

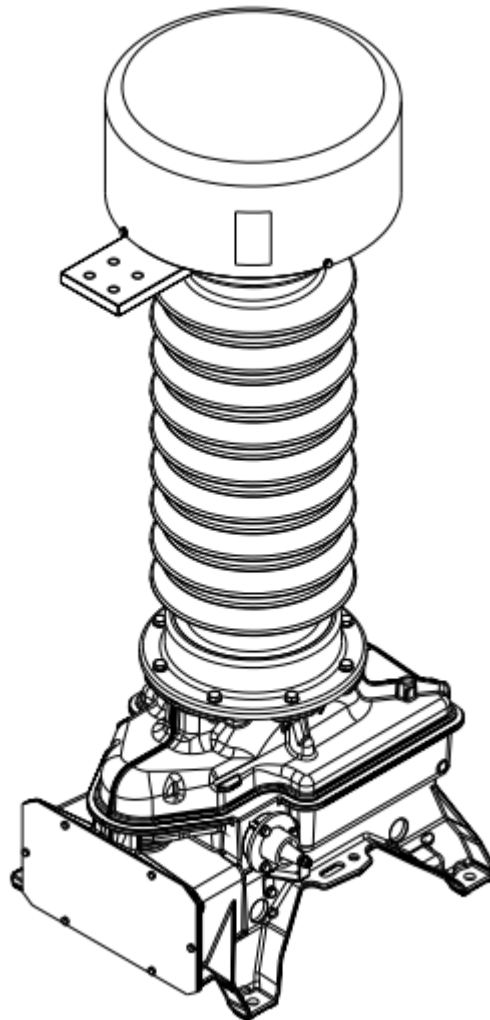


Instruction Manual

INSTRUCTION MANUAL NUMBER MIITR101

INDUCTIVE VOLTAGE TRANSFORMER

OTEF-72 / OTEF-123 / OTEF-145 / OTEF-245





Instruction Manual

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Instruction Manual

Warning!

Any person involved with transport, installation, energizing, operation and maintenance of Inductive Voltage Transformer (VT) type OTEF must read these instruction prior to any action related to these voltage transformers.

These VT is built under strict conditions which guarantee the Highest Quality achievement. In order to keep this high quality during VT's lifetime, it is utmost important that the instructions in this Book be thoroughly read and complied with.

THESE VOLTAGE TRANSFORMERS CAN NOT BE STORED IN A HORIZONTAL POSITION FOR MORE THAN FOUR MONTHS.

IN CASE OF HORIZONTAL TRANSPORTATION, IF THE TIME OF TRANSPORT AND STORAGE EXCEEDS FOUR MOUNTHS, IT IS MANDATORY TO UNPACK THE VT AND FIX IT TO THE GROUND.

Preliminary Remarks

During reception of the VT, it is important to check unpacking attentively to control the condition of the transport crate and transformer itself. Any irregularities should be recorded on the transport delivery note a formal communication sent to the responsible person immediately.

The supplied insulator can be made of porcelain, avoid sudden movements that could cause damage due to cracks for example.



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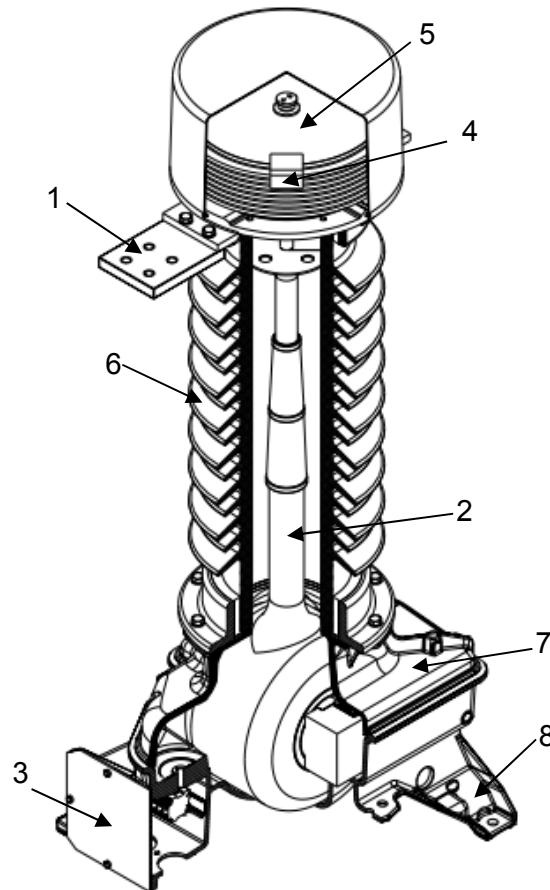
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1. GENERAL DRAWING

Description and characteristics of the OTEF voltage Transformers



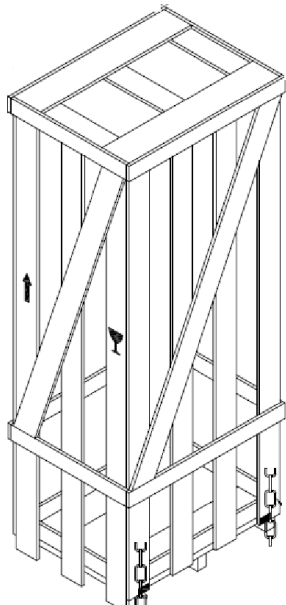
- 1- High voltage terminal
- 2- Insulation system (paper impregnated with oil)
- 3- Secondary terminal box
- 4- Oil level indicator
- 5- Metallic bellow
- 6- Insulator: porcelain or composite
- 7 – Aluminum tank
- 8- Feet with hole for anchoring



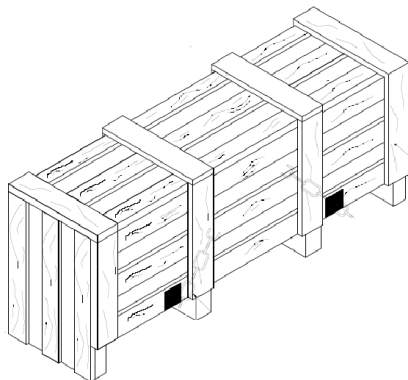
2. TRANSPORT, RECEPTION, UNPACKING AND STORAGE

2.1. Transport

The VT shall be transported as indicated by the manufacturer in an appropriate packing. Depending on the limits of transport heights, some of the VT can be transported in vertical position. To confirm this information on the packing documentations.



Example of vertical packing



Example of horizontal packing

It is important to follow Factory instructions regarding the stacking of the

packing in terms of transport and storage when applicable.

ATTENTION: The VT has fragile parts (insulator, bellows top cover, etc.) that can be damaged during transportation, by sea, air or by road (being the road paved or no). The transportation and handling shall be made with care. Sudden movements can cause impact and damage to the equipment.

2.2. Reception

Whether the shipment is of manufacturer's or customer's responsibility, the customer inspector or the service agent has to check the following on receipt of delivery:

If the crates show any signals of impact, blows or fractures, or if the transformers have any signal of damage, or oil leakage, the customer inspector or the service agent in charge of receipt shall make a written remark on shipment documents. The receipt control, mainly for the porcelain insulators and the secondary terminal box, shall be done in the presence of the forwarding agent, if possible. The remarks regarding the condition of the goods shall clearly state details of the damages found at the time of reception.

In case of damages, the customer inspector in charge of receipt shall notify GE and the insurance representative. All contact information shall be indicated on shipment insurance documents. This declaration shall be made within maximum of eight days after receipt of the material.



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2.3. Unpacking

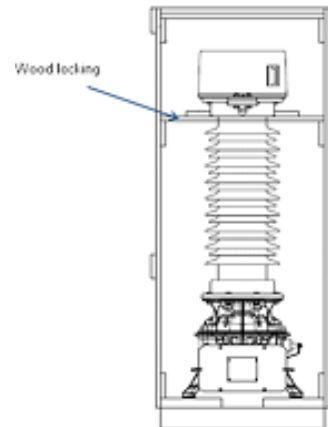
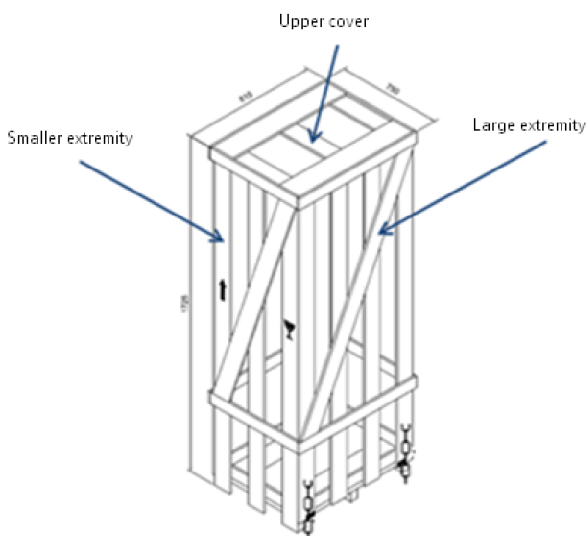
Material required for unpacking, lifting and put the transformer into service:

Qty	Description
1	Crane, munck or hoist.
1	Contact grease type PENETROX or equivalent.
1	Graphite grease MOLYKOTE type P37 or equivalent.
4	Slings of 4,5m of length (capacity 10.000 N)
1	Sling of 1,5m of length (capacity 1.000 N)

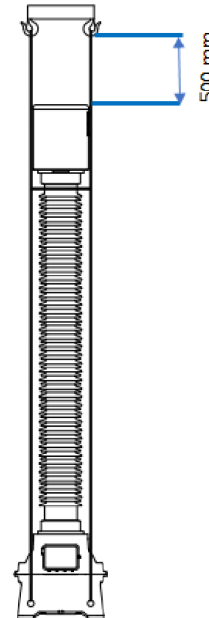
Unpacking of the transformer should be made with care.

- VT packed in vertical position:

- 1) Remove upper cover.
- 2) Remove the smaller extremities.
- 3) Remove the wood blocking pieces.
- 4) Remove the larger extremities
- 5) Remove the four screws at the equipment feet.
- 6) Lift the VT



Example of wood blocking pieces



Example of lifting a VT

NEVER lift a transformer by its primary terminal. Always lift it by the four lifting holes on the bottom tank.

- VT packed in horizontal position:

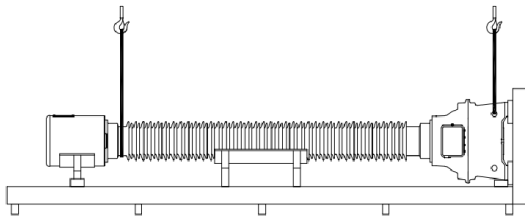
- 1) Remove upper cover.
- 2) Remove the four screws at the equipment feet.
- 3) Remove the smaller extremities.
- 4) Remove the larger extremities
- 5) Remove the green nylon slings pieces



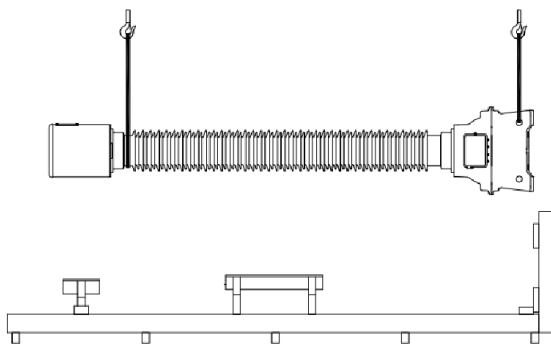
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6) Remove the VT from the packing and lift it following the next steps:

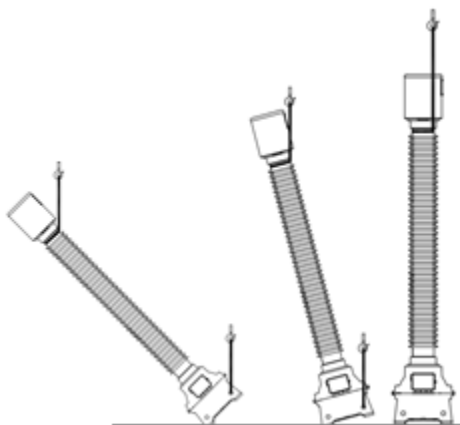
- Use two slings, one at the neck of the insulator and other at the hole for lifting



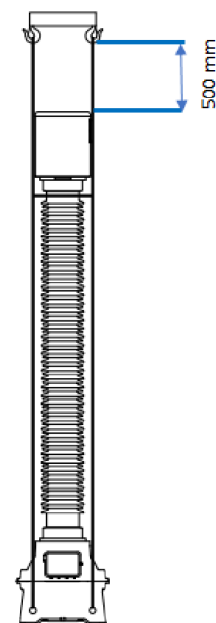
- Remove the VT keeping it in horizontal position.



- Gradually put the VT in vertical position by lifting the sling positioned in the neck of the insulator. Always keep the sling in vertical position. Handle with care in order do not damage the top cover.



- After confirming that the VT is in vertical position and supported in the ground, change the lift system by four slings positioned at the four lifting holes located in the bottom tank. Also use the 1,5m sling to connect the other ones near the area of the neck of the insulator to guarantee that the VT will not move horizontally when lifting.

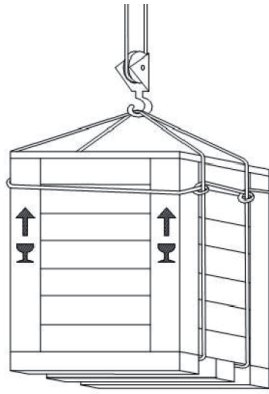


- VT handled with its package:

To lift the packaged transformer with crane or munck follow the marks on the wood crate, once it indicates the right position for the slings (nylon belts reinforced) and avoid blows and vibrations. Handle with care



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Example of lifting the VT on its packing

2.4. Storage

- The transformers can be stored in vertical position in homogeneous surface. Every time that storage is outside, remove the bellows blocking system used for transportation only as shown in 6.0 below.

NOTE: Always fix the transformer to the ground even the stored is forecasted for a short period of time.

- It is not allowed to store the VT in horizontal position.

3. ANCHORING

The transformer should be set up in vertical position. It is very important that the surface on which the VT will be set up is flat (tolerance no more than 1mm). Verify if the four feet are supported on the structure. If not, it is necessary to insert a shim before putting the fixation screws.

4. CONTACT SURFACES PREPARATION

It is recommended to clean all aluminum contact surfaces with sandpaper 150 grain to eliminate the oxidation layer. Scrub the contact surfaces with a metallic brush

(diameter of the thread 0,3mm) and impregnate with grease of the type "PENETROX" or equivalent. All the surfaces must be completely covered with grease.

For silver or tinned contacts, only clean (do not use sandpaper) and polish the side of the aluminum. Cleaning silver or tinned surfaces with sandpaper could cause damage to the protection layer.

5. CONECTIONS

5.1. Primary terminal

Connect the high voltage cable, or tube, to the primary terminal with an appropriate connector, so that they assure a good contact. Be sure that the instructions of the item 4.0 is followed.

To fix the connect to the high voltage terminal use a M12 screw applying 5,0 kgf.m (50 N.m) of tightening torque.

Remark: The screw thread shall be covered with graphite grease MOLYKOTE type P37 or equivalent. Do not use this Grease in the contact surface.

5.2. Secondary terminals

For this connection, it is important to have the set of drawings for this equipment to confirm the type of secondary terminals and the cables accepted.

Use proper connectors to guarantee a good connection. Tightening torque is indicated in the drawing of the secondary terminal box.



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The neutral point of each secondary shall be connected to the grounding terminal located in the terminal block, in order to have a reference for the voltage.

Secondary terminals not used must be kept opened and a point be grounded.

Never short circuit secondary terminals of a VT. It can cause damage and fail to the VT.

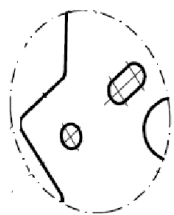
5.3. Terminal marking

Primary and secondary terminal marking are done according to the specified standard. See set of approved drawings.

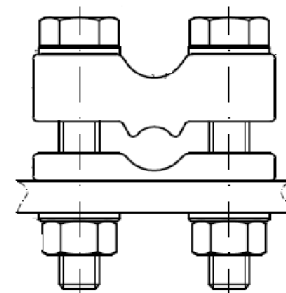
Primary and secondary connection scheme are shown on the name plate, fixed on the VT secondary box cover.

5.4. Grounding

The transformer tank has two earthing terminals located at the bottom tank that should be linked to the substation ground system through an appropriated grounding connector, if requested, supplied with the equipment. See set of drawings to confirm range of cable that can be used.



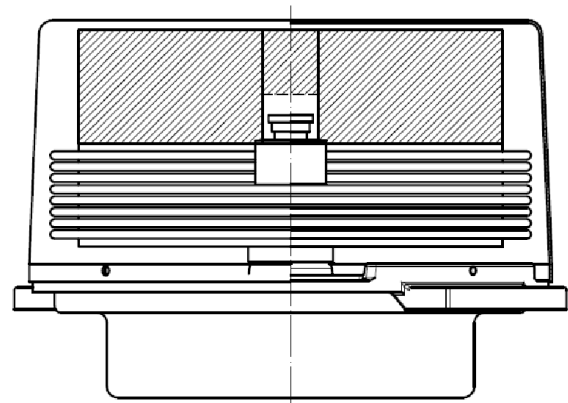
Example of grounding terminal



Example of grounding connector

6. BELLOWS BLOCKING SYSTEM FOR TRANSPORTATION

For transportation purposes, the bellows is fixed (no movement) using a KIT of synthetic cushion lightly compressed by the top cover as shown in the picture below:



Example of bellows blocking system

Before putting the VT in the pedestal or when storing, first it is necessary to remove the bellows blocking system for transportation following the steps below:

- Mark a reference line for the top cover relative to the primary terminal (using a marker or a pencil or any similar device) with the aim of at the end of the procedure the top cover will be at the original position.
- Remove the four M6 screws that fix the top cover to the bellows flange.
- Remove the top cover, with care, keeping a vertical movement. Do with care in order to



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not damage the bellows.

- Remove the bellows blocking system (kit of synthetic cushion).
- Confirm by visual inspection that the bellows are in good condition.

Geometry:

- The bellows cover in at horizontal: it is not tilted by a possible deformation in the bellows.
- The bellows is neither distorted nor asymmetric: the convolutions are equally distributed around the bellows circumference.

Surface:

- There is no damage or deformation like those caused by blows.
- Confirmed that the bellows is in good condition, put the top cover in the original position.
- Tight the four M6 screws with torque of 2kgf.m.

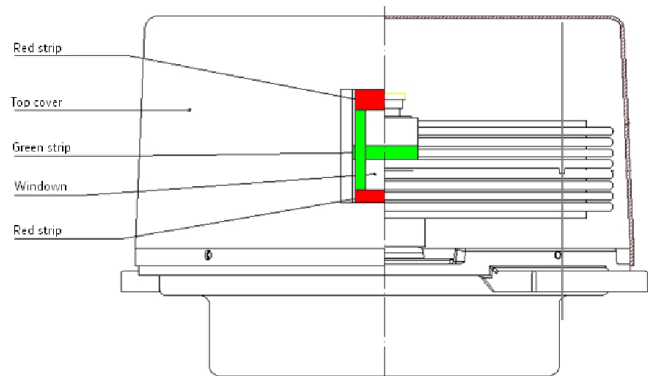
In case bellows show any type of deformation or blow the VT should not be put into service unless there is a formal release from GE. In case of doubts, to contact the technical assistance support of GE for further information.

7. OIL LEVEL INDICATOR

The position of the oil level indicator can be verified through the window of the top cover. The plate of the indicator is divided in three areas. Central green area shows the normal operation condition and higher and lower areas are shown with a red strip. In normal conditions, the indicator shows the central green area.

In case of oil level indicator is in either of the red areas, the VT shall be taken off from

operation and GE informed immediately.



Example of oil level indicator

8. INSPECTION BEFORE FIRST ENERGIZING

- Confirm terminals connections to assure the correct tightening torque.
- Confirm that there are no short-circuited secondary terminals. If so they must be opened and earthed.
- Confirm the ground connections of transformer tank.
- Confirm that the oil level indicator is in the central green area.

The VT are routine tested in the factory and do not require repeated electric test. Look for Project routine test reports for more details.

Whilst all care is taken in the factory during oil filling, the surface near of screws and bellows could have a small quantity of oil. This should not be considered as an oil leakage provided that the bellows are positioned within the green strip area.

It is not necessary to remove oil samples for analysis. The VT is hermetically sealed.

If required, small quantity of oil can be taken. Always verify oil level indicator before take oil samples.



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Never complete oil volume without prior formal authorization of GE.

Important remark: During commissioning, it is recommended to register the values founded for each of the performed test to compare with future measurements during the VT lifetime. The measurements taken in the factory are important and also the measurements during commissioning of each VT. Comparison between test results makes sense to the field measured once it is possible to follow the evolution of each parameter.

9. MAINTAINENCE AFTER ENERGIZING

After installation and energizing, the VT should not require any further intervention. However, it is suggested to perform a visual inspection during the first weeks of service to:

- Confirm the position of oil level indicator. If the indicator is significantly below or above the central green area, in comparison with other VT, it is recommend to check that there is no oil leakage and, if an oil leakage is discovered remove the VT from operation and inform GE.
- With an infrared device, check if connections are not overheating. Compare with other VT from the same circuit.

After one year of operation, it is recommended a detailed inspection of tightening torques and oil leakage and thereafter twice per year according to the substation maintenance contract.

If posible GE suggests disconnecting the VT and to perform the following examination:

- Insulator: Depending on the pollution level it is necessary to clean the porcelain.

- Metallic components: check for corrosions.
- Tightening torque of primary and secondary connections. Any adjustments should be carried out.
- Secondary terminal box: If necessary clean inside the terminal box.
- Confirm oil level indicator and if there is oil leakage.
- Remove top cover to have access to the bellows and confirm if there is an oil leakage near the fixation of the bellows and / or if the bellows is in good condition (no deformations)

10. TESTS AT SITE

The following test could be performed during VT lifetime according to the best practice of the user:

- a) Voltage ratio (T.T. R)
- b) Polarity (Polarimeter)
- c) Winding resistance (Wheatstone bridge).
- e) Insulation resistance (Megger)
- f) Infrared measurement.

11. FINAL DISPOSAL OF THE TRANSFORMER PARTS AFTER LIFETIME

The high voltage instruments transformers are made of the following components, which after life time require a properly disposal to prevent environmental contamination:



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Components	Recommended Disposal
Metallic materials	Metal recycling company
Resin and materials saturated with resin	Industrial landfill, properly licensed by the state's responsible agency.
Oil (PCB-free) – classified as Class I hazardous residue	Oil refinery at a company which is properly licensed to perform such an activity
Material contaminated with oil	Co-processing or incineration at a company which is properly licensed by the state's responsible agency.
Porcelain insulator	Industrial landfill, properly licensed by the state's responsible agency
Other materials	Industrial landfill, properly licensed by the state's responsible agency

The disposal of oil and components contaminated with oil directly into the soil or water is **prohibited**.

For further information or clarifications, contact GE environment department:
+55 35 36297112.