



**APPLICABLE TO:
DISTRIBUTION
TRANSFORMERS
With TANKS and FLAPS**



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WARNING!

**PLEASE READ THESE INSTRUCTIONS CAREFULLY AND
THOSE ACCOMPANYING THE ACCESSORIES BEFORE
COMMISSIONING THE TRANSFORMER**



1 GENERAL POINTS

1.1 Safety warnings

All persons involved in the delivery, commissioning, operation, maintenance and use of the machine must:

- Have sufficient qualifications in this subject and
- Follow the instructions in this service manual strictly.

Inappropriate or incorrect use may constitute a risk to:

- The user's life and safety.
- The machine and other materials in the area and
- The efficient operation of the machine.

1.2 Responsibility

The instructions in this Manual must be followed before each and every transformer is commissioned or operated.

1.3 Appropriate use

The transformer may only be assembled, electrically connected and commissioned by qualified personnel with the appropriate skills.

For safety reasons, operators must not act improperly or work on their own initiative during the assembly, modification, electrical connection and/or commissioning of the equipment, and/or attempt to modify the transformer, without previously consulting TRANSFORMADORES GEDELSA, SA.

Likewise, all appropriate safety measures must be taken when installing or commissioning the machine or when it is in normal operation to protect the safety of any persons or materials that regularly or on specific occasions may be working or may be present in the area and avoid the proximity of any person not involved in its operation.



WARNING!

Failure to follow these instructions strictly may result in personal injuries, damage to property and irreparable damage to the transformer, which would void the warranty and any form of contractual or extra-contractual liability from Transformadores GEDELSA, SA.



2 DESIGN, MANUFACTURE AND TESTING

Transformadores GEDELSA's transformers have been designed and built in accordance with the offered requirements and with Standard EN-60076 (IEC-76).

To achieve the certification above, the individual tests set out in Standard EN-60076 were performed with the corresponding Testing Certificate (Test Protocol) for each transformer; likewise, the type tests and special tests set out in EN-60076 were carried out on representative samples to validate that the machine fulfils the requirements of Standard EN-60076.

2.1 Individual and/or routine testing

The information on these tests is available in the Individual Test Protocol for each transformer.

2.2 Type tests and/or special tests

The information on these tests is available to our clients in our files.

Transformadores GEDELSA SA keeps the original test documentation in its files until the validity period established in its Quality Manual has elapsed.

2.3 Certifications

Transformadores GEDELSA SA holds company Registry certificate ER-0182/1994 issued by AENOR on 01/09/1994 and Environmental Management Registry certificate GA-2007/0086 issued by AENOR on 07/03/2007.



ER - 0182 / 1994



GA - 2007 / 0068

2.4 Reliability

The transformer was free of any faults when it left the factory, as proven by the tests performed.



WARNING!

The transformer's useful life depends directly on the fulfilment of the instructions contained in this manual. It is essential to follow strictly each and every one of the instructions in this Manual and to put in place the protections described in point 5, to ensure the product's reliability.



3 CONSTRUCTION DETAILS

3.1 Active Parts

The transformer's active part is the internal part containing the magnetic circuit, the windings, the connections, the switch, etc. If there is any evidence or even any minimum suspicion that the transformer has undergone any kind of accident or received a sharp blow during transportation, unloading or any subsequent operation, it is essential to check the active parts and ensure that they are exactly as they were when the transformer left the factory. Only Transformadores GEDELSA SA or a company authorised by GEDELSA may carry out the inspection.

3.2 Tank

The tank is the external part of the transformer that protects the active part and supports the rest of the elements, such as the wheeled base, the flaps, etc.



WARNING!

This type of tank is not designed to withstand vacuums or any overpressure exceeding 0.35kg /cm².

3.3 Flaps

These are the main cooling elements attached to the bottom of the walls of the tank. The flaps absorb any dielectric liquid expansion.



WARNING!

For more construction details, see the general dimensions plan with legends or contact Transformadores GEDELSA SA.



4. TRANSPORTATION, MOVEMENT, RECEIPT, OPERATION AND STORAGE

4.1 Lifting

Lifting of the transformer for loading / unloading must be performed using means appropriate to its weight, its dimensions and the form of hoisting (the total weight is stated on the name plate).

Transformadores GEDELSA SA, recommends using only cranes to hoist the eye-bolts located on the top, using each of the eye-bolts available (in other words, if there are two eye-bolts, both must be used; if there are four, then all four must be used).



WARNING!

Special care must be taken when handling the lifting elements to ensure that none of the transformer's components, such as insulators or accessories, etc, break or get damaged.



WARNING!

Be especially careful to ensure that the hitches do not press against the flaps or insulators, which could cause them to break. An appropriate protection should be placed between the hitch and the supporting part of the transformer to ensure that the paint does not get scratched.

4.2 Transportation

The transformer must be transported in a vehicle suitable to its weight and dimensions. The transformer must be properly fastened in place in the vehicle to ensure that it does not shift at all during the journey.

The transformer must be fixed in place using slings appropriate to the material that is being transported and locked in with the lifting hooks, using the four hooks on the corners of the tank and in the four holes or hooks located on top of the wheeled base; likewise, the transformer must be fixed in place to ensure that it does not shift over the flooring of the vehicle by using wooden planks suitable to the transformer's dimensions.



WARNING!

The transformer must never be transported in a truck with sheet-steel flooring.



WARNING!

Transportation must be carried out via paved roads with no more than 15% grades. If the event of transportation on roads which do not comply with these characteristics, the factory should be consulted about specific additional measures to be taken for transportation.



4.3 Receipt of transformer

When receiving the transformer, whether at the client's warehouse or at its final location, the general condition of the transformer and its accessories must be verified carefully, as there may have been anomalies or parts may have come off during transportation.

Special care must be taken with regard to the following:

- Check that the materials received match the contents of the delivery note and all the elements stated in the note are present.
- External appearance of the transformer: Check that there are no blows, especially in the cooling elements and the terminal blocks. The general condition of the paint should be checked as well to ensure that it is not flaked, scratched or scraped.
- Loss of dielectric liquid. Check the valves, pipes, weld seams, etc, to ensure that there have been no dielectric liquid leaks.
- Check that the characteristics of the transformer, as stated on the name plate, match those recorded in the test protocol and that these also match those in the order form.

- Verify that the transformer's seals are complete and in perfect condition, as manipulation or breakage of any seal will void the transformer's warranty.

If any anomaly is observed, report the situation to the transporter and contact Transformadores GEDELSA SA.



WARNING!

Record any anomaly in the delivery note and report it to the transporter and Transformadores GEDELSA SA. If in a period of 15 days, in the case of mainland Spain and 90 days for all other countries, no notification has been received, Transformadores GEDELSA SA will assume that the transformer was delivered in perfect condition and will not be liable for any subsequent anomalies or for the consequences of any such anomalies.

4.4 Handling the transformer

During unloading operations, the transformer must be lifted as described in point 4.1. Once the transformer has been lifted and is outside the truck, the wheels, if applicable, should be installed. To install the wheels, the transformer must be placed on a bedplate or some other form of support to ensure that if the lifting mechanism



fails for any reason, the transformer will not fall, trapping the operatives performing this work.

For more details on the installation of the wheels, please see the specific instructions in the relevant section of this Manual.

The wheels are designed to transport the transformer a maximum of ten metres and only once their axles have been properly lubricated; the wheels are adjustable for longitudinal and transversal transport of the transformer once it has been lifted.

The transformer must be hauled on a firm, paved surface. If this is not available, the floor should be covered with lubricated steel-sheet panels, at least 15 mm thick; the hauling operation should be performed using the holes or hooks placed in the footing where the wheels are located only. Special care must be taken to ensure that the hitch does not press against the cooling elements, accessories, valves, etc as this could damage these elements or the paint.

4.5 Storage

If the transformer is not going to be put into service immediately, it must be placed in storage taking into account the following factors:

- The storage area must be clean and dry and temperature changes must not fluctuate by more than $\pm 15^{\circ}\text{C}$; the area must be

closed and well protected to ensure the transformer does not undergo any damage whatsoever.

- If the transformer cannot be stored inside a building, it must be protected from the weather with a waterproof canvas and placed on a surface that can support its weight and lifted sufficiently to ensure that no water comes into contact with the lower part of the wheels. No pressure should be placed on the cooling elements and paint damage should be avoided.

- The instructions set out in section 4 of this Manual must be followed whenever the transformer is lifted or transported.



5 INSTALLATION AND COMMISSIONING

5.1 Installation

5.1.1 Conditions and Elements.

Both for technical reasons and for the safety, protection and integrity of persons and property, the conditions and elements of the installation must follow the Project created by the Site Manager in charge of the installation.



WARNING!

The transformer must be installed exactly as instructed in this Manual.

The transformer must be placed on a horizontal base that is able to withstand the weight without distorting. The total weight is stated on the name plate. If the wheels are left on, they must be locked in place using an appropriate system in order to avoid any movement during operation.

5.1.2 Adjustment and Verification of Sphere Thermometer

The alarm, shut-off and maximum rate needles must be put in place and checked to ensure that the contacts work.

5.1.3 Protection of Transformer from Overcurrents

The transformer must be protected from the thermal and dynamic effects of overcurrents and short-circuits.



WARNING!

An automatic switch or protection fuses must be used to protect the transformer from overcurrents, taking into account the foreseeable overloads and calibrating the protections to ensure that no currents exceeding 1.5 or 2 times the assigned current can pass through (see name plate).



5.1.4 Protection of Transformer from Overvoltages

The transformer must be protected from overvoltages which may occur internally or as a result of operations on the network (industrial frequency), such as those resulting from weather conditions or other causes.

$$E = \frac{P}{5.4\sqrt{H}}$$

$$S = 1.15E$$

Where:

H = The distance between the centre of the openings, expressed in metres.

P = The sum of the losses on no-load and those from the load in the transformer in kW.

Note.- This formula is valid for a maximum ambient temperature of 40°C and with a maximum altitude of 1,000 m.

The following must be observed:

- Ambient air must not exceed the values stated in the standards.
- The transformer should not be installed in small places and the steel doors must be appropriately insulated if they are exposed to sunlight, so that they do not become a source of heat.
- The air in the transformer room used to cool the transformer must not be extracted.



WARNING!

To protect the transformer from overvoltages, automatic valves suitable to the degree of insulation of each winding in the transformer must be used; these automatic valves must be placed on the High Voltage winding. (See name plate to set the degree of insulation).

5.1.5 Ventilation of the Transformer

If the transformer is installed in a building (cell), the area must be properly ventilated as follows:

The transformer must be at least 100 mm from the walls of the cell and the bushings at a minimum distance of 350 mm from the ceiling.

The input E and output S surfaces must have at least the M^2 resulting from the following formulas:



- The transformer should not be installed in rooms that are used for any other purpose: particularly in rooms in which there are other machines working at high temperatures: boilers, steam generators, etc.
- If the transformer is installed in rooms in which the natural ventilation is insufficient, artificial ventilation must be provided.



WARNING!

Once the cables have been connected, the screws that hold in the terminal blocks must be retightened, to stop any oil leaks through the joints of the blocks as a result of any handling during connection of the cables.

5.1.6 Collection of dielectric liquid

The transformer must be placed on top of a pit or dielectric liquid collection bund with a resistant and watertight lining, taking into account the design and volume of the oil or silicone that the transformer contains (see name plate).

5.1.7 Connection to Terminal Blocks

The line cables must be connected to the transformer's terminal blocks with fixed connections so that no pressure is applied to the bushings and with sufficient section to avoid excessive heat.

The bushings must be screwed to the conductors and tightened to the values stated in the following table:

TIN OR COPPER			STEEL		
Screw	Kg m	Nm	Screw	Kg m	Nm
M12	4	40	M12	6	60
M16	7	70	M16	10	100



5.1.8 Grounding

The transformer's tank will be grounded effectively and permanently by means of the grounding terminals (screw or plate) located on the bottom of the two sides of the largest tank. The grounding conductor must have a section of at least 50 mm².



WARNING!

The transformer's Neutral phase must be grounded if the installation is designed to be grounded, whether through a direct ground connection or through resistance.

5.2 Tests before commissioning

The transformer should be checked to ensure that all the instructions in this manual have been followed and that there have been no anomalies. In the event of any doubt, contact Transformadores Gedelsa SA.

If the transformer has not been powered in the ninety days following its departure from the factory, the following operations must be performed in addition to the routine operations stated above:

- The insulation of the windings must be checked by measuring it with a measuring device of at least 2500 V. This test must be

performed with the transformer cold and the measurements obtained must not be lower than the following:

	Minimum insulation
High voltage against earth	150 MΩ
High voltage against low	150 MΩ
Low voltage against earth	10 MΩ

- The position of the switch must be checked to ensure it is correct. There must be no current when using the switch and the transformer must be disconnected from the network and with the lines always connected to the grounding bushings.
- The transformer must be checked to ensure that it is firmly secured to the floor and that the wheels (if there are wheels) are blocked.



WARNING!

The installation for this type of transformer must have its own lightning rod and automatic valve system in the high voltage areas.



5.3 Commissioning

Once the transformer has been connected to the network, the following operations must be performed:

- Apply voltage without load and listen to noise level and observe operation over a 24-hour period. There should be no anomalies during this time.
- Measure the voltage in the terminal blocks of the secondary winding to ensure that the output voltage matches the required level.

5.4 Loading.

24 hours after powering of the transformer, the following operations must be performed:

- The transformer must be disconnected from the network. The switches and circuit breakers must be opened and the lines must be grounded.
- All of the transformer's joints must be checked and those showing signs of any leaks must be tightened.
- The transformer and its accessories must be purged.
- Finally, the transformer will be reconnected to the network and the groundings of the

lines disconnected and the switches and circuit breakers closed.

- The transformer will then be loaded progressively, until it reaches its operating power and special attention must be paid to the temperature reached in the transformer.

If no representative from Transformadores GEDELSA SA is present during the process, the client must notify the company of the date of the commissioning, with the results of the tests performed and the anomalies observed, if any.



6 MAINTENANCE AND VERIFICATIONS

6.1 Maintenance

In order to ensure the reliability of the transformer, the following maintenance procedures must be followed:

ANNUALLY:

Each year, and on the dates that the maintenance department establishes, the following verifications must be made:

- Each and every one of the protections should be checked to ensure that they work properly.
 - √ Sphere Thermometer.
- The insulation of each winding must be measured in respect of the grounding with earth and between them, to ensure that the values are still within the parameters described in point 5.2.
- State of the insulating liquid; the oil's break-down voltage must exceed 45 kV in terms of rigidity in accordance with Standard UNE EN 60156.
- Visual inspection of:
 - √ Leaks, which must be corrected.
 - √ Paint, repainting any damaged points.

The visual inspections described must be performed every THREE MONTHS additionally during the first year.

6.2 Recommended procedures.

VERIFICATION OF THE CONDITION OF THE DIELECTRIC LIQUID

The following precautions must be taken whenever it is necessary to take a sample of the liquid to determine its condition:

- No samples should be taken if it is raining or windy.
- The samples must be taken, preferably, from the lower part, using a clean and dry container, so as to avoid contaminating the dielectric liquid.
- Before taking the sample, you must:
 - √ Clean the entrance to the valve from which the sample will be taken carefully with a clean and lint-free cloth.
 - √ Let the first five litres flow out to clean the valve's pipe.
 - √ Rinse the containers with the insulating liquid that is to be measured.



√ Fill the containers, avoiding the formation of bubbles.

If the dielectric liquid in the transformer has to be replaced, it must be dry in accordance with the regulations in force.

BUSHINGS AND EXTERNAL CONNECTIONS.

- The bushing porcelains must be cleaned carefully to ensure their dielectric strength.
- The screws and connections must be verified and tightened to the values defined in the table in point 5.1.12 above.

CONDITION OF THE PAINT.

If there are any chips, scratches and/or rust marks, the affected part must be sanded until the white steel layer is exposed; the affected areas must then be repainted with anti-rust paint, on which the corresponding layers of finishing paint must be applied.

VERIFICATION OF THE TEMPERATURE.

The temperature must be verified taking into account the load that the transformer has to bear. To assess any anomaly, please see sections 3.6 and 6.3.

6.3 Anomalies in operation.

If any anomaly is observed during the transformer's operation, contact Transformadores Gedelsa SA for the relevant instructions.

If, as a result of the verification of the transformer, it has to be repaired or modified, these operations must be performed by Transformadores GEDELSA SA or a company authorised by GEDELSA.

6.3.1 Troubleshooting.

If any anomalies are observed during operation or any inspection, please see the following troubleshooting table for summaries of the problems and their possible solutions:

MANUAL DE SERVICIO

TRANSFORMADORES DE DISTRIBUCIÓN



SYMPTOMS	AFFECTED ELEMENTS / PROBABLE CAUSES	POSSIBLE SOLUTION OR RECOMMENDATION
Low insulation resistance.	<p>Dielectric Presence of humidity</p> <p>Insulator Aging of insulator</p> <p>Internal connections Movement of an internal element</p>	<p><i>Drying treatment</i></p> <p><i>Contact manufacturers</i></p> <p><i>Contact manufacturers</i></p>
Dielectric liquid leakage.	<p>Cover or valve and various joints:</p> <p>Insufficient pressure Defective joints Deficient pressure in tightness of joints</p>	<p><i>Correct or retighten</i></p> <p><i>Contact manufacturers</i></p> <p><i>Correct tightness</i></p>
The automatic protection activates when connecting transformer	<p>Fault in the coils</p> <p>Contacts thermometer Badly calibrated</p> <p>Low oil level</p> <p>Input switch Primary voltage does not match switch's position</p>	<p><i>Contact manufacturers</i></p> <p><i>Adjust temperature</i></p> <p><i>Refill with new and dry oil</i></p> <p><i>Verify that the switch's position match the primary voltage.</i></p>
<p>Abnormal secondary voltage.</p> <ul style="list-style-type: none"> • Absence of voltage <ul style="list-style-type: none"> • Very low voltage 	<p>Primary voltage Absence of primary voltage</p> <p>Windings No continuity in coils</p> <p>Primary voltage Very low</p> <p>Input switch In wrong position</p>	<p><i>Verify the installation and contact the Electricity Company</i></p> <p><i>Contact manufacturers</i></p> <p><i>Verify the installation and contact the Electricity Company</i></p> <p><i>Change position to a lower voltage</i></p>



<ul style="list-style-type: none"> • Very high voltage • Imbalanced voltage 	<p>Primary voltage Very high</p> <p>Input switch In wrong position</p> <p>Imbalanced voltage in High Voltage</p> <p>Input switch In wrong position</p> <p>Fuse Blown</p> <p>Windings No continuity of windings Low Voltage installation</p> <p>Imbalanced loads Bad joint</p>	<p><i>Verify the installation and contact the Electricity Company. Change position to higher voltage</i></p> <p><i>Verify the installation and contact the Electricity Company</i></p> <p><i>Contact manufacturers</i></p> <p><i>Change fuse</i></p> <p><i>Contact manufacturers</i></p> <p><i>Verify low voltage installation</i> <i>Verify low voltage connections.</i></p>
<p>Untimely tripping when working.</p>	<p>Contacts thermometer Badly regulated</p> <p>Windings Perforation of insulators</p> <p>Fuse Blown</p>	<p><i>Verify regulation</i></p> <p><i>Contact manufacturers</i></p> <p><i>Change fuse</i></p>
<p>Working temperature: Abnormal</p>	<p>Installation room Insufficient ventilation High atmospheric temperature Defective cooling of active part</p> <p>Low Voltage Network Overloaded</p>	<p><i>Verify ventilation of room</i> <i>Check installation and contact Electricity Company</i></p> <p><i>Check for possible increases in power and unload the transformer.</i></p>



APPENDIXES:
ACCESSORIES

