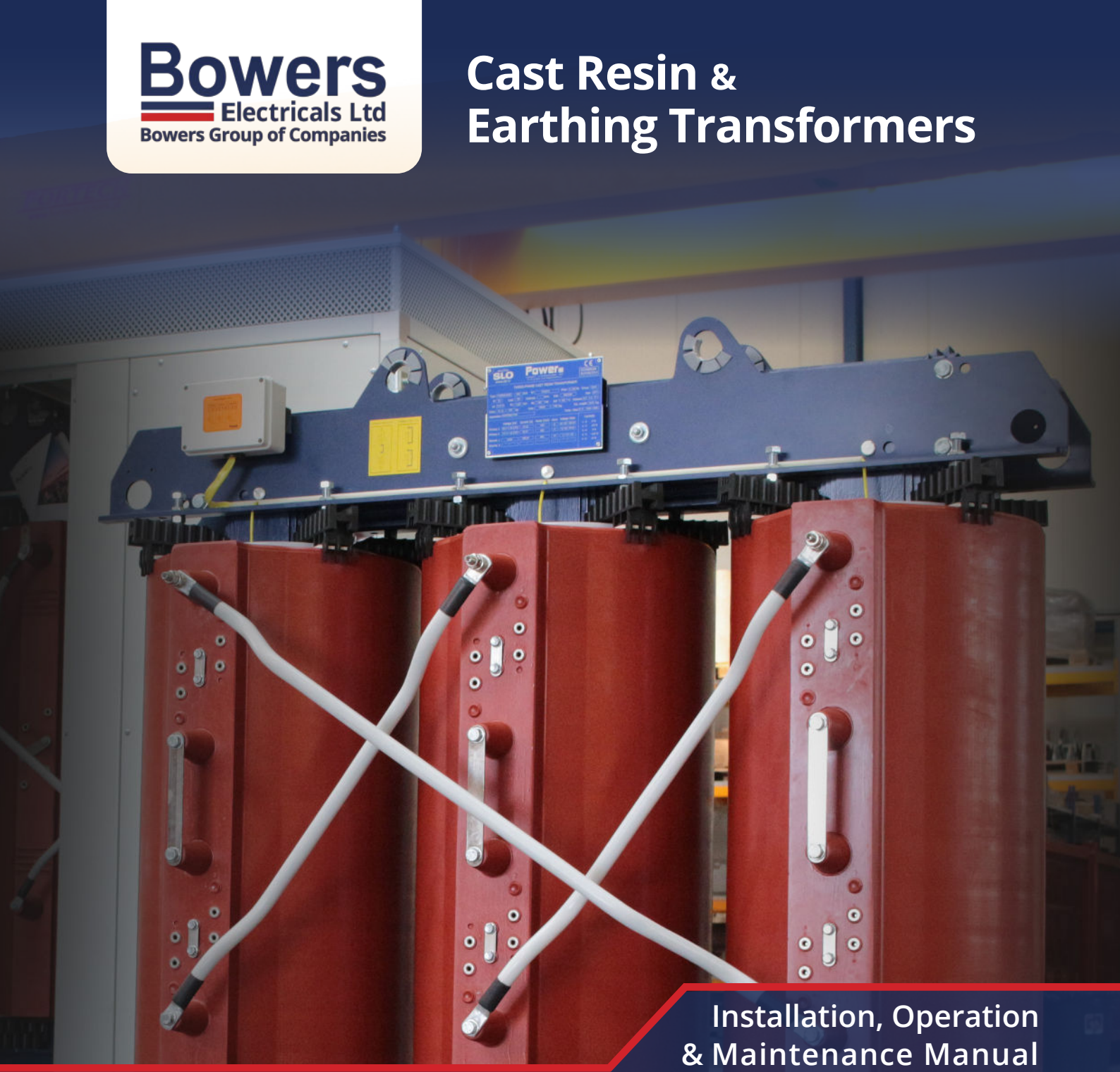
Bowers Electricals Ltd
Bowers Group of Companies

Cast Resin & Earthing Transformers



Installation, Operation & Maintenance Manual

2021

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Bowers Group of Companies are proud to be members of:

CAST RESIN & EARTHING TRANSFORMER

Installation, Operation & Maintenance Manual

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1. REFERENCE STANDARDS

Cast resin transformers by Bowers Electricals Ltd, are designed and manufactured in Conformity with the latest IEC standards currently in force *(unless specifically agreed otherwise)* Directive 2004/108/EC – Electromagnetic compatibility directive.

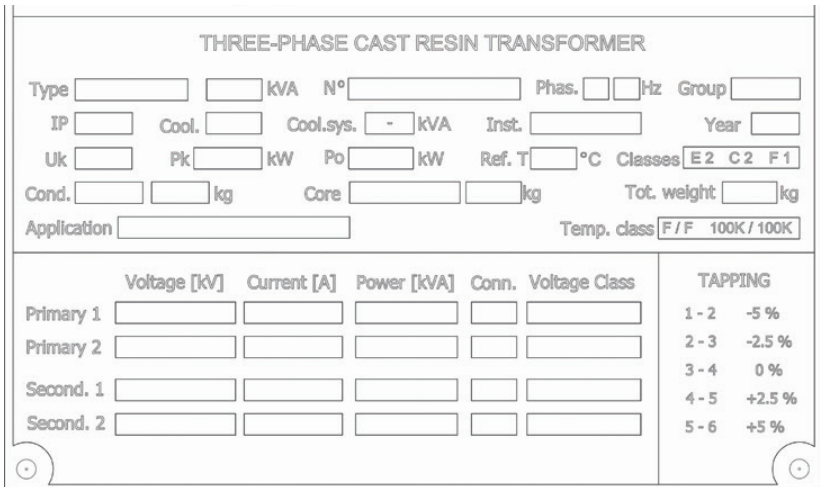
IEC 60076-11	Ed.I 2004-05	Power Transformers - Dry Type.
IEC 60076-1	Ed.III 2011-04	Power Transformers - General.
IEC 60076-2	Ed.III 2011-02	Power Transformers – Temperature Rise.
IEC 60076-3	Ed.III 2013-07	Power Transformers – Insulation levels, dielectric test and external clearances in air.
IEC 60076-4	Ed. I 2002-06	Power Transformers - Guide to lightning impulse and switching impulse testing.
IEC 60076-5	Ed. IV 2006-02	Power Transformers - Ability to with stand short circuit.
IEC 60076-10	Ed. II 2016-03	Power Transformers – Determination of sound levels.
IEC 61378-1	Ed. II 2011-07	Converter transformers - Part 1: Transformers for industrial applications.
IEC 61378-2 Ed. II 2011-07		Converter transformers - Part 2: Transformers for HVDC Application.

Starting from 1 July 2015, small, medium and large power transformers placed on the market of the EU Member States are designed according to Commission Regulation (EU) No 548/2014 of 21 May 2014 on implementing Directive 2009/125/EC of the European Parliament and of the Council.

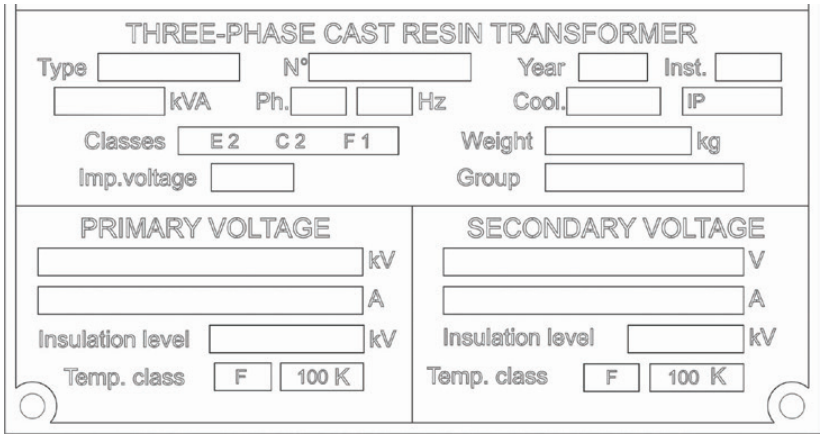
2. RATING PLATE

The rating plate reports basic technical parameters and the serial number of the transformer. Depending on the transformers design and destination, rating plates are prepared according to one of the two samples:

1) EU/548/2014 rating plate for cast resin transformers, for installation inside the European Union:



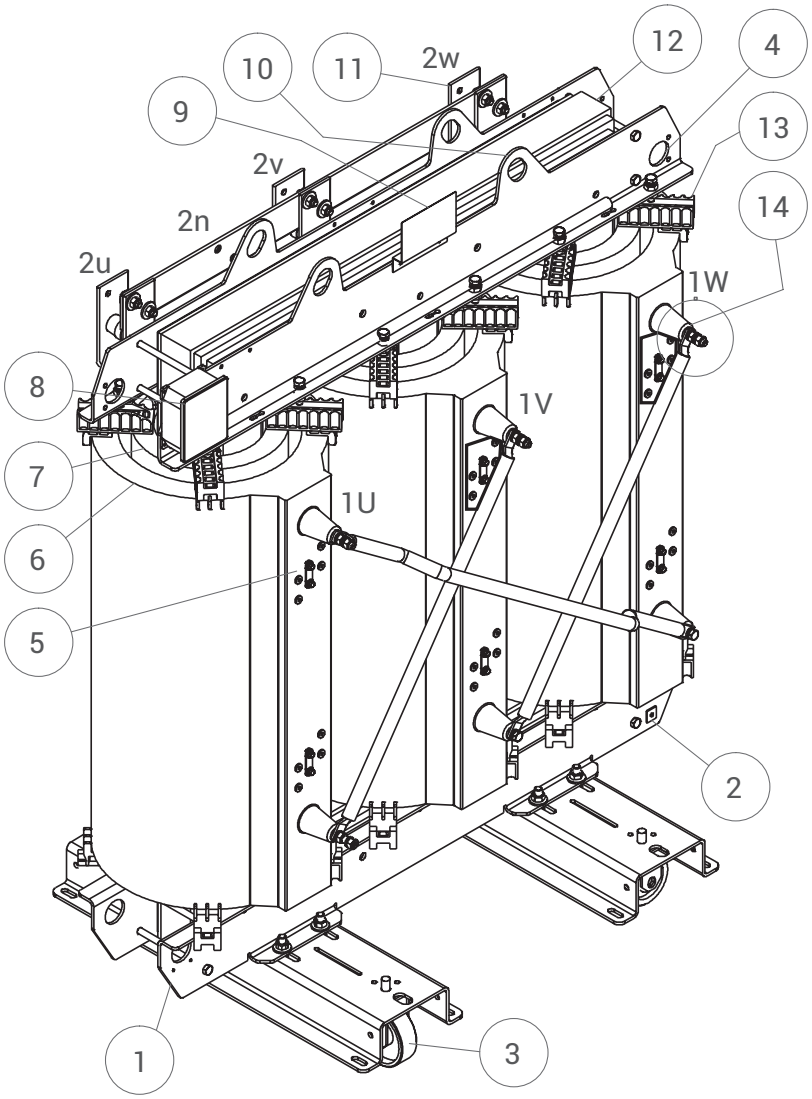
2) IEC60076 rating plate for cast resin transformers, for installation outside the European Union:



2. LIST OF COMPONENTS AND ACCESSORIES

A transformer consists of MV and LV windings, a magnetic core, clamping frames and a thermal protection system. If required, it can be equipped with other ancillary devices.

⚠ **IMPORTANT:** Descriptions and drawings presented in this manual may differ in aspect from the design delivered. They are provided for reference only and are subject to change without notice.



STANDARD COMPONENTS AND ACCESSORIES

1. Steel frames
2. Earthing links M12
3. Bi-directional wheels
4. Haulage holes
5. MV regulation tapping
6. Medium voltage windings
7. Low voltage windings
8. Centralisation auxiliary box
9. Rating plate
10. Lifting points
11. Output LV bars

12. Magnetic core
13. Winding support blocks
14. Input MV terminals

OPTIONAL COMPONENTS AND ACCESSORIES

- Thermo-controller
- Forced cooling system
- Metallic screen between primary and secondary connected to the ground
- Enclosure (IP 21-54)
- MV and LV cable boxes
- Anti-vibration pads for wheels

4. IMPORTANT SAFETY NOTICE

For your own safety and to avoid any accidental damage of the transformer, please be sure to read carefully and follow all the instructions in this manual. The transformer's technical characteristics specified in the rating plate, such as the rated power and voltage, must be strictly respected during commissioning and energising. All connection works must be carried out by competent staff, equipped with all necessary protective devices according to the local safety rules. Please pay attention to proper protection of the transformer during uploading, positioning, installation and operation. Over voltage and external agents (pollution, water, sun radiation, plants and animals) may affect the correct operation of the transformer.

5. RECEIVING, HANDLING AND STORING

5.1 RECEIVING

The transformer is generally supplied fully assembled and ready to be connected to the medium and low voltage lines. For the purposes of protection, the transformer is wrapped in polythene film or packed into a wooden box with moisture absorbers to provide extra protection against shock, vibrations and excessive dampness, especially for shipping by sea.

On receipt of the transformer, it is necessary to carry out the following checks:

- Check the package and fastenings for signs of damage, which might have occurred during shipping.
- Check the transformer, its parts and accessories for signs of damage, which might have occurred during shipping.
- Check if the characteristics of the transformer detailed in the rating plate coincide with those in the shipping documents and in the test report attached to the transformer.
- Check if each transformer is complete with the accessories specified in the contract (wheels, thermo-controller, etc.).

In cold weather, to avoid water condensation on the windings, resulting from temperature fluctuations during outdoor / indoor operations of uploading and handling, it is recommended to wait between 8 to 24 hours before unpacking the transformer, so that it reaches the temperature of the room.

⚠ **IMPORTANT:** If any defects are found, please contact Bowers Electricals Ltd immediately. If no notification of inconsistencies or defects is received within 5 days from the dispatch note, it will be assumed that the transformer delivery was flawless.

Bowers Electricals Ltd cannot be held responsible for any incidents taking place during installation or service, unless conducted by us.

5.2 HANDLING

Before commissioning, make sure that the medium voltage coils have not been damaged or displaced during transport or storage.

For lifting purposes, the upper frame of the transformer is equipped with Four (4) Lifting eyes for slings and shackles. Lift with a maximum angle of 60° between the slings.

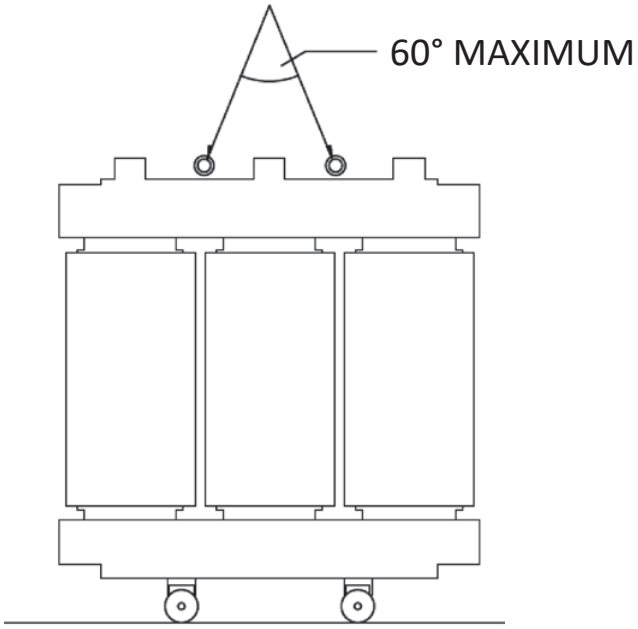
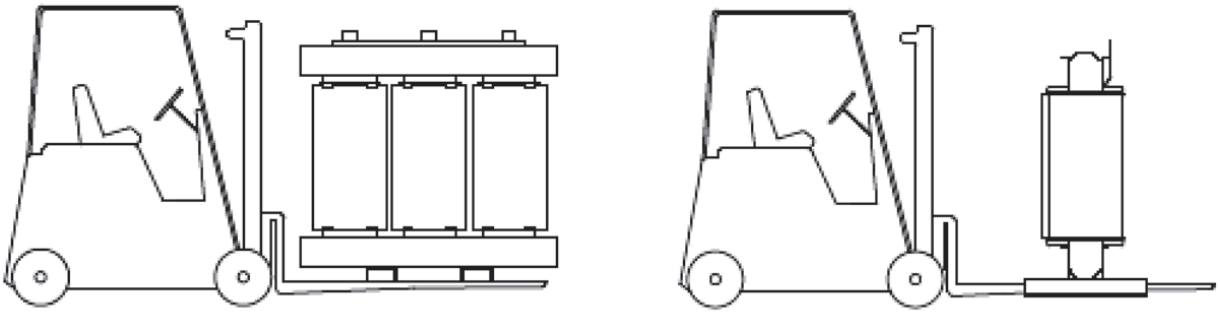


Figure 4 – Handling with overhead-travelling crane

When moving by forklift, position the forks under the bottom clamps, they should be positioned as far apart as possible. The transformer should be lifted as low as possible above the floor surface at all times during transfer.



⚠ **IMPORTANT:** The transformer must not be moved by pushing or pulling the coils and connections.

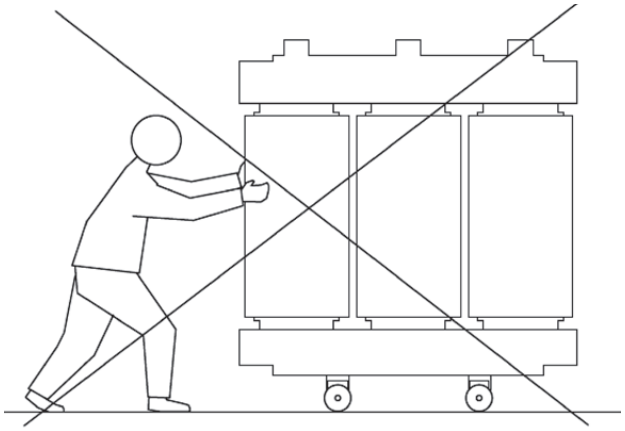


Figure 6 – Wrong manual handling

5.3 STORAGE

The transformer must be stored in a sheltered, clean and dry ambient up until its commissioning.

⚠ **IMPORTANT:** Significant temperature fluctuations should be avoided. In case of excessive humidity, it is recommended to use local heaters and / or silica gel moisture absorbers.
The storage temperature must not be lower than -25 ^{o}c.

6. INSTALLATION

Installation of the transformer must be done in full compliance with the applicable local regulations, all work must be carried out by properly trained and qualified personnel.

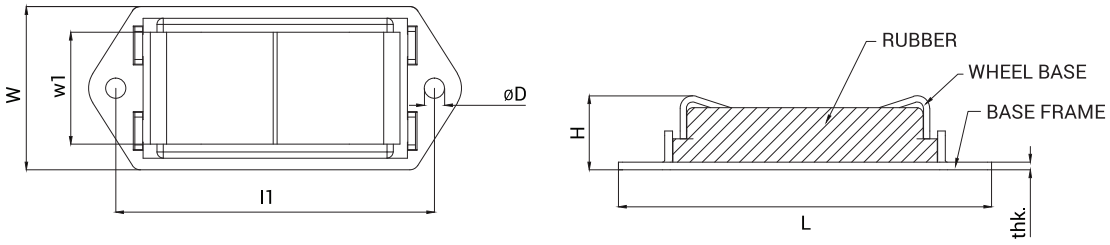
6.1 SITE PREPARATION

The transformer is designed for indoor installation. It should only be operated in a clean, dust-free environment, protected from direct sunlight, rain, snow and any kind of contamination.

Ensure that the floor of the room is properly levelled and capable of supporting the weight of the equipment. Sufficient space should be left around the perimeter of the transformer to ensure:

- Easy installation, cable connections, inspection and maintenance
- Adequate natural ventilation (***circulation of free cooling air***)
- Minimum electrical clearance in line with the local safety standards.

Special attention should be paid to choice of the installation place. If noise levels are of particular importance (sound waves generated by the transformer during normal operation may be amplified or reflected by the walls or building structure). Noise levels may be reduced, by using flexible terminations and anti-vibration pads.



PADS MODEL	Ø [mm]	L [mm]	W [mm]	H [mm]	l1 [mm]	w1 [mm]	ØD [mm]	thk. [mm]	Weight [kg]	Max Load [kg]	Max Com-press.
PWAP125	< 125	185	70	30	140	45	11	3	0.5	800	2
PWAP200	150-200	240	105	50	205	72	13	5	1.8	1900	3

Table 1 – Anti-vibration pads parameters

Additionally, Bowers Electricals Ltd, offer customised low noise transformers, with very low magnetic induction for installations in hospitals, universities, schools, office's and residences, where low noise operation is a basic requirement.

6.2 STANDARD INSTALLATION CONDITIONS

The maximum altitude of installation must not exceed 1000 metres above sea level. When the transformer is in service, the ambient temperature of the room must be within **-25°C** to **+40°C** limits.

Temperature of cooling medium. The temperature of cooling air at the inlet, to the cooling equipment **must not exceed**:

40°C at any time / **30°C** monthly average of the hottest month / **20°C** yearly average

Temperature should not be below:

-25°C for outdoor transformers
-5°C for transformers, where both the transformers, and cooler are intended for installation indoors.

⚠ **IMPORTANT:** If the altitude at the place of installation and/or the ambient temperature values are higher than the ones specified above, it should be stated at the ordering stage, since these values are taken into account for transformer design and dimensions.

6.3 WORKING TEMPERATURE

Electric current passing through the windings and magnetizing of the core are accompanied by certain electrical losses, and temperature rise in the core and windings. The transformer is designed so that natural air cooling is sufficient to maintain its temperature below the maximum values foreseen by the standards. In order to avoid temperature accumulation in the room where the transformer is installed, it may be necessary to provide suitable ventilation. The working temperature of the transformer depends on its insulation, and climatic class as per **IEC 60076-11:**

INSULATION CLASS	RANGE TEMPERATURE
B	From -25 to 120°C
F	From -25 to 155°C
H	From -25 to 180°C

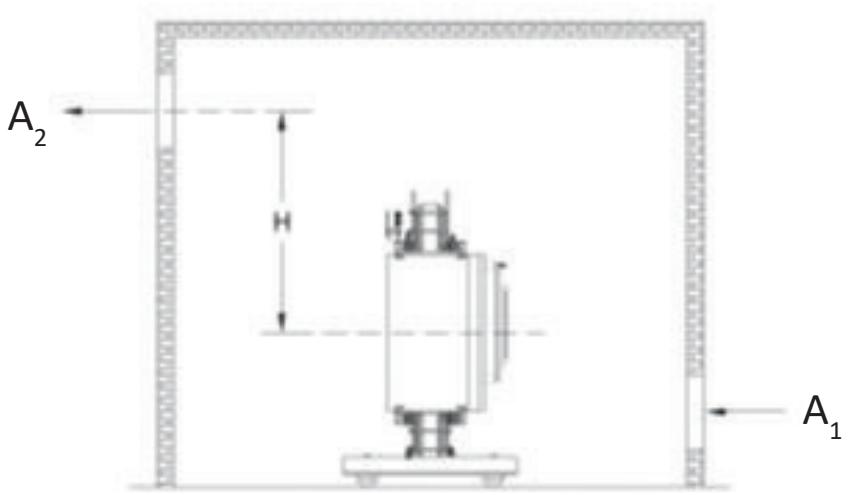
Table 2 - Insulation classes

6.4 VENTILATION

6.4.1 NATURAL / FORCED VENTILATION OF THE INSTALLATION ROOM

For optimal use of the transformer's full rating, it is essential that the losses (***heat***) produced by the core and the windings are effectively removed. The installation room must be well ventilated, in order to guarantee stable operation throughout the expected service life of the transformer. Obstructions around the transformer or close to the enclosure ventilation openings, restricting natural airflow, must be avoided.

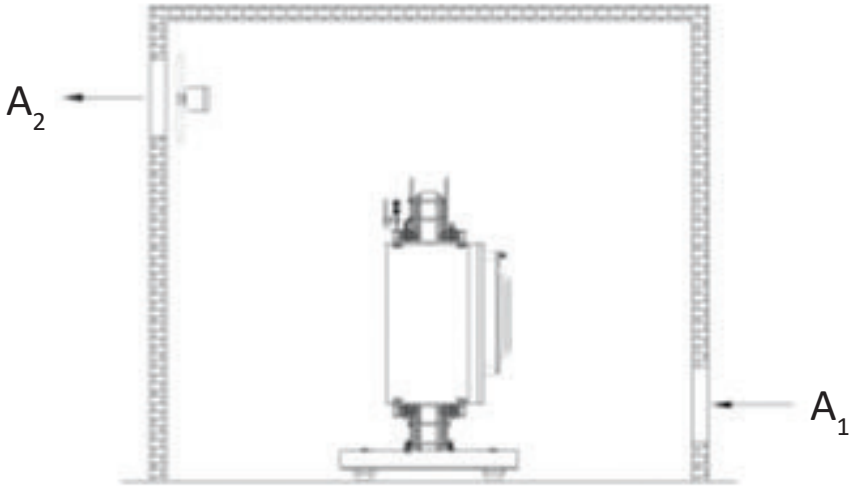
In order to guarantee standard service conditions, and to prevent the transformer from exceeding its temperature limits, it may be necessary to install air louvres in the installation room. The air louvres must be located on 2 opposite walls (one in the bottom part and the other in the upper part) and be big enough to dissipate the heat generated by the transformer during the service.



The minimum size of the openings to guarantee sufficient airflow inside the installation room (considering average annual temperature of 20°C) can be calculated using the following formulae:

A_1 = lower opening surface (m²)
A_2 = upper opening surface (m²)
P = total no load losses / load losses at 120°C (kW)
H = difference in height between the top opening and the central line of the transformer (m)
dT = temperature difference between incoming and outcoming air temperature of the room (C°)

In case the natural ventilation is not sufficient, the openings may be equipped with fans in order to increase the airflow inside the installation room. In air-conditioned rooms, to avoid water condensation and possible damage of the transformer, it is highly recommended not to blow fresh air directly on to the transformer.



6.4.2 FORCED VENTILATION OF THE TRANSFORMER

Forced cooling is necessary in the following cases:

- Short time over loadings
- Small room dimensions
- Scarcely ventilated room
- Average daily temperature higher than 30°C

It is recommended to use a forced cooling system designed by Bowers Electricals Ltd, ***(Figure 10)*** specially designed to ensure proper air circulation around each coil of a three or single-phase transformer. Forced ventilation can be designed, and fitted before manufacture or after installation of the transformer at site.

Please consult ***(Figures 11 and 12 and Table 3)*** for different models capacity and dimensions.

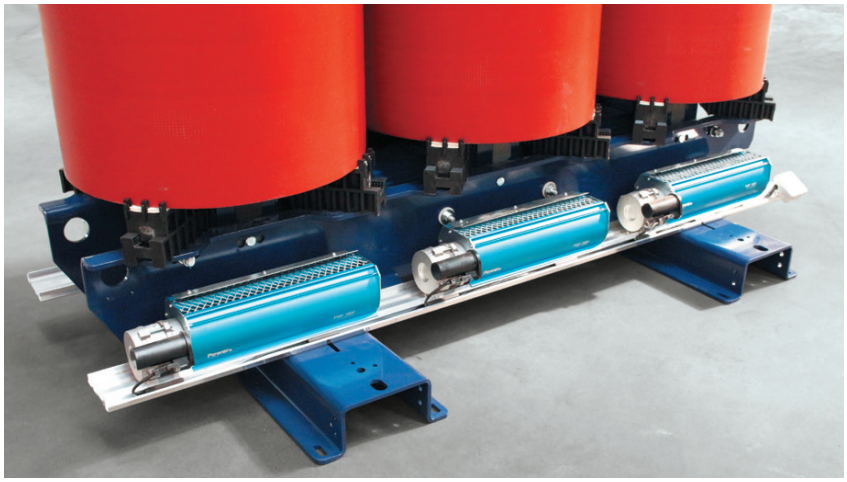


Figure 10 – Tangential ventilation bar

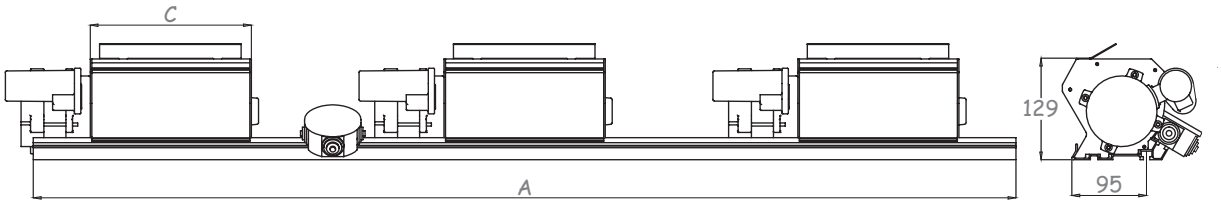


Figure 11 – Tangential ventilation bar (front view)

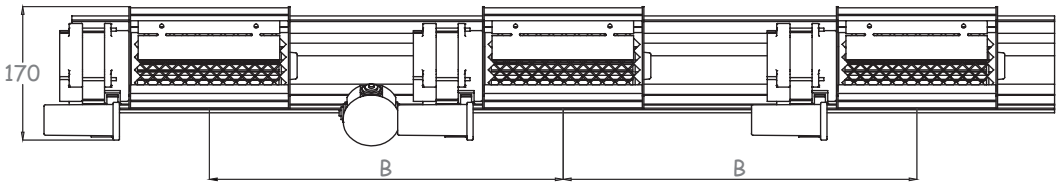


Figure 12 – Tangential ventilation bar drawings (top view)

Model	Power range (kVA)	□ □ □w (m3/h)	A (mm)	B (mm)	C (mm)
PWF1200/A	50	~1200	1230	Till 330	225
PWF1200/B	100 – 630	~1200	1400	340-460	225
PWF1200/C	800 – 1000	~1200	1600	470-540	225
PWF1800/A	1250 – 1600	~1800	1850	550-590	405
PWF1800/B	2000	~1800	2000	600-650	405
PWF3600	2500 – 3150	~3600	2200	660-730	545

Table 3 - Forced cooling systems parameters

6.5 INSULATION DISTANCES

While the transformer is working it is necessary to observe a minimum distance between the active parts of the transformer, surrounding metal elements and ancillary devices, according to **IEC 60076-3** standard.

Table 4 shows the minimum insulation clearances to be respected:

Insulation Voltage (KV)	Nominal voltage at industrial frequency (kV)	Atmospheric Impulse Voltage (kV)	Minimum air distance (mm)
3,6	10	20	60
		40	60
7,2	20	40	70
		60	90
12	28	60	90
		75	120
17,5	38	75	120
		95	160
24	50	95	160
		125	220
36	70	145	300
		170	360

Table 4 - Insulation distances

⚠ **IMPORTANT:** It must be remembered that cast resin coils have to be considered a part under voltage.

6.6 SAFETY DISTANCE

The transformer must be installed in a place with enough surrounding space, as to avoid any accidental contact between any person, and the live parts of the transformer. The transformer should be set apart from walls, grids and other external objects according to the values specified in **Table 5**, based on the applicable standards.

Installation Voltage (kV)	Nominal voltage at industrial frequency (kV)	Atmospheric Impulse Voltage (kV)	Minimum air distance (mm)
3,6	10	20	150
		40	150
7,2	20	40	150
		60	150
12	28	60	150
		75	150
17,5	38	75	150
		95	200
24	50	95	200
		125	280
36	70	145	340
		170	400

Table 5 -Safety distances

6.7 TIGHTENING TORQUE FOR ELECTRICAL & MECHANICAL CONNECTIONS

All external wirings on LV / MV and earth points must be carried out respecting minimal insulation clearances, section and position of the cables. The locking and gripping of all electrical connections and mechanical fastenings must be performed according to the values indicated in the following **tables 6 and 7**.

Bolts	TIGHTENING TORQUE (Nm)*	
	Mechanical connection	Electrical connection
M6	10	-
M8	**23**	23
M10	50	40
M12	85	50
M14	130	80
M16	205	125

Table 6 - Tightening torque, refers to regular screws.
* Divide the values by 10 for Kgm gauged dynamometrical keys.

*Divide the values by 10 for kgm gauged dynamometrical keys

Bolts	TIGHTENING TORQUE (Nm)*
M8	8
M10	9
M12	11
M14	17
M16	21

Table 7 - Tightening torque, refers to steel screws and self locking bolts.
* Divide the values by 10 for Kgm gauged dynamometrical keys.
* Refers to steel self locking bolts and screw nuts.

6.8 VISUAL INSPECTION

Before energizing the unit, it is necessary to make sure that no parts or items ***(such as bolts, nuts, washers)*** or other material coming from the surrounding equipment are obstructing the channels of the coils, or are located in proximity of active parts. This could seriously damage the unit.

⚠ **IMPORTANT:** After storage or a service interruption, it is mandatory to clean the MV and LV windings, by blowing dry compressed air, and wiping them with a dry cloth, to eliminate all dust and condensation before connecting the Transformer.

6.9 MECHANICAL AND ELECTRICAL CHECKS

Before energizing the unit, an inspection should be carried out in order to guarantee a proper installation and connection of the transformer.

The following steps must be carefully fulfilled:

- Clean the MV and LV windings, and the channels from dust by blowing dried compressed air and wiping them with a dry cloth.
- In case of condensation, pre heat the transformer with a seperate heater to dry out or by energizing at no load.
- Check proper tightening of fixing elements of the MV and LV windings, terminal connections and the adjustment plates.
- Check the position of MV and LV windings. They must be aligned perfectly to the magnetic core.

. Check the tie rods to the core or to the ground.
. Check all the protection devices of the transformer against possible over voltage.
. Check the position of the adjustment plates on the tapping board. This must be the same on all the three MV wind ings, and must coincide with the specified feeding, and loading voltages. If the voltage is higher than allowed by the tap ping intake, the no load losses and the noise will be higher.
. Check all the metallic parts to be at a safe insulation distance from all active parts of the transformer.
. It is absolutely forbidden to put metalic parts and/or MV / LV cables in contact with the windings.
. Check proper tightening of the bolts, nuts and tie rods in case the goods have been loaded and unloaded multiple times during shipping. For proper mechanical tightening.

See information included in ***Paragraph 6.7*** of this manual of use.

⚠ **IMPORTANT:** If the transformer is put into service after a long storage or de-energized period, it is necessary to clean the MV and LV windings from dust and condensation with a jet of dry compressed air and a dry cloth. It is highly recommended to carry out a visual check of the transformer in order to verify any unlikely presence of parts on the surface and inside the cooling ducts.

6.10 MEASUREMENT OF WINDINGS EARTH RESISTANCE

Check the general condition of the transformer, and proceed with measurement of the insulation resistance, by means of a Megger up to 5000 V.

The MV / LV windings must be switched off from the electrical system during the measurement procedure. The measured values should be close to the following:

. MV terminals / LV terminals grounded >= 20 MΩ
. LV terminals / MV terminals grounded >= 10 MΩ
. LV and MV terminals / ground >= 10 MΩ

If the measured values are much lower, the transformer must by dried. If necessary please contact Bowers Electricals Limited.

6.11 EARTHING CONNECTIONS, TAPS AND PROTECTION POSITION

The Manufacturer is not responsible for the transformer installation. The installation must be carried out according to the local standards in force, to the applicable laws, and to the present instructions.

The following actions must be performed during the installation:

. Connect the earthing conductors to the relative grounding points on the metallic parts of the transformer and enclosure.

. Connect the LV neutral point to earth if required by the protection system.

. Connect the thermal protection relay to the control system according to the thermal protection relay manual.

. Ensure the connection of the primary windings are safely connected.

. Ensure that the voltage regulation taps are safety connected, and if required, modify the position according to the supply voltage.

. For transformers with double ratio, please ensure that the link corresponding to the voltage of the transformer system feeding is properly connected.

6.12 MV AND LV CONNECTIONS

The cables and the bus bars which are connected to the transformer must be duly fixed to avoid any mechanical stress on the LV and HV transformer terminals. Both upper and bottom cable connections are acceptable provided the configuration showed in the (Figure 12 and 13) is respected. In case the connections arrive from the bottom please ensure that there is sufficient depth for the minimum bend radius of curvature of the cables.

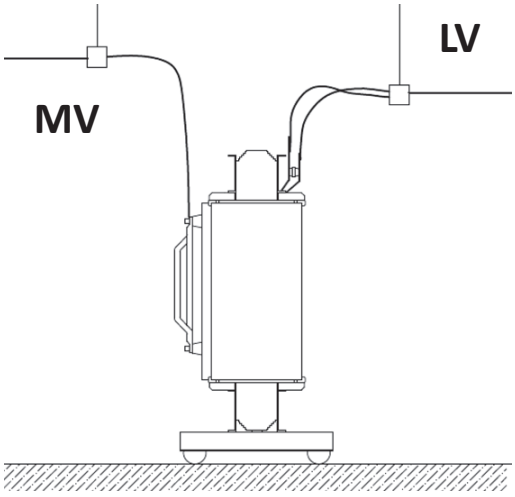


Figure 13 – Cables coming from the top

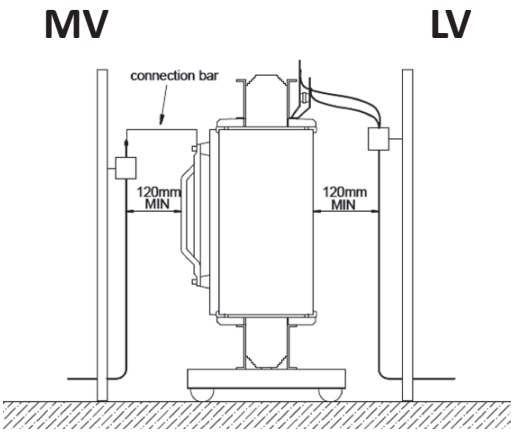


Figure 14 - Cables coming from the bottom.

6.13 TRANSFORMER RATIO ADJUSTMENT

When it is necessary to adapt the transformation ratio to the feeding voltage proceed according to the following instructions:

- Disconnect the unit from the supply on both medium and low voltage and connect it to the ground, ensure full isolation protocals are followed.
- Connect the tapping plates in the most suitable position according to the feeding voltage.
- Connect the thermal protection relay to the control system according to the thermal protection relay manual.
- Re-connect the transformer to the supply.

6.13.1 MV WINDING ADJUSTMENT ON SINGLE VOLTAGE

If after energizing the primary side of the transformer, the secondary voltage does not correspond to the rated value, adjust the primary winding, by adding or taking off turns. (***See Figure 15 for standard transformer tapping).***

The plate shown on the right is fitted on the transformer to indicate the proper position. For example: **+5%** of the primary voltage corresponds to a variation of **-5%** in the secondary voltage. **The chosen positions must be identical in all the three phases.**

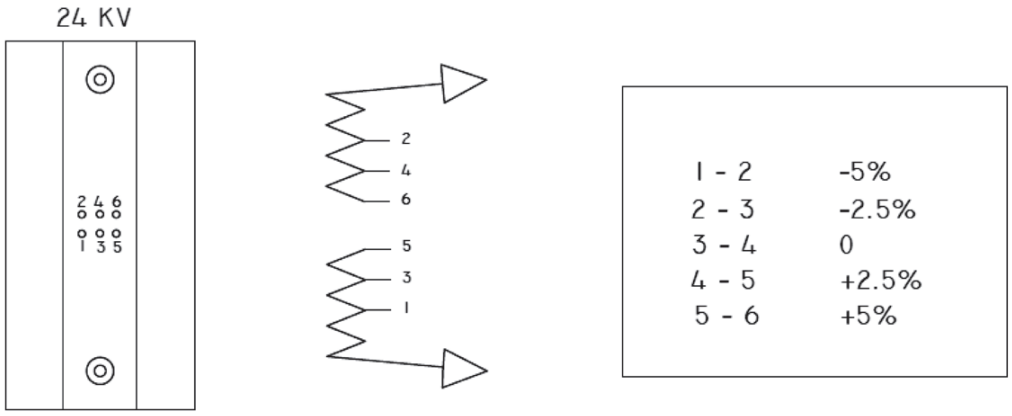


Figure 15 – Tapping regulation with single voltage

6.13.2 MV WINDING ADJUSTMENT ON DOUBLE VOLTAGE

In case of two primary voltages, For example: 10 - 20 kV adjustment is required on both parts of the winding. The voltage variation is obtained by putting the windings in line or parallel as shown in (***Figure 16)***.

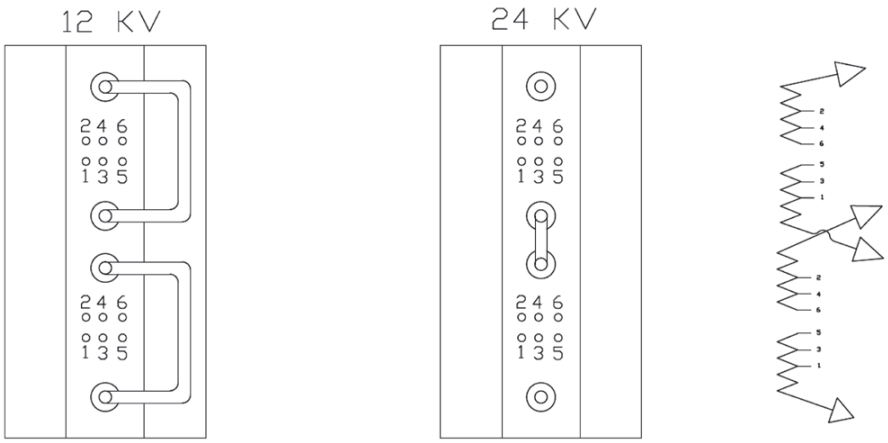


Figure 16 – Tapping regulation with double voltage

6.14 CONNECTION IN PARALLEL MORE TRANSFORMERS

In case of parallel connection of a transformer with other transformers, verify the total compatibility of the voltage ratio and other parameters required by the **IEC 60076-1** standard, particularly:

- Identical voltage ratio
- Identical frequency of functioning
- Identical vector group.
- Identical short circuit voltage (tolerance ± 10 %)

7. OVERTEMPERATURE PROTECTION

Bowers Electricals Ltd, offer two types of control and protection devices for monitoring of the transformer's temperature and tripping:

- Electronic controller for PTC sensors
- Electronic controller for PT100 sensors

For normal applications alarm and tripping temperature should be set according to the data provided in ***Table 8***.

INSULATION CLASS	ALARM	TRIPPING
B (130°C)	+120°C	+130°C
F (155°C)	+140°C	+150°C
H (180°C)	+160°C	+170°C

Table 8 – Recommended temperature settings

7.1 ELECTRONIC CONTROLLER FOR PTC SENSORS

The device is designed to control the temperature of each phase of the transformer, by means of a series of three (3) alarm steps, with upto three (3) PTC sensors. Pre-alarm (ventilation), alarm and tripping temperatures are set by choosing sensors with adequate temperature thresholds (***see Table 8***).

OutPut connections should be made according to (***Figure 17)***. ***(illustrated on page 25)***

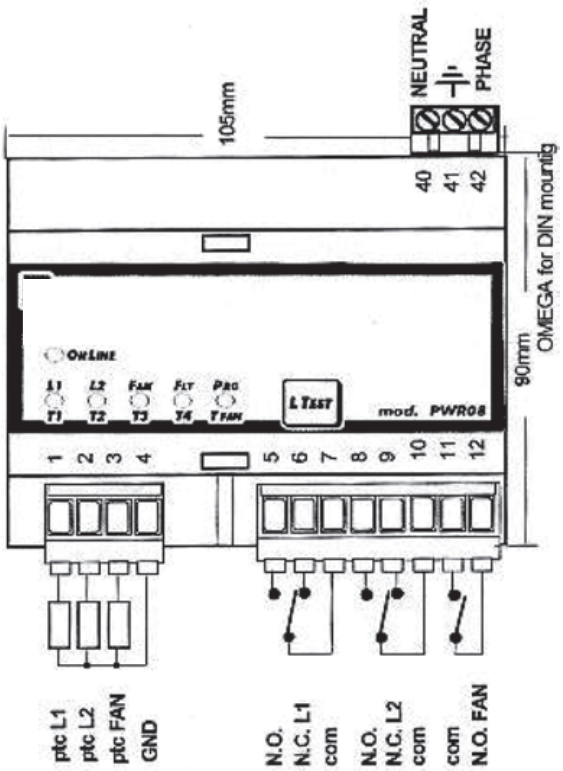


Figure 17 – PTC scheme

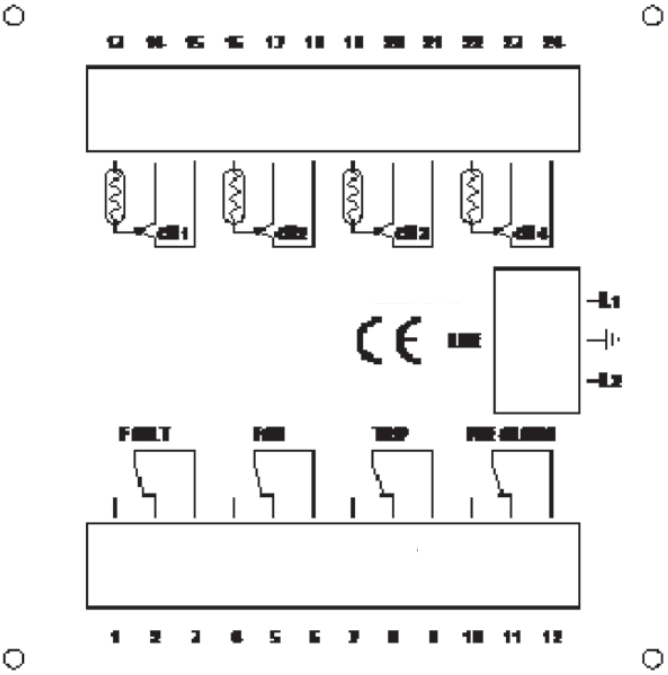


Figure 18 – PT100 scheme

7.2 ELECTRONIC CONTROLLER FOR PT100 SENSORS

This controller is designed to monitor the temperature of each phase of the transformer and, if needed, the core or the ambient by means of three (3) to Four (4) PT100 sensors.

Temperature of pre-alarm (ventilation), alarm and tripping as well as the mode of work (automatic or manual) is set in the menu. The device can display temperature in each channel at any time and report a sensor's fault.

Output connections should be made according to (***Figure 18)***.

8. OVERLOADING AND SHORT CIRCUIT PROTECTION

According to IEC standards the transformer is designed and manufactured to withstand occasional over voltages (**IEC 60076-1**), overloading (**IEC 60076-12**) and short circuit on the secondary windings (**IEC 60076-5**).

To eliminate thermal and dynamic effects caused by accidental overloading, and secondary short circuits, it is strongly recommended to protect the transformer, with an automatic switch or suitable fuses.

When making protection settings and / or choosing fuses for MV and LV side, the following should be taken into consideration:

1) The rated currents as stated in the transformer rating plate.
2) The start up current when a transformer is energised.

The relay should correspond to the highest value of current on MV side, and its time settings should allow for a little delay (approx. some tens of ms) in its actuation.

Furthermore, we recommend limiting to the minimum the number of connections and disconnections of the transformer to the network.

9. OVERVOLTAGE PROTECTION

In order to protect the transformers against over voltages at industrial frequencies or the ones of atmospheric origin, it is recommended that a voltage surge arrester with variable resistance should be used.

The surge arresters characteristics depend on the transformer insulation level and the parameters of the distribution system.

10. MAINTENANCE

10.1 PERIODIC MAINTENANCE

A careful check of the transformer during its operation period will prevent possible damages and maintain its service life as long as possible. Any maintenance operation must be performed **only on switched off, and isolated transformers.**

It is sufficient to perform the following operations:

1.	External cleaning of the MV/LV windings from dust, condensation and any further pollution.	dry compressed air jets and dry clean cloth.	After a long storage or a period with no applied voltage During standard operation - At least once per year.	General cleaning.
2.	Cleaning of the cooling and ventilation ducts between the coils.	dry compressed air jets.	After a long storage or a period with no applied voltage During standard operation - At least once per year.	The ventilation channels between the windings must be completely free of any obstructions to prevent over-heating.
3.	Check of tightening of the MV and LV connections, voltage tap changer links and of bolts (yoke and spacer blocks).	Torque wrench.	Yearly and after exceptional events.	Consult Paragraph 6.7

4.	Check the correct functioning of the thermal protection (thermal sensors and controller). Proper intervention of the overloading and short-circuit protection and tripping of the corresponding automatic switch.	This check should be carried out preferably by means of suitable equipment that allows simulating a real damage.	Every 6 months and after exceptional events.	Simulation of alarm and trip.
5.	Tightening of the upper spacer.	Torque wrench.	Yearly and after exceptional events.	Consult Paragraph 6.7
6.	Tightening of mechanical parts and fixing to the floor.	Torque wrench.	Yearly and after exceptional events.	Consult Paragraph 6.7
7.	Measurement of the windings insulation.	Megger (Mega-Ohmmeter).	After a long of inactivity.	Consult Paragraph 6.10

Table 9 –Periodic maintenance procedures

⚠ **IMPORTANT:** In case of any defects which cannot be eliminated, please contact our 24/7 assistance service immediately.

10.2 MAINTENANCE PRIOR TO RE-ENERGIZING

If the transformer is operated in a discontinuous way, before re-energising, especially after a long stop, it is necessary to perform all the checks prior to commissioning listed in ***(Paragraph 6)***.

If during the operation the transformer withstood exceptional events such as short circuits, atmospheric or operational over voltages, overflowing, etc. please consult our service before re-energising.

11. GUIDE FOR TROUBLE SHOOTING

⚠ **IMPORTANT:** Any Inspections and operations on the transformer can be performed only if it is completely de-energised.

Only qualified, and properly trained personnel equipped with all necessary protection devices, according to local regulations, should perform such works or inspections.

Whilst Bowers Electricals Ltd, are **NOT** responsible for the installation of the transformer, If a problem persists or is not listed below, please contact us.

	Anomaly	Possible cause	Possible solution
1.	Overheating.	**General overheating**	
		• High ambient temperature. • Poor ventilation of installation room.	• Check the room ventilation system (damaged fans, obstructed air louvres, faulty protection devices) • Increase cooling of the installation room.
		Overheating of one or more windings	
		• Failure of the temperature monitoring device. • Faulty temperature sensor on the winding. • Load is not distributed in uniform way.	• Reset the temperature monitoring device or replace it if faulty. • Replace the faulty sensor. • Check the position of the connection on the tapping.

1.	Overheating. *(continued)*	• Continuous overload above the foreseen level. • High unbalanced loads. • High harmonic loads.	• Check and compare the current supplied by the transformer with the rating plate. Reduce the load under the rating value of the transformer. • Install filters or chokes before the equipment generating harmonics in order to prevent there migration to the transformer. .
		Overheating measured on the core	
		• High eddy currents on the core due to loosening of the tightening bolts.	• Tighten the bolts of the core according tightening torque. ***(See Paragraph 6.7)***
		Overheating measured on the MV / LV terminals	
		• Poor contact.	• Clean the areas of contact. • Tighten bolts and nuts.
2.	Actuation of the protection relay. (Alarm or Tripping)	• Protection relay failure. • Sensor failure.	• Replace the damaged relay. • Replace the faulty sensors.
		• Load current higher than the rating values.	• Reduce the load to the nominal value indicated on the rating plate.

		• Poor electrical or sensor contacts.	• Check, clean and if necessary tighten all sensor contacts.
		• Poor or insufficient room ventilation.	• Check the room ventilation system (damaged fans, obstructed air louvres, faulty protection devices) • Increase cooling of the installation room.
3.	Excessive noise and or vibrations Please note that the sound level at the commissioning stage may decrease after a few hours. Contact Bowers Electricals Ltd, if the noise persists after a few hours.	• Resonance with surfaces around the transformer. • Low frequency. • Resonance transmitted by the connections.	• Check for loose metallic panels causing vibrations. • Increase the clearance from these vibrating parts. • Use anti-vibrations pads. • Provide flexible elements between the cables and the transformer terminals.
		• Wrong tap connection.	• Check for the most suitable voltage and adjust it to the most suitable tap.
		• Core frames are not properly fixed or loosened.	• Fix the external pulling screws at the frames.
		• High input voltage.	• Check the correct values against the rating plate. • Reduce the load under the rating value of the transformer.
4.	Reduced Voltage.	• Improper primary tap connection.	• Check if the tap connections are correct and tight. If the problem persists, contact the Manufacturer.

5.	Fuse / Breaker Opening.	• Overload. • Short circuit.	• Check current and compare with the rating plate. If the problem persists, contact Bowers Electricals Ltd.
6.	Insulation failure.	• Presence of dust or dirt on the coils.	• Check the coils for any visible damage.
		• Continuous overload.	• Check load and compare with the rating plate.
		• Mechanical damage of the transformer. • Lightning arch / switching surges	• Contact Bowers Electricals Limited.

Table 10 – Possible problems in transformers installations

⚠ **IMPORTANT:** In case of faults that cannot be eliminated by the customer, please contact Bowers Electricals Ltd immediately.

Please provide the following information at first contact:

- Serial number of the transformer
- Place of installation and application of the transformer
- Detailed description of the problem
- Your contact details.

12. WARRANTY

All the equipment is covered by warranty for a time period specified in the agreement starting from the delivery date. The warranty is limited to the repair or replacement of the damaged transformer and/or accessories. The Manufacturer declines any claims referred to indirect damages caused by the transformer default.

To report a problem, please contact the Manufacturer providing the following information:

- Serial number of transformer
- Place of installation and application of the transformer
- Detailed description of the problem
- Your contact details

SUPPLIERS DETAILS

Bowers Electricals Ltd, Heanor Gate Road, Heanor, Derbyshire DE75 7GX.

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Bowers
Group of Companies

Cast Resin &
Earthing Transformers

Installation, Operation
& Maintenance Manual

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