

DISTRIBUTION TRANSFORMER IMMERSED IN INSULATING OIL



INSTRUCTION MANUAL

MIT-001 | EN-US

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itb[®]
EQUIPAMENTOS ELÉTRICOS

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SAFETY INFORMATION

This Manual contains safety recommendations that must be observed during all phases of equipment receiving, installation, and maintenance. Failure to comply with these recommendations violates safety standards and may result in personal accidents or equipment damage. ITB assumes no responsibility for the consequences resulting from user (installer) failures to comply with these requirements. No unauthorized modifications should be made to the equipment or its accessories, and no parts should be installed or replaced without ITB's authorization. If necessary, the equipment should be returned to ITB for repairs to ensure personal and equipment safety.

This manual contains three types of warning sentences:



DANGER: Indicates an immediately dangerous situation that, if not avoided, will result in death or severe injury to the operator or individuals in close proximity to 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.



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

TERMS, CONDITIONS, AND WARRANTY LIMITATIONS

The products manufactured by ITB have their quality assured through a "WARRANTY CERTIFICATE" that accompanies the Invoice.

ADDITIONAL INFORMATION

This manual does not aim to cover all the details or variations of the products, procedures, or processes in general, nor does it provide guidance on all the practices required for installation, operation, and maintenance. If you require further information, please contact a technical representative of ITB electrical equipment Ltd.

INTRODUCTION

ITB - Electrical Equipment Ltd. is confident in offering you equipment designed and manufactured with high-quality materials to provide excellent performance under normal operating conditions.

The equipment undergoes testing in our laboratories using certified instruments and standards, ensuring its performance and operational characteristics over time.



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

REGULATION

ITB transformers are designed and constructed strictly according to 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 before leaving 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 condition of the packaging, if applicable;
- ✓ Whether the characteristics on the transformer's nameplate match 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 liquid when transformers have an inspection cover or external level indicator;
- ✓ The consistency of instrument readings, if applicable;
- ✓ The external components of the switching system. At this time, the change should be made to all positions to determine any system defects during transportation (returning to the initial position);
- ✓ The absence of leakage and corrosion at any point on 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 TRANSPORT

Transportation should be carried out in a manner that protects the entire equipment from breakage or damage due to handling.

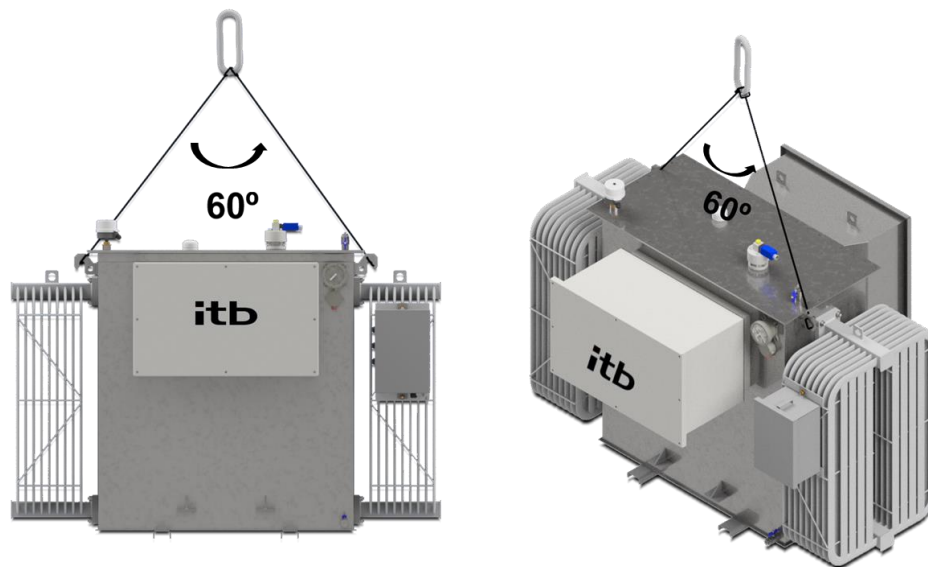


Figure 1: Full Suspension Method.



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

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

Please observe the maximum stacking height of the packaging:

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

The transformers must be shipped with their high-voltage windings connected at their highest voltage, unless otherwise specified by the buyer.

If any abnormalities are detected, the recipient must note them on the shipping document and notify ITB within the specified regulatory timeframe, so that the necessary actions can be taken in each case. The notification of the occurrence must also include the following data:

- ✓ Power rating
- ✓ Nominal voltage
- ✓ Serial number
- ✓ Transformer type
- ✓ Invoice number

If the transformer is not immediately put into service, it should be stored with the insulation liquid at its normal level. Storage should preferably be in conditions where the transformer is not exposed to weather conditions, large temperature variations, or corrosive gases, and to prevent mechanical damage.



CAUTION: It is recommended that transformers do not come into direct contact with the ground. For this purpose, boards or sleepers should be used as a base.

DISTRIBUTION TRANSFORMERS - OVERVIEW

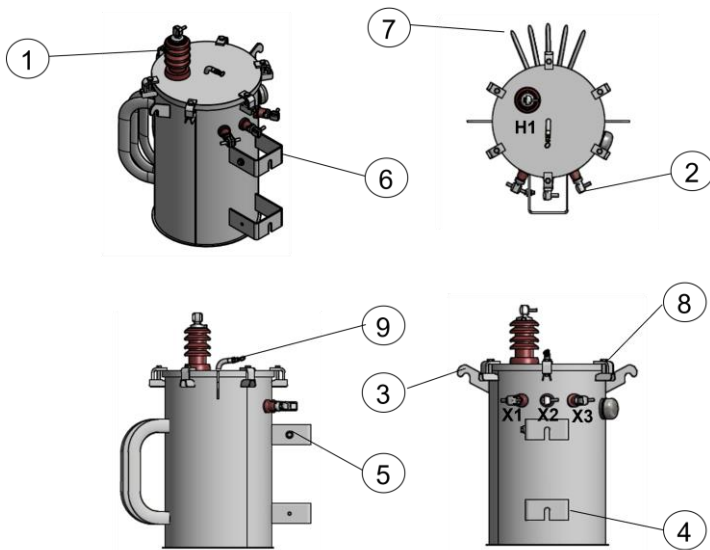
Single-phase and three-phase distribution transformers are designed for use in urban or rural overhead power distribution networks. They can be manufactured with either wound or stacked cores and filled with mineral or vegetable insulating oil.

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 phase and approval of the purchase order.

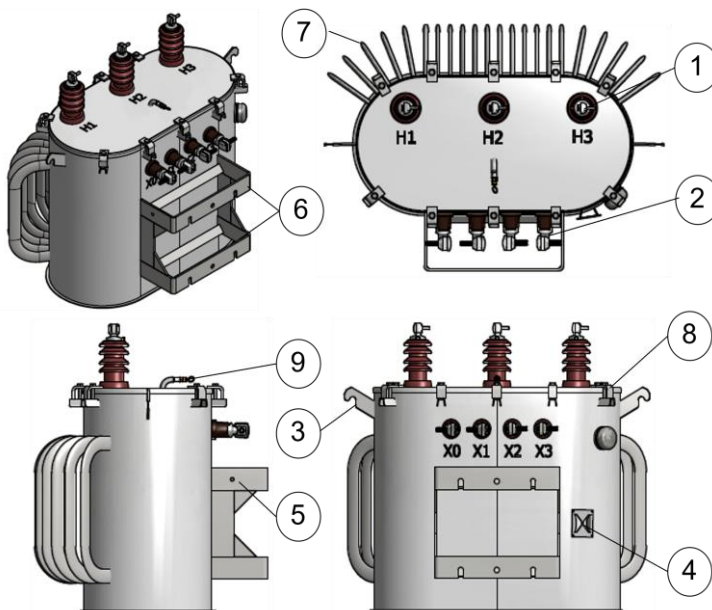
Single phase transformer



Item	Description
1	Primary bushing
2	Secondary bushing
3	Lifting hooks
4	Nameplate
5	Ground lugs and clamp
6	Pole-mounting Brackets
7	Radiators
8	Fixing clip
9	Plug for leak test

Figure 2: External view of the single-phase distribution transformer

Three-phase transformer



Item	Description
1	Primary bushing
2	Secondary bushing
3	Lifting hooks
4	Nameplate
5	Ground lugs and clamp
6	Pole-mounting Brackets
7	Radiators
8	Fixing clip
9	Plug for leak test

Figure 3: External view of the three-phase distribution transformer

Optional accessories

- ✓ Drain plug with valve
- ✓ External oil level indicator
- ✓ Inspection cover
- ✓ Support for lightning arrester fixation

Nameplate

Before installation and operation, it is essential to read all the data on the transformer's nameplate. Figure 5 shows a typical model of this plate.

It provides essential information about the transformer and necessary details for the proper use of the equipment. It also includes the serial number, manufacturing date, customer code (if applicable), and asset number (if applicable) engraved on it.



Figure 5: Identification plate.

INSTALLATION AND OPERATION

Before installing the transformer, the following checks should be carried out:

- ✓ Visual inspection, especially of bushings, connectors, and accessories, to ensure the absence of any damage or leakage 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.

- ✓ If the information on the nameplate is consistent with the system in which the transformer will be installed. The proper connection of the tap changer or the position of the switch in relation to the connection diagram.



CAUTION: The connections of the transformer must be made according to the connection diagram on its nameplate, paying attention to the correct phase sequence.

- ✓ The transformer mounting system must be in accordance with the customer's request.
- ✓ For lifting the transformer, ropes or cables should be securely attached to the handles, hooks, or eyelets specifically designed for this purpose.
- ✓ The connection of the transformer to the power grid should preferably be made using live-line connectors (clamps) for copper networks, or parallel clevis and U-bolt for aluminum networks. The secondary neutral and transformer tank should be grounded.
- ✓ Transformers must be protected against overloads, short circuits, and voltage surges. Fuse switches should be used for overload and short circuit protection, while surge arresters should be installed as close to the transformer as possible.
- ✓ The grounding of the surge arresters should be done by interconnecting the same grounding cable to the transformer neutral.
- ✓ After energizing the transformer, a final inspection with measurement of the secondary voltage is necessary.

To perform a tap changer operation, de-energize the transformer and determine the correct position using the connection diagram on the identification plate of the equipment. Take care not to leave the tap changer in an intermediate position. If the tap changer has internal operation, open the inspection cover in dry weather, adjust the correct operating position, clean the inspection cover and gasket with a clean, dry cloth, and close the inspection cover, ensuring it is tightly sealed to prevent leaks and moisture contamination.

✓ **When applicable:**

Air dryer (Air dehumidifier)

Some transformers are equipped with air dryers, which, due to their moisture absorption capacity, dry the air exchanged with the environment and the transformer.

For the installation of the air dryer, proceed as follows:

1. Remove the plug located at the end of the tube, situated in the oil conservator (no need to drain the oil from the tank).
2. Remove the upper cap of the air dryer and insert the silica gel inside.
3. Reattach the cap of the air dryer.
4. Securely fasten the air dryer onto the tube with the sight glass facing the inspection position.
5. Once it is fixed, remove the lower polycarbonate part of the air dryer and immerse it in the same transformer oil until the red level indication.
6. Carefully reattach the polycarbonate part of the air dryer.
7. Ensure that it is perfectly secured to prevent moisture from penetrating the transformer.

Silica-gel:

The drying agent, known as silica gel, changes from blue (dry) to pink when saturated. It can be rejuvenated through a drying process in an oven at temperatures ranging from 80° a 100°C (176°F to 212°F), effectively evaporating the absorbed water.

Low Voltage Circuit Breaker (Self-Protected Equipment)

Some transformers are equipped with low voltage circuit breakers to protect the equipment against faults in the power supply. Before installation, the circuit breaker should be operated approximately 10 times to adjust the contacts.

Maintenance

Generalities

This section refers to transformers immersed in insulating oil, operating under normal conditions, and serves as a general reference for maintenance services, along with the instructions and special precautions indicated by the ITB.

The instructions in this manual recommend regular measures and maintenance, both in workshops and in the field, aimed at ensuring the proper operation and a normal lifespan for each transformer.

Periodic Inspections

Every twelve months, or at the user's discretion, an on-site external inspection should be conducted with the transformer energized, analyzing the following items:

- ✓ Absence of cracks, chips, or dirt on the bushings and external damage to the tank or accessories (scratches or dents).
- ✓ Condition of the transformer's terminals and connections.
- ✓ Presence of leaks from the bushings, caps, plugs, welds, etc.
- ✓ Points of corrosion in any part.
- ✓ Absence of abnormal mechanical or electrical noises.
- ✓ Secure mounting of the transformer.
- ✓ Grounding and protective equipment of the transformer.
- ✓ Level of the insulating liquid, when the indicator is external.



WARNING: If necessary, the level of the insulating liquid should be replenished, with the transformer de-energized, using insulating liquid of the same nature.

When applicable, check every 3 years or as determined by the user:

- ✓ Operation of the gas relay (Buchholz), rubber gaskets, and wiring;
- ✓ Operation of the pressure relay or device;
- ✓ Temperature indicators;
- ✓ Silica gel air dryer;
- ✓ Cooling system;
- ✓ Wiring, control system, and terminal blocks;

Every five years, or as determined by the user, the following tests and procedures should be performed with the transformer de-energized:

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



WARNING: If the values indicate the need for a comprehensive overhaul of the transformer, it is recommended to send the unit to specialized workshops or to ITB.

Complete inspection

Complete inspection includes:

1. Disassembly of the transformer
2. Inspection of the active part
3. Inspection of the tank and radiators
4. Inspection of the bushings
5. Performing treatment of the insulating liquid or replacing it if necessary
6. Assembly of the transformer
7. Cleaning of existing accessories and, if necessary, replacement of them
8. Execution of routine tests according to ABNT NBR 5356.

Disassembly of the transformer

1. Removal of the insulating liquid;
2. Removal of the cover and bushings;
3. Loosening the active part from the tank;
4. Lifting the active part using the suspension handles, without damaging the insulation.

Revision of the active part:

1. Cleaning of the active part using clean insulating liquid jetting;
2. Inspection of the insulation condition. If necessary, it should be replaced;
3. Verification of the coil and core positioning;
4. Tightening of bolts and nuts without damaging the insulation;
5. Inspection of the coils and core, including geometry;
6. Tightening of contacts;
7. Removal of all existing impurities;
8. Inspection and cleaning of the tap changer and connections;
9. Drying of the active part.

Review of the tank/radiator assembly:

1. Removal of all gaskets, identification plate, drain plug, and grounding connectors;
2. Repair, if necessary, of dented areas and welds;
3. Cleaning of the plates, removing oxidation using sandpaper, steel brush, or an equally effective method;
4. Complete cleaning through abrasive blasting or stripping, in cases where the tank's entire surface is affected;
5. Painting, applying corrosion-resistant and finishing protection to the entire tank.

Bushings review:

1. Cleaning of the insulating body, or its replacement if necessary;
2. Replacement of all bushing gaskets;
3. Drying of the porcelain insulators in ovens, if necessary.

The review of high and low voltage terminals should include cleaning and chemical and mechanical treatment, removing any existing oxidation, especially on the electrical contact surfaces.

Transformer assembly:

1. Immediately after the drying of the active part and a general tightening, it should be placed and fixed inside the tank, without insulating liquid.
2. The low-voltage bushings should be installed, ensuring that the sealing gaskets allow for complete sealing.
3. Connect the low-voltage terminals to the outgoing cables of their respective coils.
4. Assemble the cover, preferably with high-voltage bushings already installed.
5. Connect the high-voltage terminals to the outgoing cables.
6. Reassemble all the accessories that were previously removed for inspection.
7. Tighten the cover screws evenly to ensure a perfect tank seal.
8. Fill the tank through the inspection window or the designated filling device with new insulating liquid or liquid in satisfactory condition.
9. Clearly and permanently mark the bushings according to the identification plate.



WARNING: In equipment where the active part is fixed to the cover, perform all tightening on the cover itself, ensuring its fixation. Then, make the connections of the low and high voltage terminals, position the complete assembly inside the tank, and finally proceed with the oil filling.

After the complete assembly of the transformer and a minimum resting period of 48 hours, it is recommended to perform routine tests.

Environmental Information

Due to its environmental concern and support for sustainable consumption, ITB Electrical Equipment Ltd. provides its customers with basic procedures for environmental preservation where their equipment is involved.

Life cycle

ITB Electrical Equipment Ltd. is committed to receiving and properly disposing of the equipment it produces in accordance with current legislation when they are deemed unusable.

Insulating Oil – MSDS

Distribution transformers, like many high-voltage electrical devices, have an active part immersed in insulating and cooling oil. Therefore, they are assembled in hermetically sealed tanks with pressure relief devices. During operation, this oil can reach high temperatures and, even at ambient temperature, it is a potentially polluting and aggressive agent.

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

Final considerations

When spare parts or detailed information about a specific transformer are required, the main data from its identification plate, such as type, serial number, and power, must be provided to ITB.

Damaged transformers, regardless of the revisions, should be sent to repair workshops. After the necessary repairs have been made, they should undergo the same complete revision outlined in this manual.

During the transportation of the revised transformers, they should be packaged according to the user's discretion.

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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