

OIL-IMMERSED PAD-MOUNTED DISTRIBUTION TRANSFORMER



INSTRUCTION MANUAL

MIT-002 | EN-US



itb[®]
EQUIPAMENTOS ELÉTRICOS

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SAFETY INFORMATION

This Manual contains safety recommendations that must be observed during all phases of equipment receipt, installation, and maintenance. Failure to comply with these recommendations violates safety standards and may result in personal accidents or damage to the equipment. ITB assumes no responsibility for the consequences resulting from user (installer) failure to comply with the recommendations. No unauthorized modifications should be made to the equipment or its accessories, nor should any parts be installed or replaced without ITB authorization. If necessary, return the equipment to ITB for repairs to ensure personal and equipment safety.

This manual contains three types of alert sentences:



DANGER: Indicates an imminent and extremely dangerous situation that, if not avoided, will result in death or severe injury to the operator or individuals near the network or equipment.



CAUTION: Indicates a potentially critical situation that, if not avoided, may result in operational damage to the equipment, network, or individuals in its vicinity.



CAUTION: Indicates a potentially undesired situation that, if not avoided, may result in equipment malfunction.

WARRANTY TERMS, CONDITIONS, AND LIMITATIONS

The products manufactured by ITB have their equipment quality ensured through the "WARRANTY CERTIFICATE" as per the contract, which accompanies the Invoice.

ADDITIONAL INFORMATION

This manual does not aim to cover all the details or variations of the products, procedures, or general processes, nor does it provide guidance on all the practices required for installation, operation, and maintenance. If you need more information, please contact a technical representative from ITB Equipamentos Elétricos Ltda.

INTRODUCTION

ITB Equipamentos Eletricos Ltda. is confident in providing you with equipment designed and manufactured using high-quality materials to deliver excellent performance under normal operating conditions. The equipment undergoes testing in our laboratories, utilizing certified instruments and standards to ensure its performance and operational characteristics over time.



WARNING: This manual should be used in conjunction with all technical and regulatory standards, specifications, and procedures established by competent authorities.

REGULATIONS

ITB transformers are designed and constructed strictly in accordance with the current editions of applicable standards.

TEST REPORTS

This equipment is individually tested, and a copy of the Test Report is sent along with the equipment for the user's reference. ITB certifies that these tests meet all specifications when the equipment leaves the factory.

RECEIPT

The transformers supplied by ITB are sent, tested, and inspected before leaving the factory. Upon receipt, the equipment should be examined to verify the following:

- ✓ The condition of the packaging, if applicable;
- ✓ Whether the identification plate of the transformer matches the order;
- ✓ The absence of cracks or chips in the insulating bodies of the bushings and external damage to the tank or accessories (scratches or dents);
- ✓ The integrity of connectors and accessories;
- ✓ The correct level of insulating oil when transformers have an inspection cover or oil level gauge (see accessories section);
- ✓ The consistency of instrument readings, when applicable;
- ✓ The external components of the switching system. At this time, the positions should be changed to detect any system defects during transportation (returning to the initial position);
- ✓ The absence of leakage and corrosion at any point of the transformer;
- ✓ The correct marking of terminals.

It is recommended, at the buyer's discretion, to perform the following tests:

- ✓ Insulation resistance;
- ✓ Voltage ratio.

UNLOADING, STORAGE, AND TRANSPORTATION

Transportation should be carried out in a way that protects the entire equipment from breakage or damage due to handling, following safety standards and using all appropriate support points as shown in the example in Figure 1.



Figure 1: Full Suspension Method.



CAUTION: The use of cables, straps, or chains that are too short, resulting in angles greater than 60°, will cause permanent deformation to the transformer tank and breakage of the lifting handles.

If the transformer is temporarily unloaded, the equipment should be stored, preferably in its original packaging, in a ventilated area with a level floor, away from heat sources, protected from sparks, and where there is no possibility of mechanical damage.

Please observe the maximum stacking height of the packaging:

Weight	Maximum stacking height
< 700 kg	2 units
> 700 kg	1 unit

Table 1 - Maximum stacking height of equipment.

Unless otherwise specified by the buyer, the transformer is typically supplied connected to the higher voltage tap.



DANGER: Any tap changer operation must be performed with the transformer de-energized (see accessories section).

If any irregularities are detected, the recipient must note them on the shipping document and, within the regulated timeframe, notify ITB so that the necessary actions can be taken in each case. The notification should also include the following information:

- ✓ Power;
- ✓ Nominal voltage;
- ✓ Serial number;
- ✓ Transformer type;
- ✓ Invoice number.

If the transformer is not put into service immediately, it should be stored in a sheltered, dry, and free from corrosive gases and dust location, with the insulating liquid at its normal level, always away from areas prone to collision to prevent mechanical damage.



WARNING: It is recommended that transformers should not be in direct contact with the ground.

OVERVIEW

The pad-mounted transformer is designed for situations where there is insufficient physical space for the installation of a conventional enclosed substation, and where there is potential pedestrian traffic such as in parks, sidewalks, and residential condominiums. It occupies a reduced physical space and can be installed near the load center.

The location and description of the components can be seen in the following figures:



WARNING: The following details do not aim to cover all possibilities of external construction. Intrinsic details of each project should be consulted during the technical feasibility analysis and approval of the purchase order.

RADIAL PAD-MOUNTED TRANSFORMER

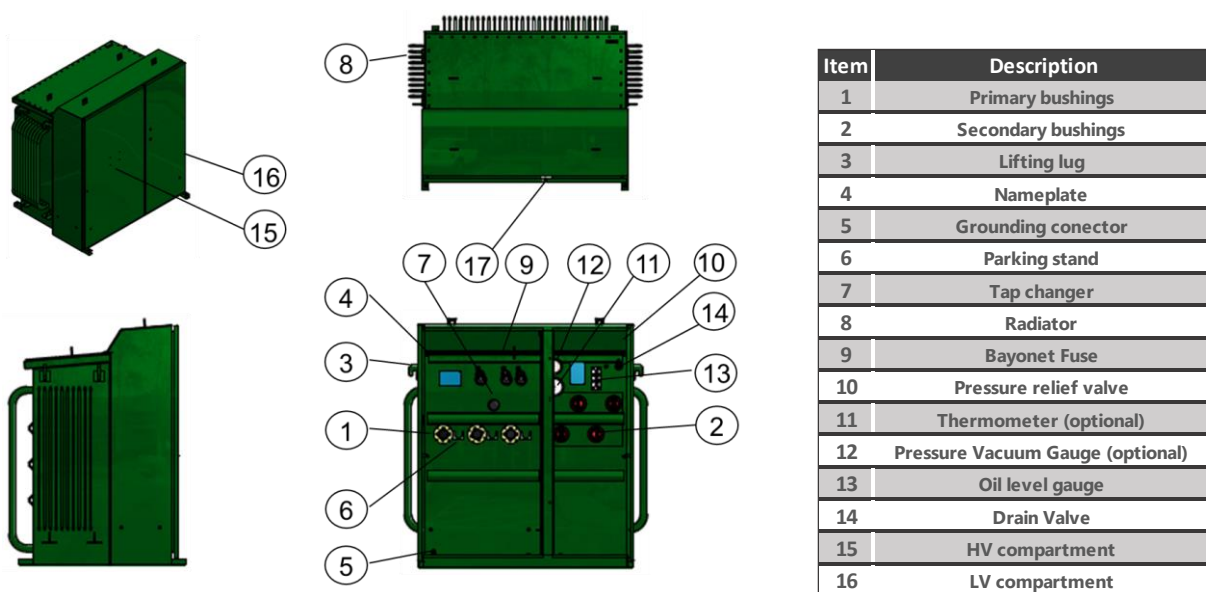


Figure 2: External view of the radial feed pad-mounted transformer.

LOOP FEED PAD-MOUNTED TRANSFORMER

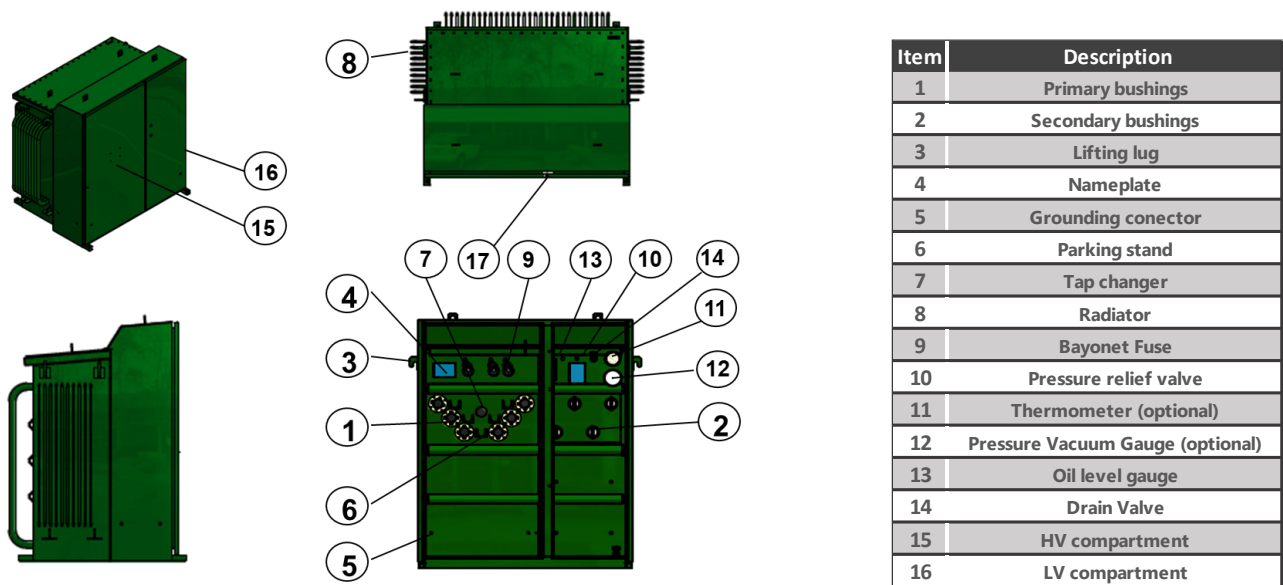


Figure 3: External view of the loop feed pad-mounted transformer.

SINGLE-PHASE PAD-MOUNTED TRANSFORMER

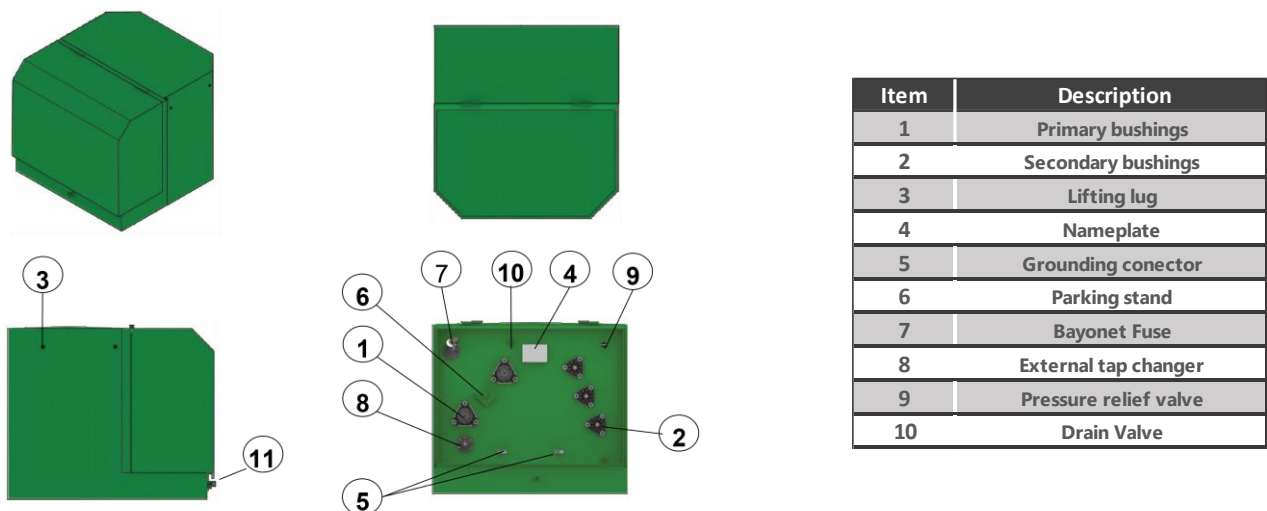


Figure 4: External view of the single-phase pad-mounted transformer.

ACCESSORIES



These accessories should only be installed by properly qualified professionals, using all safety techniques that involve high-voltage electrical equipment.

Primary bushings:

Bushing wells plug-in, as shown in Figure 5. Equipped with receptacles for the single-insertion plug and holes for installing the clamps to secure the disconnectable terminals.



Figure 5 - Illustrative image of a primary bushing.

Secondary bushings.

Secondary porcelain bushings of the connector or flag terminal type, as shown in Figure 6.

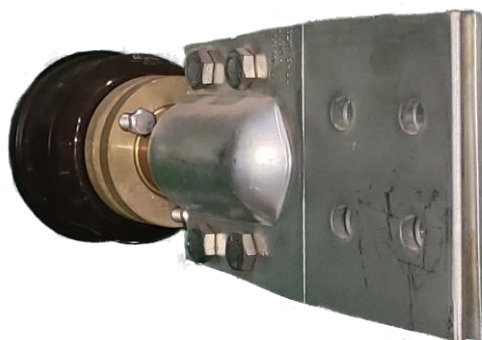


Figure 6 - Illustrative image of a secondary bushing.

Bayonet expulsion fuse.

The device where the expulsion fuse is placed is called a bayonet, and it is accessible from the external part of the tank. This device operates in the event of an external short circuit (network) or overload and protects the low current areas (external faults to the transformer).



Figure 7: Illustrative image of the fuse holder and the bayonet-type fuse link (Bay-O-Net) respectively.

To replace the fuse, follow these steps:

- ✓ Disconnect the power supply to the transformer and ensure there is no voltage present at the low-voltage terminals.
- ✓ Open the cabinet door to access the instrument panel.
- ✓ Activate the pressure relief valve to release any internal pressure.
- ✓ Unlock the base of the bayonet holder.
- ✓ Partially remove the bayonet holder and allow it to remain inside the receptacle for a few seconds to allow the draining of the insulating oil.
- ✓ Completely remove the bayonet holder.
- ✓ Unscrew the fuse cartridge from the end and extract the fuse element.
- ✓ Insert the new fuse element into the cartridge and arm the fuse cartridge.
- ✓ Reinstall the bayonet holder, ensuring it is properly secured in place.



Figure 8 - Real image of the expulsion fuse bayonet.



CAUTION: The fuse must be replaced with an identical one from the same manufacturer. If this is not possible, it should be verified if the interruption characteristics are the same and if the fuse curve meets the stated coordination requirements.

Current-limiting fuse

Current-limiting fuses are installed in their own base and their function is to limit the maximum current, as designed in the construction of the active part of the transformer. They are immersed in the insulating oil, as shown in Figure 9. The device is installed inside the tank and is not visually accessible.



Figure 9: Illustrative image of the current-limiting fuse assembly.

Tap changer

The tap changer is a device that allows voltage adjustments according to the available power supply. This operation should be done manually without the use of tools, while ensuring that the transformer is de-energized (without voltage and load). The handle should be pulled towards the operator to enable the change of position as indicated on the nameplate. The device is installed on the high voltage side. Unless otherwise specified, the transformer is supplied connected to the higher voltage tap.

To change the voltage, follow these steps:

- ✓ Ensure that the transformer is switched off.
- ✓ Open the cabinet door that provides access to the instruments.
- ✓ Move the voltage selector switch handle to the desired position.
- ✓ Power up the transformer and verify that the secondary voltage is correct.
- ✓ Close the cabinet door that provides access to the instruments.

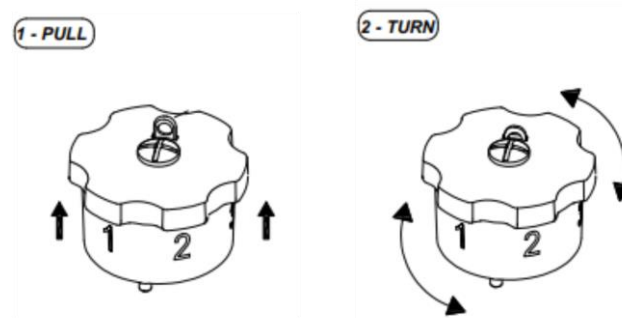


Figure 10: Illustrative image of the tap changer.

MagneX

The MagneX switch is an overcurrent protection device that safeguards distribution transformers against overload and secondary faults, and it is also used for switching the transformer on or off. The device operates with single-phase sensing and three-phase tripping. In addition to its protective function, it can be used as a primary switch to disconnect the transformer windings. On the other hand, current-limiting fuses serve as a backup, providing high-current interruption capability. It is not necessary to depressurize the TSA (Transformer Safety Assembly) to operate (switch on/off) the MagneX circuit breaker. The important thing is always to observe the oil level of the transformer, but this accessory has a protection device that blocks the operation if the oil level is below the safe operating level.

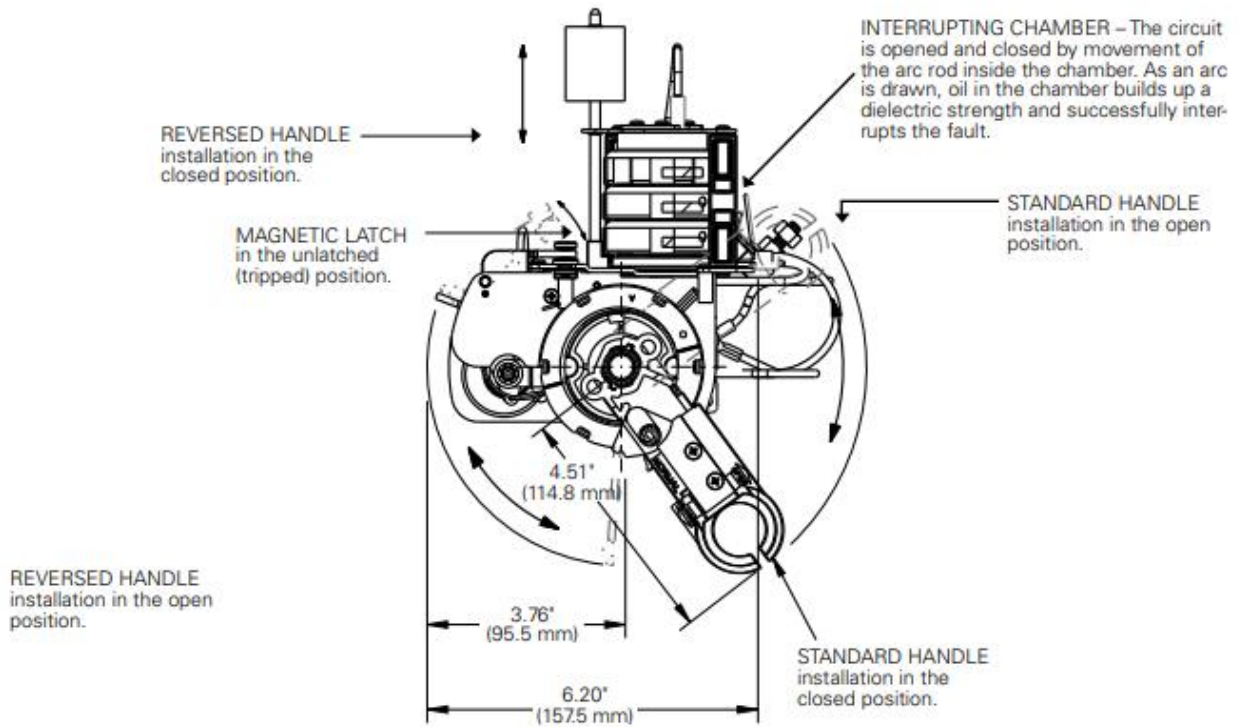


Figure 11: Detailed drawing of MagneX.

Pressure relief valve

The function of the device is to relieve the internal pressure of the transformer.

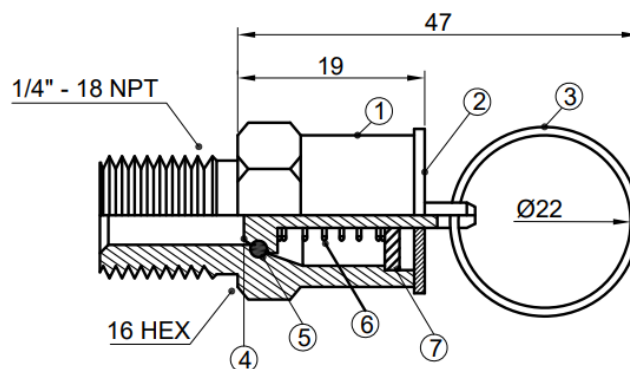


Figure 12: Detailed drawing of the pressure relief valve.

Before putting the transformer into operation or performing any maintenance, the internal pressure, if accumulated, must be released using the pressure relief device.

Drain valve

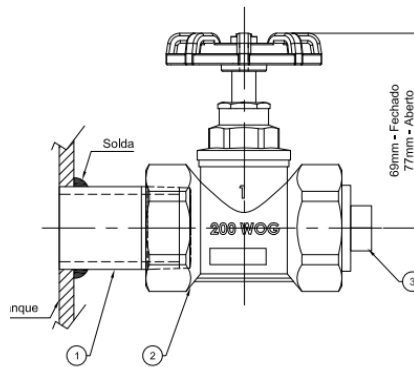


Figure 13: Detailed drawing of the drain plug.

Procedure for collecting insulating oil sample:

This item aims to establish and guide the criteria for collecting samples of insulating oil used in transformers.

Materials used:

- ✓ Plastic hose
- ✓ Container with lid for oil disposal
- ✓ 1000ml amber glass container with ground glass stopper, properly cleaned and "dry"
- ✓ Safety goggles and PVC gloves

Procedures for oil sample extraction:

- ✓ Carefully clean the valve or dedicated device for this purpose;
- ✓ Insert the plastic hose into the transformer valve and connect it to a disposal container;
- ✓ Allow approximately 01 liter of transformer oil to drain through the hose valve;
- ✓ Adjust the flow rate and fill the glass container without turbulence, preventing the entry of any impurities or moisture;
- ✓ Seal the container tightly;
- ✓ Properly label the container with transformer data, including at least the serial number and power rating of the transformer;
- ✓ Place the sealed and labeled container in a transport box, taking care not to expose the sample to direct sunlight, and send it to a laboratory of your choice.



WARNING: The collection of insulating oil samples should only be carried out under favorable atmospheric conditions, namely, without rain, fog, or any condition that poses a risk of sample contamination, such as dust.

Oil level gauge

Due to its purpose, it is used to check the level of insulating oil in the transformer, graduated from the minimum level at 25°C ambient temperature to the maximum level. This device can be of the column type or graduated magnetic type, as shown in the following figure:

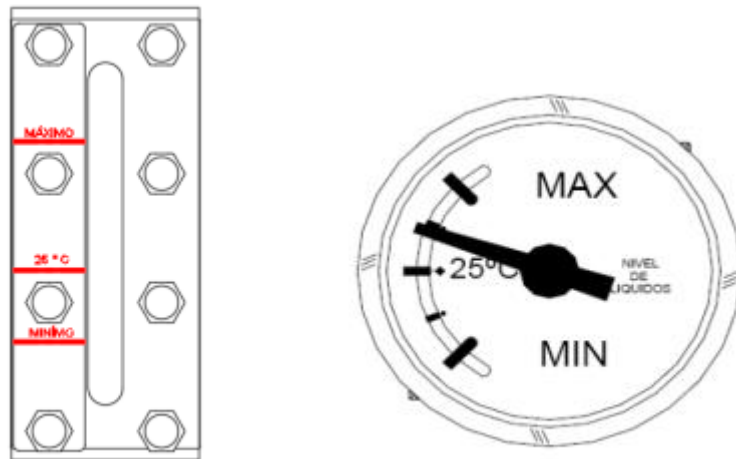


Figure 14 - Illustrative drawing of the 2 types of insulating liquid level indicators.

The indicator has three markings, as follows:

- Minimum:** Indicates the minimum level, below which the transformer should not operate.
- 25°C:** Indicates the level at which the oil should be when the ambient temperature is 25°C.
- Maximum:** Indicates the maximum level, above which the transformer should not operate.

Oil temperature gauge

Graduated submersible thermometer, used to indicate the temperature near the surface of the insulating oil, as shown in Figure 15.

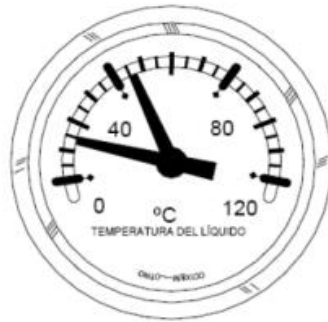


Figure 15: Illustrative drawing of the oil temperature gauge.

Under normal conditions, the transformer should never exceed the temperature limit specified in its technical design specifications.

Accessories only provided upon prior quotation

Definitions:

DeadBreak - For de-energized and no-load operation.

LoadBreak - For use with a switching stick, allows energized and loaded operation.



CAUTION: Before energizing the transformer, remove any dirt or foreign objects and check if the bushings are intact and free from cracks and deformations. Failure to follow these guidelines may result in equipment damage.



CAUTION: Follow the manufacturer's instructions and warnings regarding the use and installation of the equipment.

Insert bushings: The insert bushings or simple insertion plugs are designed for connection to the transformer well bushing. They come in two types:

LoadBreak:



Figure 16 - Loadbreak type insert bushing.

DeadBreak:



Figure 17 - Deadbreak type insert bushing.

Elbow connector are designed for the connection between insert bushings and medium-voltage cables, and they also come in two types:

Loadbreak:



Figure 18 - Loadbreak Elbow Connector

Deadbreak:



Figure 19 – Loadbreak Elbow Connector.

Insulated protective cap: It is a device used to isolate the insert bushing when it is not in use. There are two types available:

Loadbreak:



Figure 20 – Loadbreak insulated protective cap.

Deadbreak:



Figure 21 – Deadbreak insulated protective cap.

Metal Oxide Varistor Elbow (M.O.V.E.): It functions as a device for protection against atmospheric discharges.



Figure 22 – Metal oxide varistor elbow.

Transformer nameplate

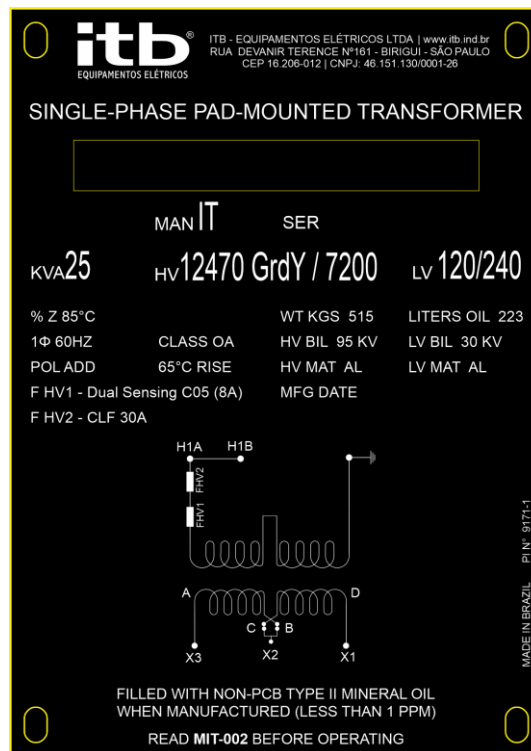


Figure 23: Nameplate.

Before installation and operation, it is essential to read all the data on the transformer nameplate. Figure 23 shows a typical model of this nameplate. It provides inherent transformer information and necessary details for the proper use of the equipment. It also includes the serial number, manufacturing date and customer code (if applicable).

INSTALLATION AND OPERATION

The structure of the pad-mounted transformer is designed to be mounted on a concrete base. It is important to check the levelness of the base before installation.

Before installing the transformer, the following checks should be performed:

- ✓ Visual inspection, especially of the bushings, connectors, and accessories, should be conducted to ensure the absence of any damage or leaks that may have occurred during handling and transportation of the transformer;



CAUTION: It is recommended to check the correct level of the insulating liquid before installation (refer to the accessories section).

- ✓ Check that the identification plate data is compatible with the system in which the transformer will be installed. Be sure to make the proper connection of the tapping panel and position the tap changer according to the connection diagram;



CAUTION: The connections of the transformer must be made according to the connection diagram specified on its identification plate, ensuring the correct phase sequence.

- ✓ For lifting the transformer, the ropes or cables used must be attached to the handles, hooks, or eyelets provided for this purpose (see figure 1).
- ✓ To perform a tap changer operation, make sure to determine the correct position of the tap changer using the connection diagram on the equipment's identification plate. Be careful not to leave the tap changer in an intermediate position.

The following precautions should be taken during the installation of disconnectable connectors:

- ✓ Check for cracks, chips, or damages.
- ✓ Grounding: Always ground the disconnectable terminal to the grounding system.
- ✓ Perform cleaning, lubrication, and connector installation according to the manufacturer's procedure.
- ✓ Install inserts on insulators and/or elbow connectors on inserts or integral isolators (Isolator + insert), compatible with the equipment's voltage class. For more information, refer to the manufacturer's manual of the accessories

to be used.



CAUTION: If the installation does not include anyone bushings, it is necessary to install the appropriate accessories compatible with the equipment's voltage class before energization, in order to ensure proper circuit isolation.

Before energizing, verify the following:

- ✓ Oil level (refer to the accessories section).
- ✓ Tap changer position.
- ✓ Effective grounding of the system (we recommend maintaining a low ohmic resistance in the grounding mesh assembly below 10 ohms).
- ✓ Test all equipment accessories, if present.
- ✓ Insulation resistance.
- ✓ Transformation ratio (performed with disconnected cables).
- ✓ Disconnected terminals.



WARNING: All assembly, operation, and maintenance should be performed by qualified, trained, and authorized professionals in accordance with safety standards and regulations governing the service.

After energization:

- ✓ Secondary voltage levels;
- ✓ Temperature rise;
- ✓ Nominal load;
- ✓ Noise level;
- ✓ Locking of front panel doors.



DANGER: Primary bushings should not be energized with protective caps, therefore, they must be removed during transformer energization and replaced with the appropriate disconnectable accessories for the type of installation, as they are only used for weather protection during transportation and storage.



Figure 24 - Protective cap used for transportation and storage.

MAINTENANCE

The instructions in this manual provide recommendations for periodic maintenance procedures both in workshops and in the field, aiming to ensure proper operation and a normal lifespan for each transformer.

PREVENTIVE MAINTENANCE

First week after energization (energized transformer):

- ✓ Check the level of insulating oil;
- ✓ Due to the increased fluidity of the insulating oil caused by the normal increase in transformer temperature during operation, it is recommended to repeat checks for possible leaks;
- ✓ Monitor temperature rise.

Every twelve months (energized transformer):

An external inspection should be carried out in the field with the transformer energized, analyzing the following items:

- ✓ Absence of cracks, chips, or dirt on the bushings, as well as external damage to the tank or accessories (scratches or dents);
- ✓ Condition of the transformer terminals and connections;
- ✓ Presence of leaks from bushings, caps, plugs, welds, etc.;
- ✓ Points of corrosion in any part of the transformer;
- ✓ Absence of abnormal mechanical or electrical noises;
- ✓ Proper fixation of the transformer;

- ✓ Condition of the grounding and protection equipment of the transformer;
- ✓ Check the level of insulating liquid when the indicator is external.



WARNING: If necessary, the level of insulating liquid should be topped up with the transformer de-energized, using insulating liquid of the same nature, either at a specialized workshop or by the ITB.

Every 3 years (De-energized Transformer):

- ✓ Transformation ratio test (performed with LV cables disconnected)
- ✓ Insulation resistance test (performed with LV cables disconnected)
- ✓ Insulating oil test (dielectric strength)
- ✓ Check the condition of the paint
- ✓ Perform a visual inspection of the tank and its accessories to identify any potential oxidation points
- ✓ Clean the disconnectable terminals (primary connectors)
- ✓ These elements are prone to dust accumulation, which can compromise their insulation function and lead to voltage leaks
- ✓ We recommend using disposable towels with isopropyl alcohol
- ✓ Clean the porcelain insulators (secondary terminals)
- ✓ These elements are also prone to dust accumulation, which can compromise their insulation function and lead to voltage leaks.

Every five years (de-energized transformer):

The following tests and procedures should be performed with the de-energized transformer:

- ✓ All previously mentioned items;
- ✓ Insulation resistance measurement;
- ✓ Sampling of the insulating liquid for laboratory analysis.



WARNING: If there is a need for a complete overhaul of the transformer, it is recommended to contact ITB

Every ten years (de-energized transformer):

- ✓ A complete inspection of the transformer should be carried out, for which it needs to be sent to the ITB factory or a specialized workshop.

ENVIRONMENTAL INFORMATION

Due to our environmental concern and support for sustainable consumption, ITB Equipamentos Elétricos Ltda. provides basic guidelines to its customers regarding environmental preservation related to its equipment.

Life Cycle

ITB Equipamentos Elétricos Ltda. commits to receiving and properly disposing of its produced equipment, in accordance with current legislation, when they are deemed unusable.

Insulating Oil - Material Safety Data Sheet (MSDS)

Distribution transformers, like many high-voltage electrical devices, have active parts immersed in insulating oil. Therefore, they are assembled in hermetically sealed tanks with pressure relief devices. During operation, this oil can reach high temperatures and, even at room temperature, it can be a pollutant and aggressive agent.

We recommend reading the Material Safety Data Sheet (MSDS) for the insulating oil, which contains all the necessary information for safe handling, proper disposal, associated risks, and actions to be taken in case of accidents.

Final Considerations

When spare parts or detailed information about a specific transformer are needed, please provide ITB with the main data from its nameplate, such as type, serial number, and power rating.

Damaged transformers, regardless of the revisions, should be sent for repair at workshops. After the respective repairs, they should undergo the same complete revision as outlined in this manual.

ITB is available to provide clarifications and additional information. ITB reserves the right to revise and update this manual without prior notice. It is not allowed to use the registered trademark ITB Equipamentos Elétricos Ltda. without prior consent.

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