CTC

Under pole compact transformer substation

General Instructions
IG-086-EN, version 03; 25/03/2015
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.

In order to ensure an acceptable level of protection for people and property, and in compliance with applicable environmental recommendations, Ormazabal 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 forthcoming IEC standard 62271-1. It must only be operated by qualified and supervised personnel, in accordance with the requirements of standard EN 50110-1 on the safety of electrical installations and standard 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 State Gazette BOE 269, dated 10 November, and the update in accordance with R.D. 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.

Guarantee

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

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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 notification.

These characteristics, as well as the availability of components, are subject to confirmation by Ormazabal.
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1 Overview and main characteristics

Ormazabal’s CTC is an Under Pole Compact Transformer Substation designed to be installed on the surface, with outdoor operation, complying with the UNE-EN 61330 standard. It can be used in electrical distribution public networks up to 36 kV and can house a transformer up to 250 kVA.

The main elements of the CTC Transformer Substation are as follows:

Fig. 1.1: Main Elements of the CTC TS

| 1 | Prefabricated Outer Enclosure |
| 1.1 | Concrete Monoblock Construction |
| 1.2 | Removable Cover |
| 1.3 | Transformer’s Doors |
| 1.4 | LVB Access Door |
| 2 | Power Transformer |
| 3 | Low Voltage Board (LVB) |

1.1 Prefabricated enclosure

It consists of:

- Concrete monoblock prefabricated construction with IP339 rating, complying with the UNE 20 324 standard.
- Removable cover.
- One front access door to the Low Voltage Board (LVB) with dimensions of 975 x 970 mm. The one leaf access door is provided with a system that allows to fix it at 90° and avoids accidental closing. There is a physical barrier from the LVB access area to the transformer access area.
- Two side doors with dimensions of 982 x 1320 mm that allow access to the transformer area. Both doors can be unlocked from the LVB compartment.
- Two side grilles over each of the transformer access doors, for air intake / exhaust, allowing optimal ventilation. They are provided with a mosquito netting of 6 mm maximum mesh.
- Two cable access areas, one for MV cable incoming, with dimensions of 400 x 190 mm, at the CTC TS back bottom and another one for LV cable outgoing, with dimensions of 440 x 190 mm, at the front bottom.
- Dielectric liquid collecting pit with a capacity of 400 l.
- Electrical warning plate.

1.2 Transformer

- Transformer up to 250 kVA, 36 kV series.

This functional unit is included in the CTC TS only upon request.

1.3 Low voltage board

The CTC Transformer Substation can be supplied with the Low Voltage Board (LVB) installed at the factory.

The LVB consists of a metal frame that supports the protection functional unit, which is made up of vertical fuse holder bases BTVC. The busbar functional unit, made up of horizontal bars, is fixed on these bases. To identify the horizontal bars different colours are used.
1.4 Mechanical characteristics

The dimensions and weights of the CTC Transformer Substation are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Total [mm]</th>
<th>View [mm]</th>
<th>Length [mm]</th>
<th>Depth [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>2080</td>
<td>1600</td>
<td>1330</td>
<td>2170</td>
</tr>
<tr>
<td>Weight [kg]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enclosure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without Transformer</td>
<td></td>
<td>2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With Transformer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*</td>
<td></td>
<td>4600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cover</td>
<td></td>
<td></td>
<td></td>
<td>500</td>
</tr>
</tbody>
</table>

* Maximum weight for a 250 kVA / 36 kV transformer

Fig. 1.2: CTC Dimensions

Dimensions in millimeters
2  Transport

2.1  Access
The site must be visited in advance to check if vehicles can have access and if there is sufficient space for unloading.

2.2  Road transport
The transport takes place in a truck, placing the CTC TS on the truck’s platform on one or two pallets, so that the sitting surface of the transformer substation is stable. The height from the truck’s platform to the CTC TS base must be at least 80 mm.

The enclosures are loaded in such way that the door on the short side faces the truck’s cab.

Once the CTC TS has been placed on the pallets, it will be fixed to the truck’s platform with slings (never with cables).

The corners will be protected with carton or polyspan between the sling and the CTC TS, in order to avoid any marks or cracks as a consequence of the pressure exerted by the slings when tightened.

The maximum amount of CTC TSs that can be transported at a time on a three-axle low loader is five units. The truck should be articulated and provided with features that allow to load the enclosures in the position indicated:

For multiple transport of CTC Transformer Substations, these are placed at enough distance to avoid damage during transport.
2.3 Sea transport

The sea transport will take place in open reinforced floor “flat-rack” containers.

The ventilation grilles on the two biggest sides of the enclosure will be protected with elastic plastic tape wound around several times, in order to avoid water filtering in the enclosure during transport.

Two boards of 2000 x 150 x 20 mm will be used to rest the CTC Transformer Substation in the container.

Once positioned inside the container, a 100 mm long 100 x 100 x 10 mm bracket will be placed on each corner of the enclosure, welded to the floor of the container in order to prevent any movement during transportation.

Then two transversal slings will be placed over the enclosure (as shown in Figure 2.3).

The corners will be protected with carton or polyspan between the sling and the transformer substation, in order to avoid any marks or cracks as a consequence of the pressure exerted by the slings when tightened.

Fig. 2.3: Sea Transport
3 Installation

3.1 Location
The site shall be defined exactly indicating the alignment and the height of reference points.

3.2 Planning
The coordination of the transport and the crane or tow truck adequate to the weight of the CTC Transformer Substation needs to be planned.

3.3 Handling
For a correct handling, the CTC TS is provided with DEHA hooks that used with a lifting beam, slings and adequate hooks ensure that the lifting operation is as balanced as possible.

CAUTION
Lifting the CTC TS with the specified lifting beam is prohibited when the transformer is installed inside it. To lift the TS with the transformer, consult Ormazabal’s Technical – Commercial department.

3.4 Dimensions of the excavation
It is recommended to make an excavation for the installation, as shown in Figure 3.3.

The burying level marked on the CTC TS walls must not be exceeded. The maximum burying height is 480 mm measured from the base of the Transformer Substation.

These levels will be adapted to the earth network solution taken for each case, according to the earth connection guide plan.

Necessary excavation for the recommended earthing ring: see Figure 3.9.

Fig. 3.1: Correct fitting of the DEHA hooks
For the transversal balancing, a lifting beam with reference ABF/3 is used that allows to lift a maximum of 3000 kg.

Fig. 3.2: Positioning of the lifting beam to handle the CTC

Fig. 3.3: Dimensions of the excavation

Dimensions in millimeters

a 100 mm compacted sand
3.5 Levelling process

Levelling the ground is important for the correct installation of the enclosure.

The following tools are necessary:

- 1 Bubble lever
- 1 Square shovel
- 8 Levelling tools

**CAUTION**

For installations on sloping ground, consult Ormazabal’s Technical – Commercial department.

It is necessary to cover the base of the pit with a 100 mm thick layer of compacted and levelled sand to avoid an uneven base.

The installation operation involves positioning the CTC TS in the excavation made for this purpose and connecting the LV and MV cables, as well as the external earthing circuit.

![Excavation elements](image)

3.6 Protection and earthing circuit

The CTC TS is provided with an internal earthing circuit to connect the different elements to the external earthing circuit.

Inside the enclosure, there are two earth disconnection boxes corresponding to:

- Protection earthing circuit (metallic parts).
- Service earthing circuit (transformer zero-sequence earth).

3.6.1 Protection earth connection

The protection earthing circuit (metallic parts) provided with the CTC Compact Transformer Substation is connected to the protection earthing disconnection box on the right-hand side wall of the transformer area, looking from the LVB.

The metal enclosure is connected to the protection earthing circuit (metallic parts) which is finally connected to the protection disconnection box.

3.6.2 Service earth connection

The service earthing circuit (zero-sequence earth) connects the LVB zero-sequence to its disconnection box located in the LVB area, on the left-hand side wall, looking from the LVB. It is recommended to make the connection with insulated copper wire.

**CAUTION**

The LVB zero-sequence bar (service earth connection) is not connected to the protection earth connection bar (metallic parts).

Both earthing circuits are independent.

The Transformer Substation project must include the section regarding the execution of the earth connection (check the Utility's standard project), as well as the justification of its sizing. The Earthing Installations section of the Regulations regarding Power Plants, Substations and Transformer Substations (MIE-RAT 13) describes the requirements this kind of facility must comply with.

The copper connector cross-section, the contact surface of terminals and tightening torques shall be suitable for a default current delimitated by Network protections.
In the cases when it is not feasible to maintain the values of step and touch voltages within the limits specified in Supplementary Technical Instruction MIE-RAT 13 of the Transformer Substations Regulations (R.D. 3275/1982 and updates), the owner of the facilities shall implement at least one of the additional safety measures provided in this instruction, in order to reduce the risks to persons and assets.

The recommended tightening torque for the electrical connections of the earthing network is described on the table below:

<table>
<thead>
<tr>
<th>METRIC</th>
<th>TIGHTENING TORQUE [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Steel 8.8</td>
</tr>
<tr>
<td>M8</td>
<td>21</td>
</tr>
<tr>
<td>M10</td>
<td>38</td>
</tr>
<tr>
<td>M12</td>
<td>60</td>
</tr>
</tbody>
</table>

Fig. 3.5: Recommended Earthing Ring

Dimensions in millimetres

⚠️ CAUTION
It is recommended to make a 50 mm² bare copper loop without interruption. Use a conductor prolonged to the inside of the transformer substation to connect to the disconnection box of the protection earthing circuit.

3.7 Positioning of the transformer

To position the transformer, follow the steps below:

1) Remove the plugs from the cover tips and place the four eyebolts supplied with the equipment on the cover, screwing them all the way in.

2) Lift the cover with four chains of the same length.

3) Place the cover on the floor on two boards.

4) Put the transformer into the CTC TS with the tow-truck.

5) Place the cover on the CTC TS and connect the earth cable that connects the cover with the enclosure.

6) Remove the eyebolts and place the plugs on the tips.

Fig. 3.6: Removing the cover

Fig. 3.7: Inserting the transformer

The transformer rests on the concrete enclosure base. It may be fixed to the floor by tightening a set of nuts on the four fixing points available on the enclosure.
To access the transformer, follow the steps below:

1) Open the door of the CBT TS compartment and put it in its fixed position.
2) Install signals on the working area.
3) Activate the locking of the door-grille of the transformer compartment.

3.8 Access to MV and LV cables

The CTC TS is provided with one MV cable incoming hole, with dimensions of 400 x 190 mm, at the rear of the enclosure, on the opposite side of the access door to the LVB.

To unlock the door, pull the bar upwards, as indicated in Figure 3.9.

It also has another LV cable outgoing hole, with dimensions of 440 x 190 mm, at the front of the enclosure, under the access door to the LVB.

To open a hole, just hit it with a hammer.
3.8.1 Connection of the MV Cables to the Transformer

If the transformer is fitted with 24 kV plug-in bushings, it is recommended to use 24 kV / 250 A single connection plug-in connectors and single core cable.

If the transformer is fitted with 36 kV plug-in bushings, it is recommended to make the connection with 36 kV / 400 A plug-in connectors and a single core cable.

If the transformer is fitted with open porcelain bushings, as per the standard UNE-EN 50180, it is recommended to make the connection to the M12 bolt of the bushing with the connecting points.

3.8.2 Connection between the Transformer and the LVB

It is recommended to make the connection between the transformer and the LVB with 0.6/1 kV extraflexible copper wire of adequate cross-section with hexagonal connectors, as per DIN 46.235.

The connection is made directly on the busbar with M10 screws.

To identify the phases, pay attention to the colour code on the cables and on the bars.

3.8.3 Connection of the Cables to the LV Outgoing

The LV cable outgoings are made with the LVB’s BTVC bases screws.

Fig. 3.13: MV and LV mains

Fig. 3.14: Elements of the CTC Transformer Substation

Once the cable connections to the LVB and to the transformer MV bushings have been made, the cables will be sealed in the holes in order to obtain an adequate watertightness level.
3.9 Electrical equipment replacement

To replace the transformer, follow the steps below:

1) Cut the LV and MV voltage sources.
2) Lock the breaking switchgear.
3) Check voltage absence.
4) Remove the plugs from the cover tips and replace them with the lifting eyebolts of the CTC TS, as indicated in chapter 3.7.
5) Disconnect the protection earth wire (metallic parts) which connects the cover to the concrete enclosure.
6) Lift the cover with four chains of the same length (see figure 3.6).
7) Place the cover on the floor on two boards.
8) Open the LVB compartment door (see figure 3.8)
9) Earth the circuit.
10) Activate the locking of the door-grille of the transformer compartment.
11) Open the transformer compartment doors.
12) Disconnect all the MV and LV cables (see chapters 3.8.1, 3.8.2 and 3.8.3)
13) Remove the transformer by lifting it. (see figure 3.7)
14) Place the new transformer in the CTC TS with the tow-truck.
15) Connect all bridges (see chapters 3.8.1, 3.8.2 and 3.8.3).
16) Place the cover on the CTC TS and connect the earth cable that connects the cover with the enclosure.
17) Remove the eyebolts and place the plugs on the tips.
18) Restore service to the circuit.
4 Maintenance

The prefabricated enclosure does not require maintenance. Occasionally, it might be advisable to check and grease the locks.

There should be no obstacles (signs, plants, etc.) on the ventilation grilles of the prefabricated enclosure.
5 Additional information

5.1 Accessories included in the supply

► First aid sign.
► Electrical warning plate.
► Document holder with the information specific to the CTC TS.
► Insulated key to operate the LVB disconnector.
► Eyebolts to lift the cover.
Subject to changes without prior notice.

For more information, contact your nearest Ormazabal commercial branch.