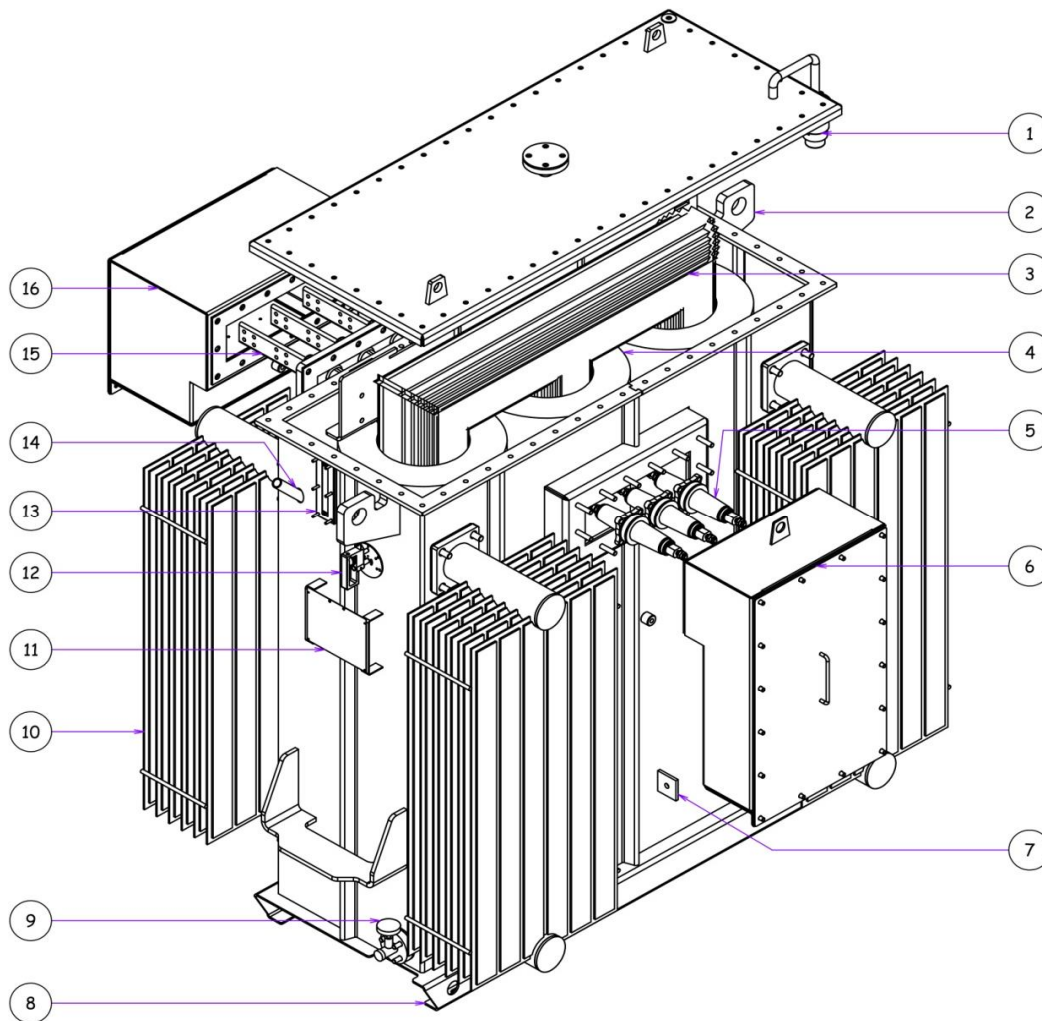


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TECHNICAL CHARACTERISTICS



Standard Accessories

1. Dehydrating breather
2. Lifting lugs
3. Magnetic core
4. Windings
5. MV shrinkable type bushing
6. MV cable box
7. Earth terminals flat type
8. Skid base and hitches
9. Oil discharge and extraction valve
10. Radiators for heat dissipation
11. Rating plate
12. Off load tap changer
13. Oil level indicator
14. Pocket well 3/4" g
15. Cast resin LV monoblock
16. LV cable box

Accessories available upon request

- Thermometer with two electric contacts
- Buchholz relay
- DGPT2 or RIS (if airtight)
- Antiburst valve
- Elastimold connections
- Conservator

PART I - INTRODUCTION

1.1 Introduction

The oil immersed transformer needs simple but mandatory checking to be carried out to guarantee correct installation, commissioning, and also needs periodical maintenance. Please refer to this manual for more details on the procedures to follow.

There are two different types of oil immersed transformer:

- hermetically sealed
- free breathing

Some accessories described in this manual may not be present on your transformer. Always refer to the technical documentation, drawings and/or the delivery note to check the list of accessories supplied.

1.2 Reference Standards

- IEC 60076 Standard Power transformers
- IEC 61378 Standard Converter transformers
- BS 5262

PART II - INSTALLATION

2.1 Transport

The transformer must be transported vertically. Immediately upon arrival at site, the transformer should be visually checked for any sign of external damage during transport. Please report immediately GBE SpA and to the transport contractor in case of loss / damage of any components / parts / paint works or shortage / leakage of oil or any signs of tampering. Any remarks must be noted on the delivery note to claim the compensation.

Unless otherwise agreed, the oil immersed transformer is supplied without any external protection and is solidly fixed to the transport lorry by belts. The wheels, if provided, are fixed to the bottom skids.

For special transportation needs, or if specified and agreed at the order stage, the transformer is supplied with sea worthy packing or in a wooden box.

	Use belts or straps fix the transformer well to the means of transport. Remove the transformer wheels if provided.
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2.2 Moving

Each transformer has:

- skids or 4 rollers (if provided)
- hitches for moving
- 2 (or 4) eyebolts for lifting.

Small movements can be made with a suitable hydraulic jack. IT IS FORBIDDEN to lever the bottom of tank, the fins and all the other transformer accessories.

If lifting with cords, choose the correct cord width to be used, keeping in mind that the same number of cords should be used as there are eyebolts, and that the angle between the cord vertexes should never exceed 60°.

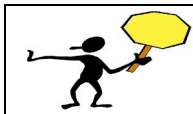
To move with the skids (if provided):

- use the skids hitches to push or pull the transformer
- never use any other parts of the tank or the accessories to push and/or pull the transformer.

2.3 Transformer receipt and storage

When you receive the transformer, please make sure that:

- the packaging (if present) has not been damaged;
- there are no surface damages;
- the tank or the radiators have not been damaged or misshapen;
- there are no oil leakages;
- all accessories are present;
- no other parts or elements are damaged



If you find any problems or damages, if something is missing or if the transformer does not match to what you ordered, please note it on the delivery note and report immediately to GBE SpA, otherwise it will be impossible to claim compensation.

To speed up the action, it is advised to take photos of the damaged parts and send them, along with your claim, to our Sales Office:

GBE S.p.A.
Teonghio Str, 44
36040 Orgiano (VI)
ITALY
Tel +390444774334
Fax +390444775294
e-mail: info@gbeonline.com

GBE UK Limited
1200 Century Way
Thorpe Park Business Park
Leeds,
LS15 8ZA
Tel 0113 2515111
e-mail: sales@gbeuk.co.uk

If the transformer is not immediately installed, it can be stored for short periods (2-3 months).

If storing over longer periods, it is advised to place the transformer in a closed, clean area. Storage temperature needs to be no lower than -25°C unless otherwise indicated in the name plate.

2.4 Site Installation



The transformer must be installed by **specialised staff according to the local and safety rules.**

If the transformer is delivered with conservator/radiators/bushings detached, they need to be re-assembled by specialised staff and/or under GBE technical supervision

The transformer must be installed so that the cooling surfaces are well ventilated. Keep a minimum distance of 30 cm between the cooling surfaces and the cell walls, and 50 cm between nearby transformers. The cabin must allow air to circulate at 4-5 m³/min for every KW of loss. If the air circulation is not sufficient, the transformer will not perform correctly. According to the standards, the ambient temperature should be within the values indicated below:

- minimum temperature -25°C;
- average yearly temperature 20°C;
- average daily temperature 30°C;
- maximum temperature 40°C.

If the temperature exceeds one of these limits, please inform the manufacturer.

2.5 Positioning the transformer

The transformer is usually equipped with two skids. Pull along the direction of the skids.

It can be mandatory by law to provide a proper collecting tank to avoid flaming oil flooding out of the cabin or the transformers area.

2.6 Electric connections: MV, LV and Earthing

All the powered parts of the transformer must keep the correct insulation distances as indicated in the table below (Table 1).

The connections should be well fixed so that the weight of the cables or short circuit resistance do not stress the insulators for any reason.

Each transformer has 2 ground points on its sides in order to connect the transformer efficiently to the earthing system.

All dimensional and descriptive information is indicated in the transformer layout drawing, which is provided with the test reports.

Connect all the signalling and protection devices using flexible copper wire with a minimum section of 1.5 mm². If power circuits are being used (fans, CT, etc.) check the absorption and then the capacity of the connections.

Table 1

MAX. INSULATING TEMP.	NOMINAL VOLTAGE AT SERVICE INDUSTRIAL FREQUENCY (kV)	SEAL NOMINAL VOLTAGE AT ATMOSPHERIC IMPULSES CREST VALUE (kV)	INSULATION DISTANCE (cm) WITHOUT PROTECTIONS *
3,6	10	20	6
		40	6
7,2	20	40	7
		60	9
12	28	60	9
		75	12,5
17,5	38	75	12,5
		95	17
24	50	95	17
		125	22,5
36	70	145	27,5
		170	31,5



* The above table indicates the minimum air distances between electrical terminals. If these are less than those indicated, the terminals must be covered by adequate protections.

The tightening torques for the nuts and bolts are given below:

Table 2

NUTS AND BOLTS	TIGHTENING TORQUE (Nm) Mechanical connections	TIGHTENING TORQUE (Nm) Electrical connections
M 6	10	/
M 8	23	23
M 10	50	40
M 12	85	50
M 14	130	80
M 16	205	125

NOTE: If the oil immersed transformer has elastimold plug-in connection, the following information is needed when purchasing the mobile connector:

- current and interface type
- cable code or at least information about:
 - cable section and material
 - diameter of primary insulator
 - external cable diameter

2.7 Transformers working in parallel

Two or more transformers can only work correctly in parallel if the following requirements are satisfied:

- Identical transformation ratio with a tolerance of 0.2% (maximum 0.5%);
- Equal short circuit voltage with 10% tolerance;
- Same vector group;
- The ratio between the transformers power (if different) must not exceed 3

Before making the transformers work in parallel, carry out the following actions:

1. Create an electric bridge between the secondaries and the transformers
2. If provided, it is recommended to connect the neutral.
3. Use a voltmeter to measure the existing voltage between the same phases.
4. If the difference of the voltages between the same phases is constantly zero, it means that all the parallel conditions have been satisfied

GBE S.p.A. cannot be held responsible for any damage caused by incorrect transformer connection.

PART III – COMMISSIONING

3.1 Visual checks

The oil immersed transformer should be visually checked before commissioning, please make sure that:

- there are no oil leakages;
- the tank or the radiators have not been damaged or misshapen;
- all accessories are present;
- no other parts or elements are damaged

In case of any damages or missing parts or accessories, please contact GBE office:

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3.2 Electric and mechanical checks

A list of the most important checks is given below. As already indicated, the transformer must be commissioned by specialised staff.

- Make sure that the nominal values indicated in the data plate are the same as those of the net;
- Make sure that all the medium and low voltage cables, and the protection and earthing circuit wires are correctly positioned and properly connected;
- Make sure that the medium voltage cable screen is grounded;
- Check the correct connection of the neutral bushing to ground;
- Make sure that the bolts are tightened with correct torque (see Table 2);
- Make sure that the transformer accessories are correctly positioned and wired.

3.3 Working temperature

The oil immersed transformer is typically made with class A insulating material that withstands a maximum working temperature up to 110°C. We recommend the working temperatures given below.

Insulation material class	Alarm Temperature	Release temperature
A	105°C	110°C

3.4 General indications for the main accessories

Dial thermometer

This instrument shows the temperature of the oil at the hottest point. The thermometer has a bulb sensor that must be inserted in a pocket. To measure the temperature correctly, the pocket must be completely filled with oil. If the thermometer has contacts, refer to the previous paragraph for setting the release temperature.

Voltage tap changer

The transformer is normally equipped with a 3, 5 or 7 step tap changer to regulate the voltage.

The positions are normally numbered please refer to the name plate for the required position.

The modification must be made exclusively when the transformer is disconnected from the supply.

To change the position of the tapping:

- Remove the padlock if present
- Turn the handle to the required position
- Lock the handle with padlock in this position:



The Tap Changer is set to obtain the nominal output voltage (at no-load condition). In case of wrong tapping and/or too high output voltage, there might be an increment of the noise and of the no load losses of the transformer

Primary Voltage selector (if provided)

If the transformer has more than one primary voltage (for example: 10-15 KV, 10-20 KV, 15-20 KV), the voltage can be changed using the knob and following the instructions on the data plate.

Other accessories that might be supplied:

Oil level: is mounted on the site tank or on the conservator (if provided) and gives the level of oil present. As the temperature of insulating oil increases or decreases, there is a corresponding rise/fall in the oil volume. A Prismatic or Plain hardened glass type oil gauge fitted on tank site or on conservator is generally marked with calibrated level to show cold oil level. Oil level must always be within the minimum and the maximum marks.

Silica gel: These are salts inside a unit mounted on the tank or on the conservator. The salts hold air humidity in free breathing transformer. In case of Envirogel, for visual indication of degree of saturation, the silica-gel is impregnated with suitable non-toxic dye. Envirogel in YELLOW / ORANGE colour, indicates the ACTIVE state or readiness to absorb moisture and when in GREEN colour, indicates the INACTIVE / saturated state or presence of moisture or inefficient to absorb

further moisture. In case of Blue Silica-Gel, for visual indication of degree of saturation, the silica-gel is impregnated with Cobalt Chloride [Class-2 Carcinogen]. When Silica-Gel is a BLUE colour, this indicates the ACTIVE state or readiness to absorb moisture and when it has become PINK it's unable to absorb further moisture. 120-150°C until it returns to its original colour or replace it.

Buchholz relay: The Buchholz (gas/liquid operated) relay is connected in the pipe work between transformer tank and conservator. If a valve is fitted to isolate the conservator, the Buchholz relay is usually on the transformer tank side of the valve. Under normal condition the relay is full of oil. As generally known, most types of faults occurring within oil filled transformers are accompanied by the generation of gas by the oil due to liberation of heat. Such generated gas gets accumulated in the relay thereby operating the float / flap switches.

If the dielectric strength is below 30kV(rms), the oil should be reconditioned by passing it through either a centrifugal separator or a filter. After reconditioning, the dielectric strength should be such that oil can withstand a minimum of 40 kV(rms).

3.5 Oil analysis after long storage periods

If the transformer has not been used for **a long time** (>6 months), we recommend to test the oil dielectric strength before starting. Extract the oil from the valve in the lower part of the tank. Remove the protection **cup** and the sealing tap.

	BEFORE ENERGISING THE TRANSFORMER: - All the Oil Shut-Off Valves are OPEN and Draw-Off Valves are CLOSED. - All Thermometer Pockets are nearly filled (85%) with oil. - Oil is at correct level in the Bushings, Conservator, etc. - Desiccant colour in breather is blue for blue silica-gel or yellow /orange for Envirogel. Earthing Connection of Main Tank, Neutral Bushing, Marshalling Box, Control Gear Box, Cable Box, Arcing-Horn, etc., are correctly made. - All CT Secondary Circuits are closed. - All Air-Release Plugs of Main Tank, Radiator, Conservator, Buchholz Relay, Bushings, etc., are free of air pocket / bubbles. Note: After Oil-Filling or Before Commissioning, AT LEAST 12hrs should be allowed for the oil to settle-down and air is released from all points at 2 hourly intervals.
	It is recommended to initially transformer put the transformer at NO-LOAD.for 6-8 hours before putting ON LOAD
	AFTER ENERGISING at no-load conditions, if the Primary Side Circuit Breaker is tripped, investigate the cause thoroughly and re-energise the transformer ONLY AFTER ensuring that the fault is properly cleared.

NOTE: Oil must be treated by specialised staff and with proper equipment.

PART IV – OPERATION AND MAINTENANCE

4.1 Maintenance

Oil immersed transformer maintenance must be done while the transformer is disconnected and the phases are directly connected to ground. If working in highly polluted environment, we advise increasing the frequency of the maintenance.

4.2 Periodic inspections

Some routine maintenance operations that may be necessary during the working life of the transformer are given below.

CHECK	HOW OFTEN	DESCRIPTION
Dehydrating breather	Every 6 months	Check the salt colour, refer to the label for salt state.
Oil dielectric strength	Every 2-3 years	It is suggested to have an oil sample analysed by a specialised laboratory (gas content analysis to check the transformer general conditions)
Accessory check	Every 2 years	All the transformer accessories must be checked periodically for damage and tightness of wiring connections.

4.3 Special maintenance

Special maintenance must be carried out by specialist technicians. For further information, please contact **GBE** offices:

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ITALY
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e-mail: sales@gbeuk.co.uk

4.4 Troubleshooting

Some of the most common problems that may arise and their solutions are given below. Please remember that our Technical Department is always available whenever help is needed.

PROBLEM	CAUSES	SOLUTIONS
Oil Temperature Indicator alarm goes off	Incorrect temperature set Excess load Strained current High room temperature	Check the settings Limit the load Measure the strain and filter the current Ventilate the area

Buchholz relay activates (if provided)	Presence of gas in the relay	Bleed the relay several times to remove all the air present inside. If the problem persists, contact our Technical Department
Excessive noise	Supply voltage too high Rigid connections Mechanical resonance	Tap accordingly on the tap changer Use flexible connections Use anti-vibration pads
Protections activate at starting	Insertion current	Increase switch delay

PART V – CONCLUSIONS

5.1 Guarantee

GBE transformers are covered by guarantee according GBE sales conditions that are found at www.gbeonline.com

5.2 Conclusion

Our Sales Office is available for any information that may be necessary.

We, GBE, thank you for purchasing our transformer and we guarantee that the information given herein is helpful for using the product well and correctly.