transforma

Electrical distribution transformers immersed in liquid dielectric up to 2500 kVA

General Instructions
IG-168-EN, version 04; 13/10/2015
CAUTION!

When medium-voltage equipment is operating, certain components are live, other parts may be in movement and some may reach high temperatures. Therefore, the use of this equipment poses electrical, mechanical and thermal risks.

Ormazbabal designs and manufactures its products according to the principle of integrated safety, based on the following criteria:

- Elimination of hazards wherever possible.
- Where elimination of hazards is not technically or economically feasible, appropriate protection functions are incorporated in the equipment.
- Provision of information on remaining risks to facilitate the design of operating procedures which prevent such risks, training for the personnel in charge of the equipment, and the use of suitable measures for personal protection.
- Use of recyclable materials and establishment of procedures for the disposal of equipment and components so that once the end of their service lives is reached, they are duly processed in accordance, as far as possible, with the environmental restrictions established by the competent authorities.

Consequently, the equipment to which the present manual refers complies with the requirements of section 11.2 of the IEC standard 62271-1. It must only be operated by qualified and supervised personnel, in accordance with the requirements of standard UNE-EN 50110-1 on the safety of electrical installations and standard UNE-EN 50110-2 on activities in or near electrical installations. Personnel must be fully familiar with the instructions and warnings contained in this manual and in other recommendations of a more general nature which are applicable to the situation according to current legislation (MIE-RAT, LEY 31/1995, of 8th November, on the prevention of occupational hazards. State Journal BOE 269, dated 10th November, and its update in accordance with Royal Decree 54/2003).

The above must be carefully observed, as the correct and safe operation of this equipment depends not only on its design but also on general circumstances which are in general beyond the control and responsibility of the manufacturer. More specifically:

- The equipment must be handled and transported appropriately from the factory to the place of installation.
- All intermediate storage should occur in conditions which do not alter or damage the characteristics of the equipment or its essential components.
- Service conditions must be compatible with the equipment rating.
- The equipment must be operated strictly in accordance with the instructions given in the manual, and the applicable operating and safety principles must be clearly understood.
- Maintenance should be performed properly, taking into account the actual service and environmental conditions in the place of installation.

The manufacturer declines all liability for any significant indirect damages resulting from violation of the guarantee, under any jurisdiction, including loss of income, stoppages and costs resulting from repair or replacement of parts.

Warranty

The manufacturer guarantees this product against any defect in materials and operation during the contractual period. In the event that defects are detected, the manufacturer may opt either to repair or replace the equipment. Improper handling of this equipment and its repair by the user shall constitute a violation of the guarantee.

Registered Trademarks and Copyrights

All registered trademarks cited in this document are the property of their respective owners. The intellectual property of this manual belongs to the manufacturer.

In view of the constant evolution in standards and design, the characteristics of the elements contained in this manual are subject to change without prior notice.

These characteristics, as well as the availability of components, are subject to confirmation by Ormazbabal.
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1 DESCRIPTION AND MAIN CHARACTERISTICS

1.1 Design, manufacturing and testing

Ormazabal’s transformers have been designed and constructed in accordance with the mandatory standards. They meet the testing requirements of the current Medium Voltage (MV) Electrotechnical Regulations, as well as particular customer specifications.

1.1.1 Routine or normal tests

The transformers are subjected to routine tests, which guarantee compliance with the following standards:

- Winding resistance measurement:
  UNE-EN 60076-1, IEC-60076-1
- Transformation ratio measurement and check up of vector group:
  UNE-EN 60076-1, IEC-60076-1
- Measurement of load losses and short-circuit voltage at main tapping:
  UNE-EN 60076-1, IEC-60076-1
- Losses and no-load current measurement:
  UNE-EN 60076-1, IEC-60076-1
- Power frequency voltage test:
  UNE-EN 60076-3, IEC-60076-3
- Induced voltage test:
  UNE-EN 60076-3, IEC-60076-3

1.1.2 Test protocol

All the information regarding the transformer tests is recorded in the "Test Protocol" enclosed with the transformer documentation.

Fig. 1.1: Detail of elements of transforma

| 1 | Medium Voltage (MV) bushings      | 6 | Enclosure and dielectric liquid |
| 2 | Pocket for thermometer installation | 7 | Dragging eyes                 |
| 3 | Bracing eyes                      | 8 | Low Voltage (LV) bushings     |
| 4 | Ferromagnetic nucleus             | 9 | Lifting eyes                  |
| 5 | Medium Voltage (MV) and Low Voltage (LV) windings |
2 TRANSPORT AND HANDLING

Use the four bracing eyes located on the transformer corners for its transportation and so prevent damage to the cooling elements.

The transformers can be transported and handled using a forklift truck, crane or rollers.

2.1 Transport on a forklift truck

In this case, the transformer must be properly fitted and fastened to a pallet adequate to handle its weight and size. Make sure the cooling elements are protected against possible damage caused by the forklift support.

WARNING
Risk of machinery breakage

- The selection of the hoisting elements must be based on the transformer total weight, shown on the name plate.

2.2 Transport using a crane

The tank is robust enough for lifting the transformer by means of the lifting eyes. Aspects to consider:

- The slings on the eyes must form a minimum angle of 60° with the transformer’s horizontal.

DANGER

Risk of death by crushing and damage to the transformer or to the installation

- Use the eyes in the transformer cover for lifting the transformer with a crane while maintaining a horizontal position at all times.
- Avoid causing damage to the elements that are located on the transformer cover. Use the proper hooks to achieve a perfectly vertical elevation.

Fig. 2.2: Elevation using a crane

2.3 Transport on rollers

WARNING
Risk of machinery breakage

- Do not use the transformer cooling fins as a fulcrum.

In order to move the transformer by means of its rollers, lean a lever against the transformer carriage.
3 STORAGE

If commissioning is not immediate, transformers must be stored following the recommendations below:

► Store the transformer in a place that is dry and clean.
► If the transformer is equipped with plug-in terminals, make sure the conical protector provided for keeping the connection terminals clean and intact is in place.
4 INSTALLATION

4.1 Reception of the transformer

transforma is supplied prepared for its connection to Medium Voltage (MV) and Low Voltage (LV) lines. Some elements, such as the rollers and / or the thermometer, may be supplied unassembled for shipping.

When the transformer is received (at the customer warehouse or at the transformer’s final location), it must be carefully inspected, paying special attention to the following aspects:

► The characteristics of the transformer, as indicated on the Name Plate, must coincide with those in the Test Protocol; and these must correspond with those specified on the corresponding order.
► Verify the general condition of the transformer and check for absence of dents, especially on the cooling equipment and on the Medium Voltage (MV) and Low Voltage (LV) bushing insulators.
► Verify that the transformer has all of its accessories (rollers, thermometer, etc.), ensuring they are not damaged.
► The transformer seals must be unbroken and untouched.

If any anomaly is detected upon the receipt of the transformer, inform Ormazabal immediately. If, after a 15 day period, the manufacturer has not received a report of anomalies or defects found, it is assumed the transformer arrived in perfect conditions and the Ormazabal will not be responsible for any future anomalies or their consequences.

If any accessory is missing or damaged, immediately notify the carrier and Ormazabal.

4.2 Transformer site

The transformer site for both exterior and interior installations, must allow for adequate cooling.

Poor ventilation of the transformer may cause it to overheat.

Both the technical conditions and the personal and property safety requirements of the transformer’s design and site are defined in the applicable legislation and standards.

If the transformer is installed indoors, prepare a horizontal base that supports the transformer. Take into account the total weight of the transformer, which is indicated on its name plate.

Lock the rollers to prevent the transformer from moving during its operation.
4.3 Transformer electrical connections

4.3.1 Standard procedure

**DANGER**
Risk of death by electric shock and of irreversible damage to the transformer or to the electrical installation

- The transformer electrical connections can only be performed by qualified personnel while always observing the proper electrical safety measures.

Connect the transformer as follows:

1) Verify that the electrical power supply to the transformer meets the service values indicated in the transformer’s name plate.

**WARNING**
Risk of causing irreversible damage to the transformer or to the electrical installation.

- Verify that the electric power supply to the transformer meets the service values indicated in the transformer’s name plate.

2) Open all the electrical power sources and interlock or block the necessary switching devices to prevent the power supply.

3) Verify that electrical voltage is not present.

4) Earth and short-circuit all the electrical power sources.

5) Delimit and mark the work area properly.

6) Check for proper dielectric liquid level.

**WARNING**
Risk of causing irreversible damage to the transformer or to the electrical installation.

- In case of oil leakages contact the manufacturer.

**WARNING**
Risk of causing irreversible damage to the transformer or to the electrical installation.

- Start the electrical connection by earthing the transformer tank.
7) Connect the transformer’s tank to earth, earthing its different connections using round connection terminals for a regulation section cable.
   Tools:
   - Standard cross-section earthing cable.
   - Round connecting points of suitable diameter.
   - 1 M12 screw (M10 to order).
   - 2, 14 mm (12 mm for M10) washers (one for each side of the connecting points).
   Apply a torque of 40-60 Nm for M12 (25-35 Nm for M10).

   ! WARNING
   Danger of irreversible damage to the transformer.
   ► The torque must guarantee the proper electrical contact of the connections.

8) Connect the transformer to the Medium Voltage circuit (MV). Use flexible connections which do not place any strain on the transformer bushings, sufficiently sized to prevent excessive overheating and, at the same time, allow for the dilatations caused by heat without damaging the transformer.

   ! WARNING
   Danger of irreversible damage to the transformer.
   ► The torque must guarantee the proper electrical contact of the connections.

9) Connect the transformer to the Low Voltage (LV) circuit. Use flexible connections that do not place any strain on the transformer bushings. Their size must be enough to prevent excessive overheating and, at the same time, allow for the dilatations caused by heat without damaging the transformer.

10) Connect the transformer’s neutral to the electrical installation’s neutral.

11) Check that the tap changer position is correct; and in the case of a multi-voltage transformer, ensure the Medium Voltage (MV) winding is connected to the electrical voltage that is going to be used as service voltage.
4.3.2 Special transformers for photovoltaic or wind applications
Transformers to be connected in renewable energy power plants (photovoltaic and wind) must also take into account the following considerations (in addition to those of conventional distribution transformers):

► Transformers may be fitted with an internal electrostatic shield to mitigate the effects of disturbance associated to power electronics. The electrostatic screen must have its connector bushing identified as P.E. or E.S. and must be connected rigidly to the transformer station’s neutral earthing.

⚠️ DANGER
Risk of death by electric shock and of irreversible damage to the transformer or to the electrical installation

► If the transformer is fitted with an electrostatic shield, connect the screen to the transformation station’s neutral earthing.

► The transformers may have more than one secondary coil. Properly connecting the coils to the different sources which will supply energy to the transformer must be taken into account.
5 COMMISSIONING

5.1 Transformer verification before commissioning

Once the transformer is connected to the Medium Voltage (MV) and Low Voltage (LV) networks, and before connecting the electrical power source, the following checks should be performed:

1) Check that the Medium Voltage (MV) network values and the transformer rated voltage coincide.
2) Feed the no-load transformer and check its correct connection and regulation by measuring the values at the Low Voltage side.

![DANGER]

Risk of death by electric shock and of irreversible damage to the transformer or to the electrical installation

► The tap changer shall always be operated without electrical power. Ensure the handle is well locked and in its working position.
► Check that the electrical voltage applied corresponds with the transformer's rated voltage. In case of anomaly, contact the manufacturer.
► If after commissioning the transformer, it is necessary to perform an adjustment, follow the safety instructions specified in section 6.1, Access for Maintenance Operations, of this document.

3) Regulate the transformer's voltage using the corresponding tap changer, taking into account the safety requirements set out above:

![Transformer's tap changer]

4) Progressively apply the load until the operating power is achieved, while ensuring that the transformer temperature does not go over 105 °C.
6 MAINTENANCE

### 6.1 Access for maintenance operations

Before performing any maintenance operation on the transformer, follow the measures required by the applicable legislation, including:

1) Disconnect all the electrical power sources for the Medium Voltage (MV) and Low Voltage (LV) circuits until the transformer is turned off. Interlock or block the necessary switching devices to prevent the power supply.

2) Verify that electrical voltage is not present.

3) Earth and short-circuit all the electrical power sources.

4) Using an insulating stick, earth the transformer bushings and ensure that any static electricity is discharged.

5) Delimit and mark the work area properly.

### 6.2 Periodic maintenance

It is recommended that the transformer undergoes a periodic visual inspection of the following aspects:

**DANGER**

Risk of death caused by electric shock and of irreversible damage to the transformer or to the electrical installation

- Before handling the installation, exactly follow the instructions of section 6.1 of this document.
- Do not operate the tap changer with electrical power applied to the transformer.

**WARNING**

Risk of causing irreversible damage to the transformer or to the electrical installation.

- In case of oil leakages contact the manufacturer.

6) Check that the transformer does not leak dielectric liquid
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Maintenance

General Instructions

Water-tightness: check that the transformer does not leak dielectric liquid.

Cleaning: check for proper cleanliness and care of the transformer.

Noise: check that the transformer does not produce strange or untimely noises.

6.3 Repairs

If the transformer presents any anomaly in its operation, the user must notify the manufacturer, who must provide the appropriate instructions.

If after the transformer inspection, repairs or modifications are required, these operations must be performed by the manufacturer.

If a company other than the original manufacturer performs the repair or modification, they must place a plate on the transformer indicating the modification or repair performed and the new characteristics of the transformer.

DANGER

Risk of death

The requirements set out in the applicable legislation on Transformer Substations to protect people and property which may be damaged by the installations must also be met.

If someone other than the manufacturer handles and unseals the transformer, the manufacturer will no longer be responsible for its operation and reliability.
7 ADDITIONAL INFORMATION

7.1 Reliability

As shown by the tests, the transformer leaves the factory free of defects and is ready to provide service for its entire service life.

In order to maintain that level of reliability, transformers must be properly handled, stored, transported and commissioned, applying the corresponding checks and the protections established in the Medium Voltage (MV) Electro-technical Regulations.

In addition, the maintenance instructions listed in this document must be observed. Additionally, it is required that during its installation, the necessary precautions are taken to protect personnel who normally or circumstantially work around it and that those persons not required for its operation are kept at a safe distance away from the transformer.

7.2 Company registration certificate

Company record sheet Nº ER – 0227 / 1996, granted by AENOR – EQ – NET, dated 23/5/1996, guarantees our Quality Assurance System, from the design and development stage of the product through to Service After-sales establishes the management criteria and the procedures and processes which guarantee the delivery of transformers which are free of defects, including by suppliers, applying knowledge and lessons deriving from investigation and standard and special tests in order to guarantee a uniform design in the product components, the manufacture procedures and tests, staff training and the ongoing improvement of the entire process.
8 FINAL APPENDIX

Torque recommended for Medium Voltage (MV) and Low Voltage (LV) connections.

<table>
<thead>
<tr>
<th>Metric Size</th>
<th>M10</th>
<th>M12</th>
<th>M16</th>
<th>M20</th>
<th>M30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrench Size</td>
<td>17</td>
<td>19</td>
<td>24</td>
<td>30</td>
<td>46</td>
</tr>
<tr>
<td>LV busbar connections (steel screw and nut).</td>
<td>45-60</td>
<td>65-85</td>
<td>95-130</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Low voltage (LV)
- Connection between nuts. 15-20 70-100 250-350
- Fastening the palms to the pin (stainless steel screws). 25-35 40-60
- Screws to the surface of the palms. 25-35 40-70 100-150

Medium voltage (MV)
- Fastening the bushings to the medium voltage pin (Brass bolt and nuts [*]). 10-15

(*) The MV bushings include 3 nuts, but only the two top ones can be handled. The purpose of the lower nut is to tighten the insulator gasket; loosening it could cause leakage of the dielectric liquid.

Tab. 8.1: Recommended Tightening Torque [Nm]
Subject to change without prior notice.

For further information, contact Ormazabal.

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