THE POWER BEHIND POWER.

Operating instructions Buchholz relay CEDASPE®

10028411/00 EN

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1 Introduction

This technical file contains detailed descriptions on the safe and proper installation, connection, commissioning and monitoring of the product.

This technical document is intended solely for specially trained and authorized personnel.

1.1 Manufacturer

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20098 S. Giuliano Milanese (MI)
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Further information on the product and copies of this technical file are available from this address if required.

1.2 Safekeeping

Keep this technical file and all supporting documents ready at hand and accessible for future use at all times.

1.3 Notation conventions

This section contains an overview of the symbols and textual emphasis used.

1.3.1 Hazard communication system

Warnings in this technical file are displayed as follows.

1.3.1.1 Warning relating to section

Warnings relating to sections refer to entire chapters or sections, sub-sections or several paragraphs within this technical document. Warnings relating to sections have the following format:

⚠ WARNING

Type of danger!
Source of the danger and its consequences.

- Action
- Action

1.3.1.2 Embedded warning information

Embedded warnings refer to a particular part within a section. These warnings apply to smaller units of information than the warnings relating to sections. Embedded warnings use the following format:

⚠ DANGER! Instruction for avoiding a dangerous situation.

1.3.1.3 Signal words

Depending on the product, the following signal words are used:

Signal word	Meaning
DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates measures to be taken to prevent damage to property.

Table 1: Signal words in warning notices

1.3.2 Information system

Information is designed to simplify and improve understanding of particular procedures. In this technical file it is laid out as follows:

Important information.

1.3.3 Instruction system

This technical file contains single-step and multi-step instructions.

Single-step instructions

Instructions which consist of only a single process step are structured as follows:

Aim of action
✓ Requirements (optional).
1. Step 1 of 1.
   » Result of step (optional).
» Result of action (optional).

Multi-step instructions

Instructions which consist of several process steps are structured as follows:

Aim of action
✓ Requirements (optional).
1. Step 1.
   » Result of step (optional).
2. Step 2.
   » Result of step (optional).
» Result of action (optional).

1.3.4 Typographic conventions

Typographic convention	Purpose	Example
UPPERCASE	Operating controls, switches	ON/OFF
[Brackets]	PC keyboard	[Ctrl] + [Alt]
Bold	Software operating controls	Press **Continue** button
...>...>...	Menu paths	Parameter > Control parameter
Italics	System messages, error messages, signals	*Function monitoring* alarm triggered
[► Number of pages]	Cross reference	[► Page 41].
Dotted underscore	Glossary entry, abbreviations, definitions, etc.	Glossary entry

Table 2: Typographic conventions used in this technical file

2 Security

Read this technical file through carefully to familiarize yourself with the product. This technical file is a part of the product.
- Read and observe the safety instructions provided in this chapter in particular.
- Observe the warnings in this technical file to avoid function-related dangers.

The product is manufactured based on state-of-the-art technology. Nevertheless, danger to life and limb for the user or impairment of the product and other material assets may arise in the event of improper use.

2.1 Intended use

The Buchholz relay is a protective device designed for use on oil-filled power transformers with oil conservator.

The product is designed solely for use in stationary large-scale systems.

If used as intended and in compliance with the requirements and conditions specified in this technical file as well as the warning notices in this technical file and attached to the product, then the product does not present any danger to people, property or the environment. This applies throughout the service life of the product, from delivery, installation and operation to removal and disposal.

The following is considered intended use:
- Only use the product for oil-filled power transformers.
- Operate the product in accordance with this technical documentation, the agreed-upon delivery conditions and the technical data.
- Ensure that all necessary work is performed by qualified personnel only.
- Use the equipment and special tools supplied solely for the intended purpose and in accordance with the specifications of this technical file.

2.2 Fundamental safety instructions

To prevent accidents, malfunctions and damage as well as unacceptable adverse effects on the environment, those responsible for transport, installation, operation, maintenance and disposal of the product or parts of the product must ensure the following:

Personal protective equipment

Loosely worn or unsuitable clothing increases the danger of becoming trapped or caught up in rotating parts and the danger of getting caught on protruding parts. This results in danger to life and limb.

- All necessary devices and personal protective equipment required for the specific task, such as a hard hat, safety footwear, etc. must be worn. Observe the "Personal protective equipment" [▶Section 2.4, Page 13] section.
- Never wear damaged personal protective equipment.
- Never wear rings, necklaces or other jewelry.
- If you have long hair, wear a hairnet.

Work area

Untidy and poorly lit work areas can lead to accidents.

- Keep the work area clean and tidy.
- Make sure that the work area is well lit.
- Observe the applicable laws for accident prevention in the relevant country.

Explosion protection

Highly flammable or explosive gases, vapors and dusts can cause serious explosions and fire.

- Do not install or operate the product in areas where a risk of explosion is present.

Safety markings

Warning signs and safety information plates are safety markings on the product. They are an important aspect of the safety concept. Safety markings are depicted and described in the chapter "Product description".

- Observe all safety markings on the product.
- Make sure all safety markings on the product remain intact and legible.
- Replace safety markings that are damaged or missing.

Ambient conditions

To ensure reliable and safe operation, the product must only be operated under the ambient conditions specified in the technical data.

- Observe the specified operating conditions and requirements for the installation location.

Modifications and conversions

Unauthorized or inappropriate changes to the product may lead to personal injury, material damage and operational faults.

- Only modify the product after consultation with Maschinenfabrik Reinhausen GmbH.

Spare parts

Spare parts not approved by Maschinenfabrik Reinhausen GmbH may lead to physical injury, damage to the product and malfunctions.

- Only use spare parts that have been approved by Maschinenfabrik Reinhausen GmbH.
- Contact Maschinenfabrik Reinhausen GmbH.

Working during operation

You must only operate the product when it is in a sound operational condition. Otherwise it poses a danger to life and limb.

- Regularly check the operational reliability of safety equipment.
- Perform the inspection tasks described in this technical document regularly.

2.3 Personnel qualification

The person responsible for assembly, commissioning, operation and inspection must ensure that personnel are sufficiently qualified.

Electrically skilled person

The electrically skilled person has a technical qualification and therefore has the required knowledge and experience, and is also conversant with the applicable standards and regulations. The electrically skilled person is also proficient in the following:

- Can identify potential dangers independently and is able to avoid them.
- Is able to perform work on electrical systems.
- Is specially trained for the working environment in which (s)he works.
- Must satisfy the requirements of the applicable statutory regulations for accident prevention.

Electrically trained persons

An electrically trained person receives instruction and guidance from an electrically skilled person in relation to the tasks undertaken and the potential dangers in the event of inappropriate handling as well as the protective devices and safety measures. The electrically trained person works exclusively under the guidance and supervision of an electrically skilled person.

Operator

The operator uses and operates the product in line with this technical file. The operating company provides the operator with instruction and training on the specific tasks and the associated dangers arising from improper handling.

Technical Service

We strongly recommend having repairs and retrofitting carried out by our Technical Service department. This ensures that all work is performed correctly. If a repair is not carried out by our Technical Service department, please ensure that the personnel who carry out the maintenance are trained and authorized by CEDASPE S.r.l. to carry out the work.

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2.4 Personal protective equipment

Personal protective equipment must be worn during work to minimize risks to health.

- Always wear the personal protective equipment required for the job at hand.
- Never wear damaged personal protective equipment.
- Observe information about personal protective equipment provided in the work area.

Protective clothing	Close-fitting work clothing with a low tearing strength, with tight sleeves and with no protruding parts. It mainly serves to protect the wearer against being caught by moving machine parts.
Safety shoes	To protect against falling heavy objects and slipping on slippery surfaces.
Safety glasses	To protect the eyes from flying parts and splashing liquids.
Visor	To protect the face from flying parts and splashing liquids or other dangerous substances.
Hard hat	To protect against falling and flying parts and materials.
Hearing protection	To protect against hearing damage.
Protective gloves	To protect against mechanical, thermal and electrical hazards.

Table 3: Personal protective equipment

3 Product description

3.1 Scope of delivery

The product is delivered as follows:
- Buchholz relay
- Plastic bag with fastening materials for connection cables

3.2 Function description

The device is a protective device for on-load tap-changers, oil-filled transformers and reactors with an oil conservator. The device is installed in the pipe between the transformer tank and oil conservator on the transformer and/or between the on-load tap-changer head and oil conservator on the on-load tap-changer.

If the device trips, a signal is sent via reed-type switches (normally open contact or change-over contact). The reed-type switches are connected to the electrical controller and the monitoring circuit of the transformer.

The function of the device will be illustrated in the following using the EB and ET device models as an example. The function can be transferred to the EE device model regardless of design differences. The device detects the following:

Gas accumulation in the device (warning contact, ALARM)

The gas migrates upwards in the insulating liquid, collects in the gas chamber of the device and displaces the insulating fluid. As the fluid level drops, the upper float gauge pair lowers, activating the reed-type switch and triggering an electrical signal.

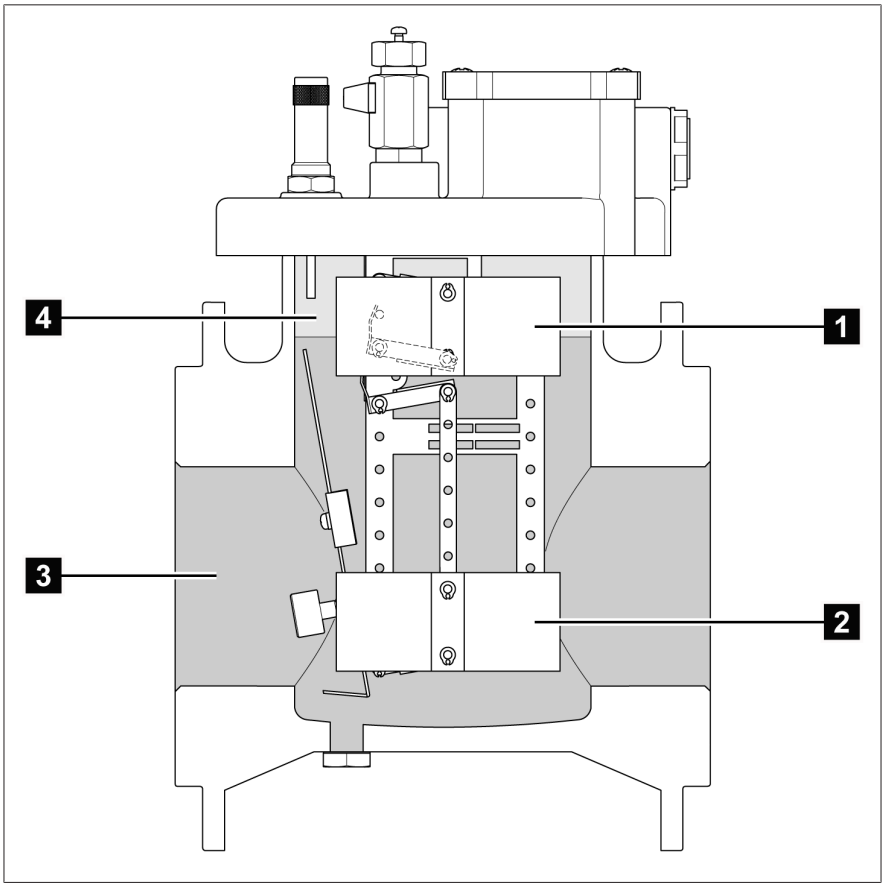


Figure 1: Gas accumulation in the device (example illustration using the EB and ET device models)

1	Upper float gauge pair	2	Lower float gauge pair
3	Insulating fluid	4	Gas

Loss of insulating fluid (cut-off contact, TRIP)

As the fluid level drops, first the upper float gauge pair lowers, activating a reed-type switch and triggering an electrical signal. As the fluid level drops further, the lower float gauge pair also lowers, activating another reed-type switch and triggering another signal.

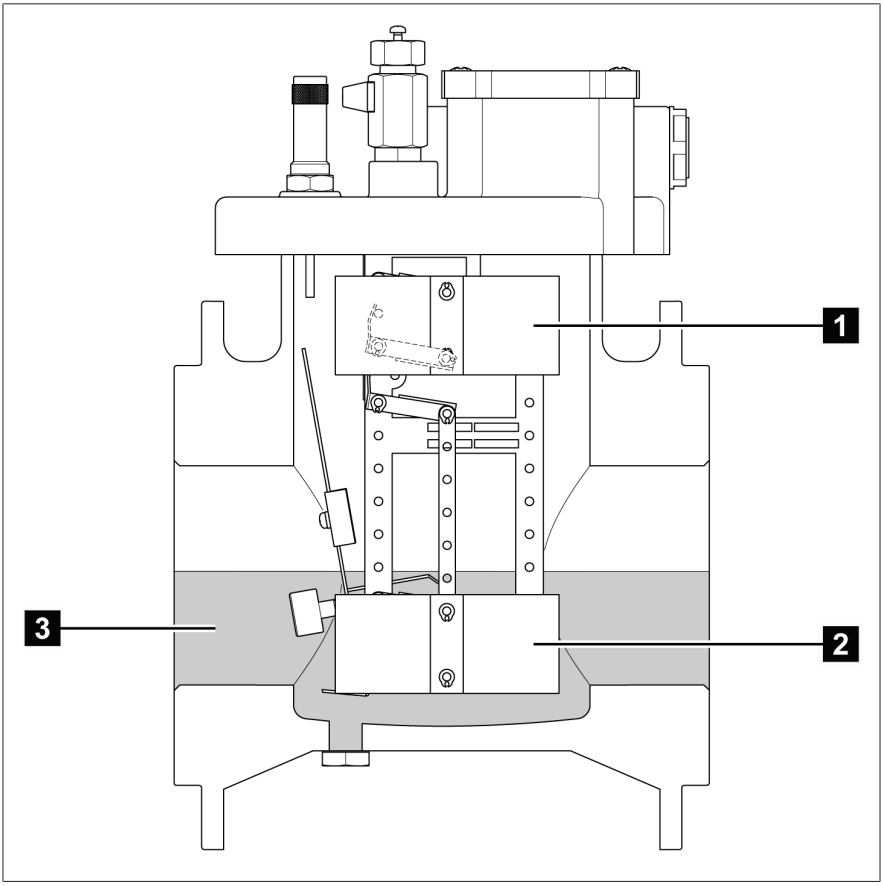


Figure 2: Loss of insulating fluid (example illustration using the EB and ET device models)

1	Upper float gauge pair	2	Lower float gauge pair
3	Insulating fluid		

Insulating fluid flow speed too high (cut-off contact, TRIP)

If the specified flow speed towards the oil conservator is exceeded, a flap valve moves in the direction of flow, activating a reed-type switch and triggering a signal.

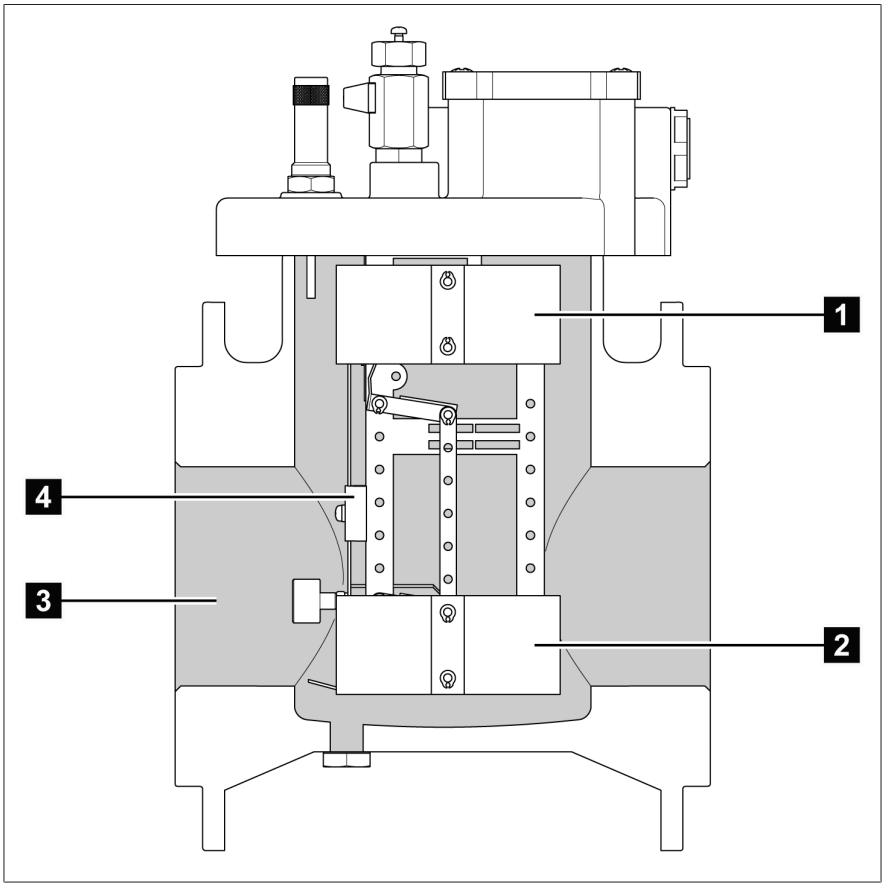


Figure 3: Insulating fluid flow speed too high (example illustration using the EB and ET device models)

1	Upper float gauge pair	2	Lower float gauge pair
3	Insulating fluid	4	Flap valve

3.3 Design/versions

The device is suitable for installation in the nominal DN25, DN50 and DN80 pipe diameters. As a special version, the device is also suitable for installation in the nominal DN100 pipe diameter.

The connecting flanges on the device can be equipped with 4, 6 or 8 drill holes (see "Drawings" chapter for available versions).

The device can be equipped with a maximum of 4 reed-type switches (normally open contact or change-over contact). Special versions can be equipped with up to 6 normally open contacts. The reed-type switches are connected electrically via the terminal box.

A mechanism in the device interior has 2 float gauge pairs and a flap valve, each of which actuate the warning contact and the cut-off contact, thus triggering the signals.

The EE device model is equipped with an additional drain valve in the base of the device.

3.3.1 EB and ET device model design

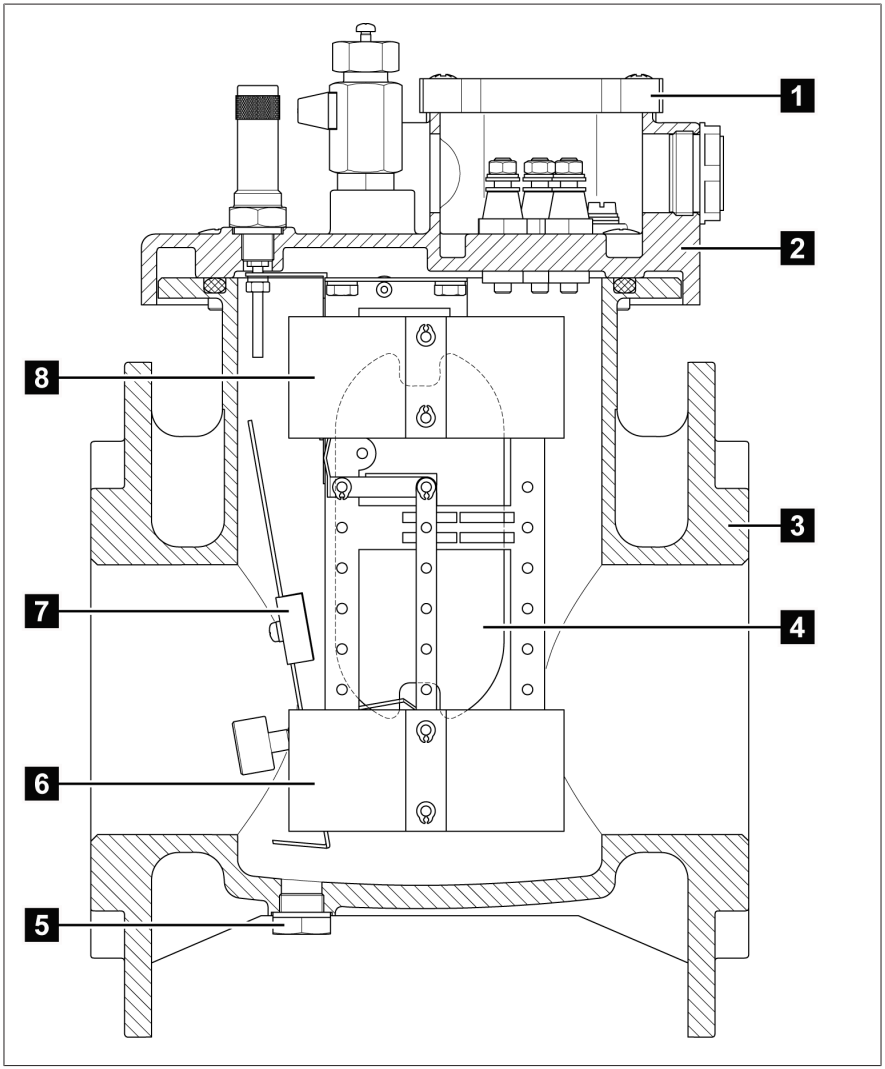


Figure 4: EB and ET design (cross-section)

1	Terminal box cover	2	Cover
3	Housing	4	Inspection window

5	Drain plug	6	Lower float gauge pair
7	Flap valve	8	Upper float gauge pair

3.3.2 EE device model design

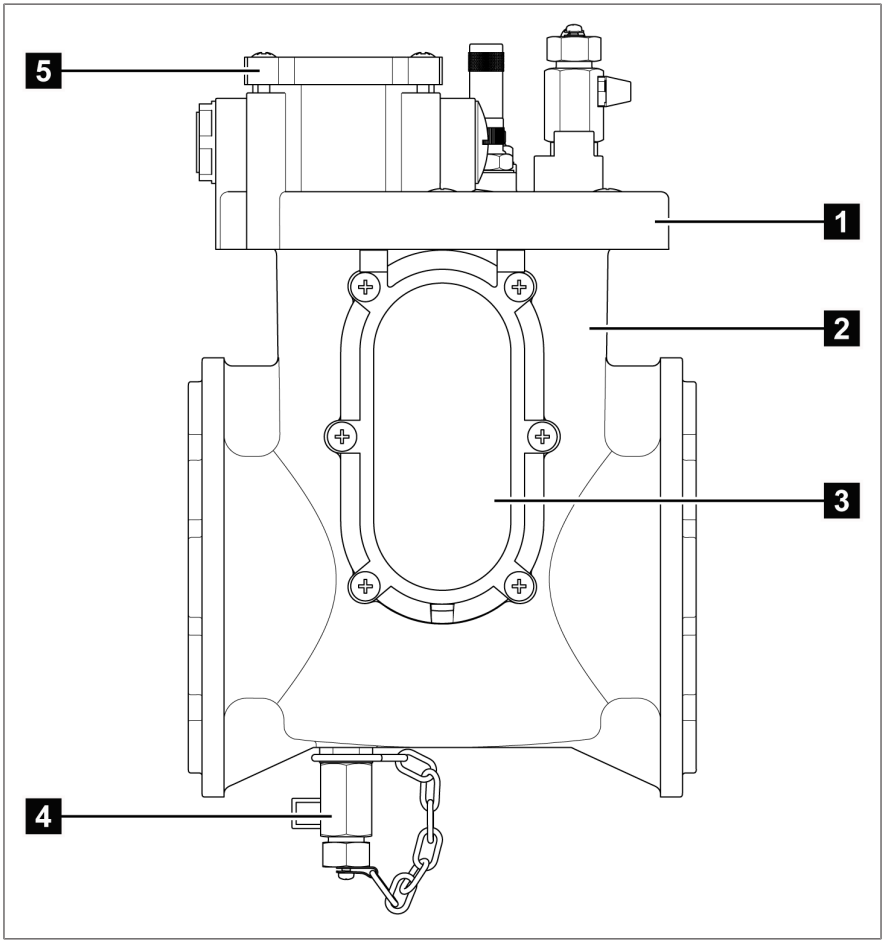


Figure 5: EE design (external view)

1	Cover	2	Housing
3	Inspection window	4	Drain valve
5	Terminal box cover		

3.3.3 Cover design

The covers of the EB, ET and EE device models are equipped with the same components, but their arrangement differs depending on the device model. The arrow printed on the cover, which indicates the orientation of the device during installation, points away from the terminal box on the EE device model, whereas it points toward the terminal box on the EB and ET device models.

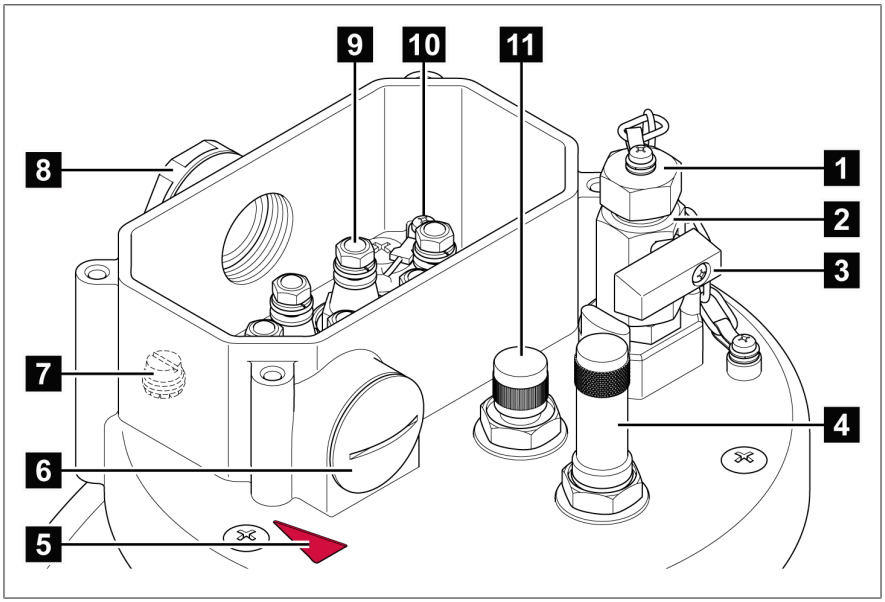


Figure 6: Cover design (EB and ET device models)

1	Gas extraction valve protective cap	2	Gas extraction valve
3	Gas extraction valve lever	4	Test button cover
5	Arrow for orientation during installation	6	Dummy plug (metal)
7	Grounding screw	8	M20 x 1.5/M25 x 1.5 adapter

9	Terminals	10	Earthing cable
11	Pneumatic valve cover (pneumatic valve available as an option; not available for devices for nominal DN25 pipe diameter)		

4 Packaging, transport and storage

4.1 Purpose

The packaging is designed to protect the packaged product during transport, loading, unloading and during periods of storage in such a way that no detrimental changes occur. The packaging must protect the goods against permitted transport stresses such as vibration and knocks.

The packaging also prevents the packaged goods from moving impermissibly within the packaging.

4.2 Suitability, structure and production

The goods are packaged in a sturdy cardboard box. This ensures that the shipment is held securely in the intended transport position.

Inlays inside the box stabilize the goods, preventing impermissible changes of position, and protect them from vibration.

4.3 Markings

The packaging bears a signature with instructions for safe transport and correct storage. The following symbols apply to the shipment of non-hazardous goods. Adherence to these symbols is mandatory.

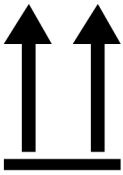
		
Protect against moisture	Top	Fragile

Table 4: Shipping pictograms

4.4 Transportation, receipt and handling of shipments

In addition to vibrations, jolts must also be expected during transportation. In order to prevent possible damage, avoid dropping, tipping, knocking over and colliding with the product.

If the packaging tips over or falls, damage is to be expected regardless of the weight.

Every delivered shipment must be checked for the following by the recipient before acceptance (acknowledgment of receipt):
- Completeness based on the delivery slip
- External damage of any type.

The checks must take place after unloading when the cartons or transport container can be accessed from all sides.

Visible damage

If external transport damage is found upon receipt of the shipment, proceed as follows:
- Immediately record the transport damage found in the shipping documents and have this countersigned by the carrier.
- In the event of severe damage, total loss or high damage costs, immediately notify CEDASPE S.r.l and the relevant insurance company.
- After identifying damage, do not modify the condition of the shipment further and retain the packaging material until an inspection decision has been made by the transport company or the insurance company.
- Record the details of the damage immediately on site together with the carrier involved. This is essential for any claim for damages.
- If possible, photograph damage to packaging and packaged goods. This also applies to signs of corrosion on the packaged goods due to moisture inside the packaging (rain, snow, condensation).
- Be absolutely sure to also check the sealed packaging.

Hidden damage

When damage is not determined until unpacking after receipt of the shipment (hidden damage), proceed as follows:

- Make the party responsible for the damage liable as soon as possible by telephone and in writing, and prepare a damage report.
- Observe the time periods applicable to such actions in the respective country. Inquire about these in good time.

With hidden damage, it is very hard to make the transportation company (or other responsible party) liable. Any insurance claims for such damage can only be successful if relevant provisions are expressly included in the insurance terms and conditions.

4.5 Storage of shipments

When selecting and setting up the storage location, ensure the following:

- Store the product and accessories in the original packaging until installation.
- Protect stored goods against moisture (rain, flooding, water from melting snow and ice), dirt, pests such as rats, mice, termites etc. and against unauthorized access.
- Store crates and boxes on pallets, timber beams or planks as protection against ground moisture and for improved ventilation.
- Ensure that the foundation has sufficient load-bearing capacity.
- Keep entrance paths clear.
- Check the stored goods at regular intervals. Also take appropriate action after storms, heavy rain or snow etc.

5 Mounting

⚠ DANGER

Electric shock!
Danger of death due to electrical voltage when assembling/disassembling the device.

- Switch off transformer on high-voltage side and low-voltage side.
- Lock transformer to prevent unintentional restart.
- Make sure that everything is de-energized.
- Visibly connect all transformer terminals to ground (grounding leads, grounding disconnectors) and short circuit them.
- Cover or cordon off adjacent energized parts.

This chapter describes how to mount the Buchholz relay on a pipe as well as the electrical connection of the reed-type switches.

5.1 Checking the pipe flanges

The pipe flanges must be flush and clean to allow the device to be positioned with the least possible stress.

NOTICE! A residual distance between the flanges caused by a deviation in evenness can cause damage to the flanges.Even slight unevenness can cause the flange of the device to be curved too much, leading to cracks in the flange caused by the resulting transverse stress.

Therefore, check the following:
- Pipe flanges
  - Flush and even
  - Evenness deviation ≤ 0.2 mm

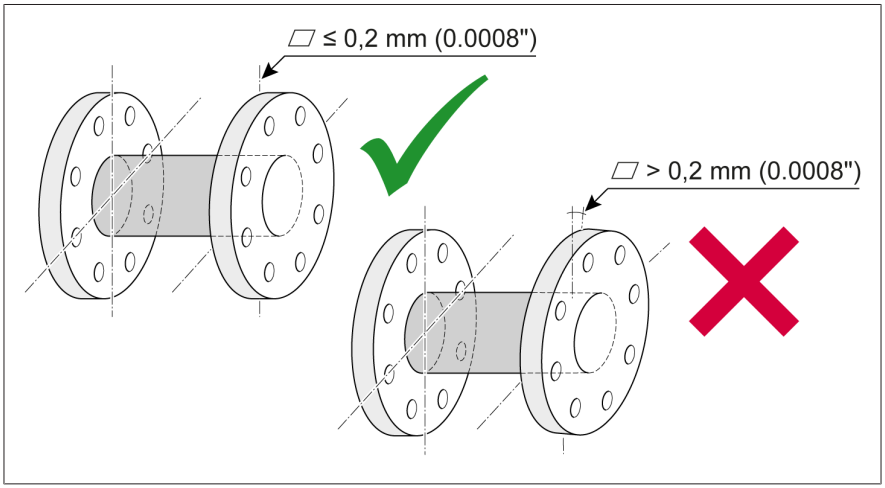


Figure 7: Flanges

- Pipe flange sealing surfaces
  - Clean and undamaged
  - Without any damage along the radial surface such as scratches, dents or points of impact
  - The surface quality of the sealing surface must be suitable for the gasket being used
- Installation material (screws, nuts, washers)
  - Clean and undamaged, particularly the threads and contact surfaces

5.2 Gasket requirements

When selecting the gaskets, observe the following notices:
- Ensure that the design of the gasket and, if applicable, the sealing groove are state-of-the-art.
- Use new and clean gaskets.
- Use O-rings or flat gaskets in accordance with the following mounting description.
- Never use paper gaskets.
- Gasket material:
  - The material must be chemically resistant to the insulating fluid used to prevent later leaks due to chemical degradation.

- The gasket material must be suitable for use at the intended ambient temperatures and operating temperatures.
- The gasket material must be suitable for the relative humidity prevalent on site.
- When mounted, x gaskets must fill a maximum of 80% of the sealing groove. The remaining 20% is required as expansion space.

5.3 Preparation for mounting

1. *NOTICE!* To ensure correct function, align the device on the pipe so that the arrow printed on the cover of the device points in the direction of the conservator.

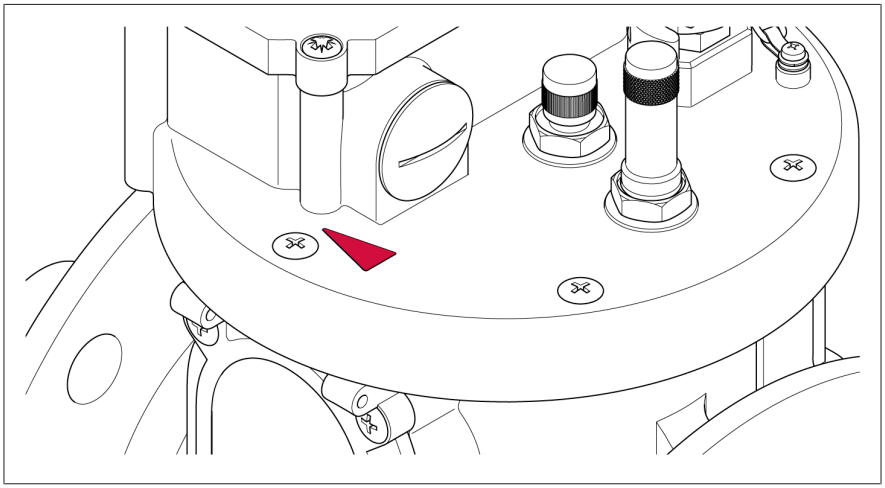


Figure 8: Arrow in the direction of the conservator (EB and ET device models)

2. The pipe from the Buchholz relay to the oil conservator must be routed with a consistent incline of at least 1.2° to ensure the switching gases can escape freely. The Buchholz relay is intended for use in a horizontal operating position. A positive inclination of up to 5° from the horizontal is permitted in the direction toward the conservator. An inclination of up to 5° from the vertical to either side is permitted.

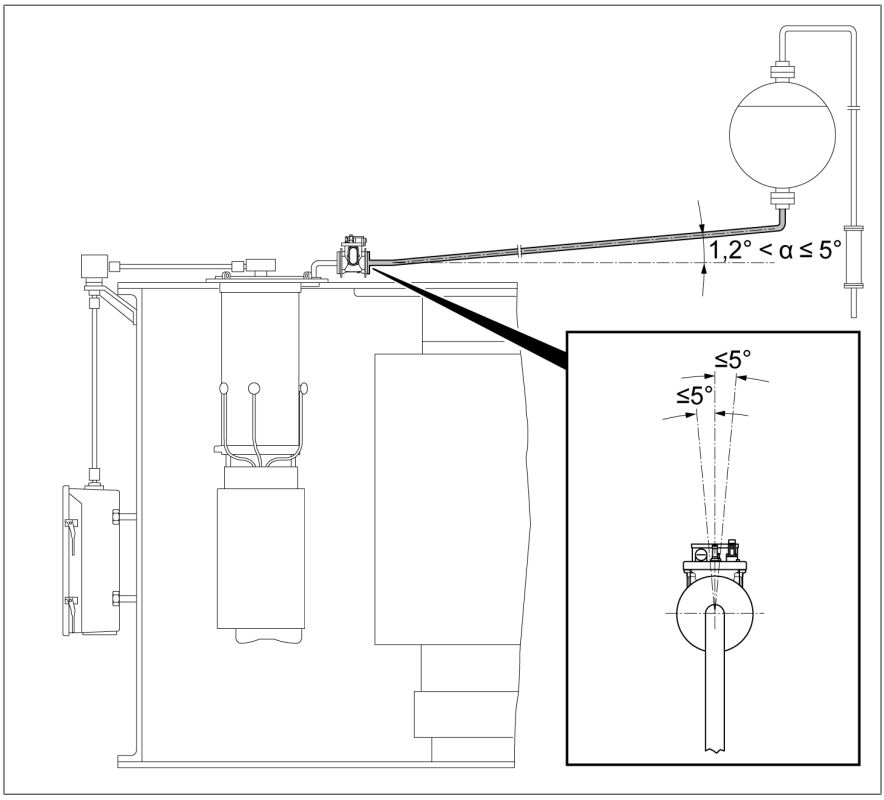


Figure 9: Necessary incline of the pipe and permitted inclination of the Buchholz relay

3. Remove the plastic covers on both flanges on the Buchholz relay.

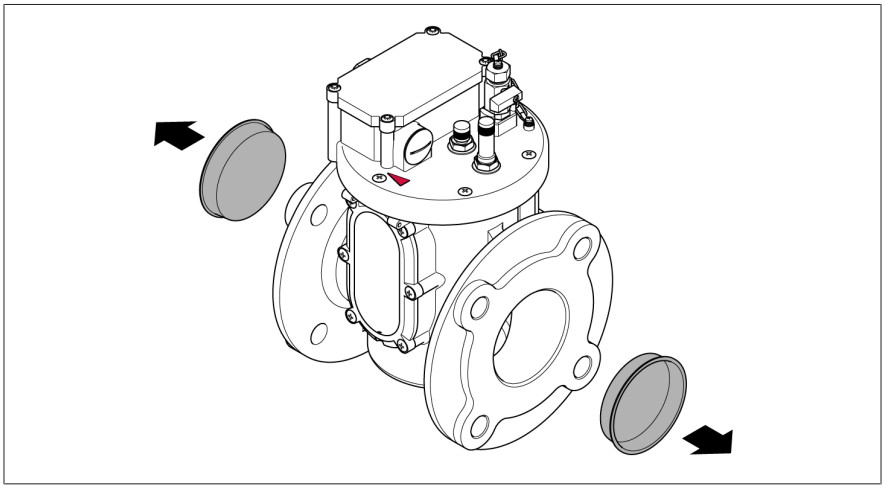


Figure 10: Removing the plastic cover

4. *NOTICE!* Malfunction! The plug on the test button must be removed to ensure the correct functioning of the device. Loosen and remove the test button cover by hand, remove the plug on the test button and fasten the cover back onto the test button.

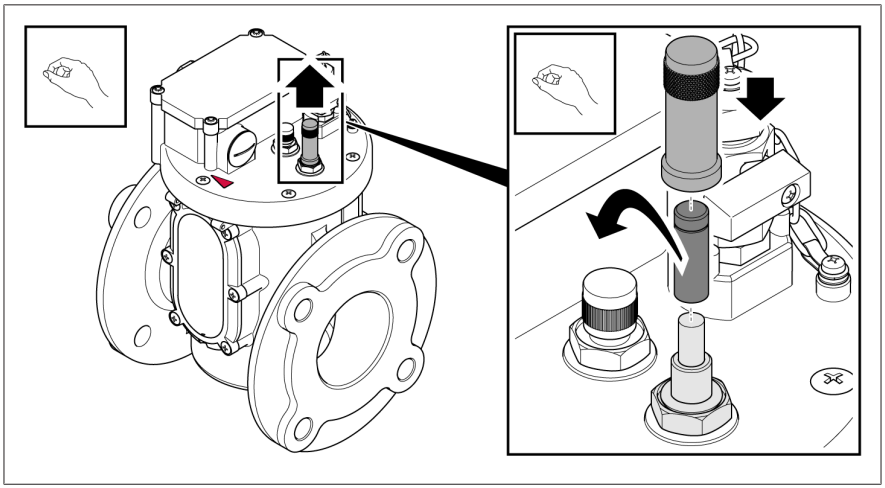


Figure 11: Removing the plug in the test button

5.4 Fastening the Buchholz relay to the pipe

We recommend using isolation valves on both flanges of the device, which ensures that the device can be removed without a loss of oil in the event of an error. The following mounting steps describe the procedure in accordance with this recommendation.

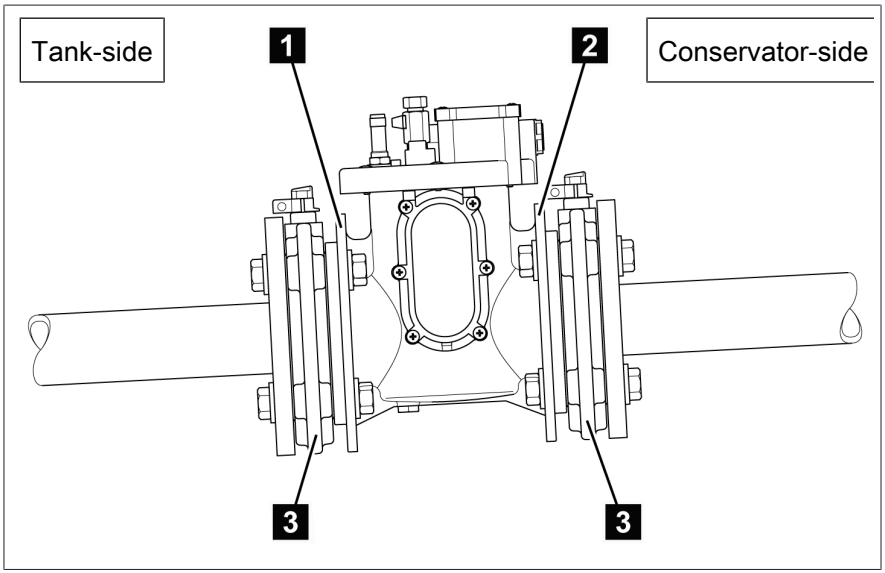


Figure 12: Fastening the device to the pipe (mounting example)

1	Tank-side flange	2	Conservator-side flange
3	Isolation valves (recommended)		

1. Ensure that there is no insulating fluid in the pipe.
2. Insert the two o-ring gaskets supplied into the tank-side isolation valve.
3. Mount the isolation valve on the pipe on the tank side in accordance with the operating instructions provided.
4. On the tank side, fasten the Buchholz relay to the tank-side isolation valve using suitable screws (M10/M12 for a nominal pipe diameter of DN25; M10/M12/M16 for a nominal pipe diameter of DN50; M10/M16 for a nominal pipe diameter of DN80; M16 for the special version with a nominal pipe diameter of DN100), washers and nuts. Only tighten screws by hand.

5. Insert the two o-ring gaskets supplied into the conservator-side isolation valve.
6. Mount the isolation valve between the conservator-side flange of the Buchholz relay and the pipe flange in accordance with the operating instructions. Only tighten screws by hand.
7. On both sides of the Buchholz relay, tighten the screws with 10% of the target tightening torque and ensure that there are no gaps between the flanges. If there is a gap, repair the affected pipe flanges or, if necessary, detach and re-weld them so that there is no longer a gap.
8. Tighten the screws crosswise with 30% of the target tightening torque.
9. Tighten the screws crosswise with 60% of the target tightening torque.
10. *NOTICE!* Damage to the flanges due to a tightening torque that is too high. Use a torque wrench. Tighten the screws crosswise with 100% of the target tightening torque and continue to retighten the screws with 100% of the target tightening torque until the screws can no longer be turned further.

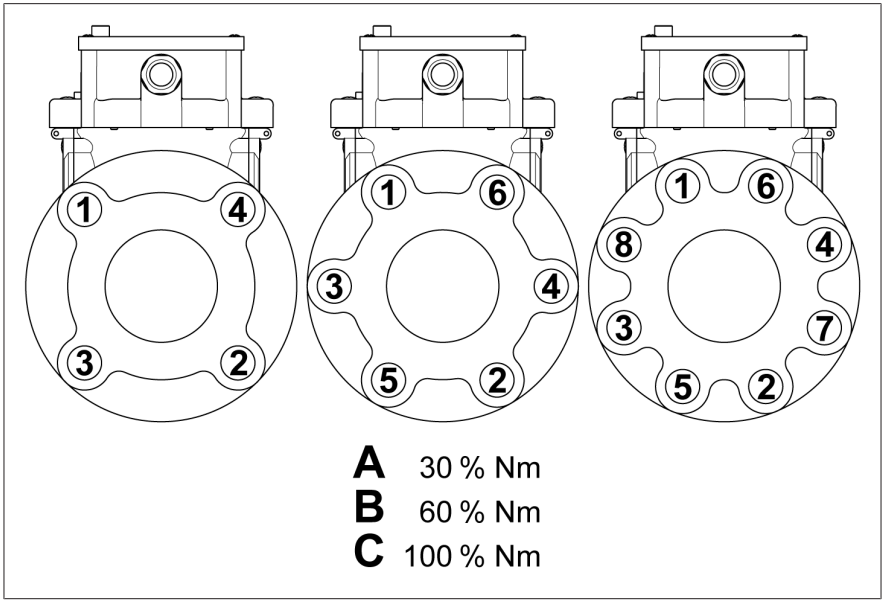


Figure 13: Tightening the screws crosswise

5.5 Electrical connection

⚠ DANGER

Electric shock!
Risk of fatal injury due to electrical voltage when connecting the device.

› Ensure that all cables are free of voltage during connection work.

5.5.1 Cable recommendation

Please note the following recommendation when wiring the device:
- To make the connection, you need suitable ring cable lugs and cable glands that are not included in the scope of delivery.
- The cables used must be flame-resistant in accordance with IEC 60332-1-2 or UL 2556 VW-1.
- If both low voltage and extra-low voltage are connected in the device, it must be ensured that the circuits for extra-low voltage and for low voltage in the connection area and in the cable are separated from each other with double insulation.

Cable	Conductor cross-section	Connection
Signal lines	1.5...4 mm^2	M5 thread
Protective conductor	≥ all other conductors	M5 screw

Table 5: Cable recommendation

5.5.2 Electrically connecting the reed switches

The reed-type switches installed in the device are either normally open contacts or change-over contacts.
1. Unscrew the screws (4x M5 Phillips screws, crosshead screwdriver) on the terminal box and remove the cover.
2. Remove the plastic bag with fastening materials for connecting the cables from the terminal box.

3. Remove the dummy plug from the M20 x 1.5/M25 x 1.5 adapter.

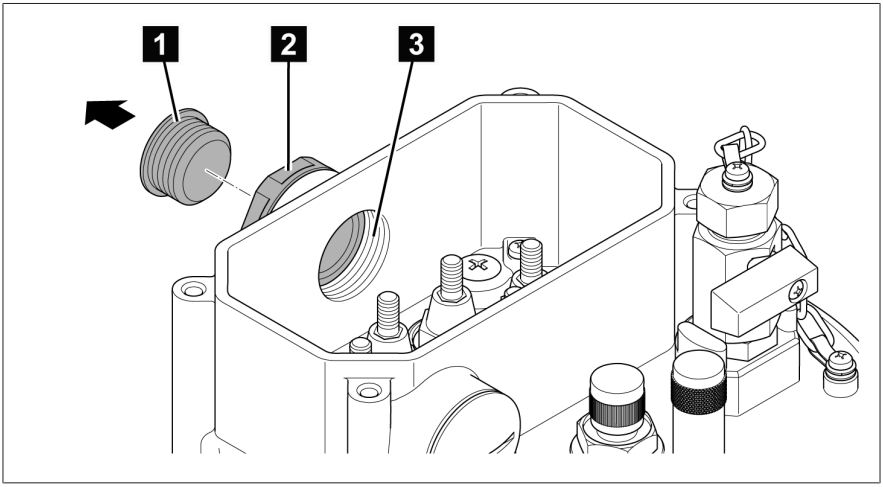


Figure 14: Dummy plug and M20/M25 adapter

1	Dummy plug	2	M20 x 1.5/M25 x 1.5 adapter
3	Housing thread: M25 x 1.5		

4. Fit an M20 cable gland in the adapter or remove the adapter and fasten an M25 cable gland (wrench size 28) directly in the housing.
5. *NOTICE!* To ensure the IP degree of protection of the device, use a suitable cable gland with at least IP65.
6. The wiring diagram can be found on the inside of the terminal box cover.

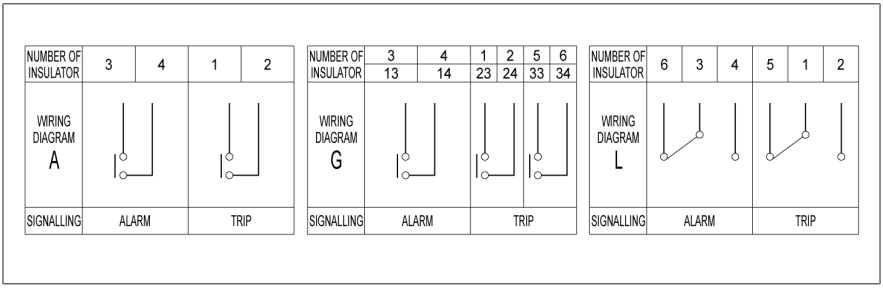


Figure 15: Standard wiring diagrams for all versions

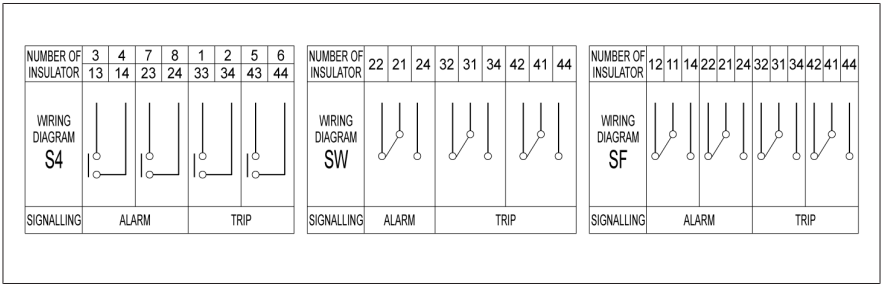


Figure 16: Special wiring diagrams for versions with DN50 or DN80

7. *NOTICE!* To prevent damage, observe the specified tightening torques.
8. Guide the cable through the cable gland and connect the ring cable lugs to the terminals using the fastening materials in the plastic bag as follows.

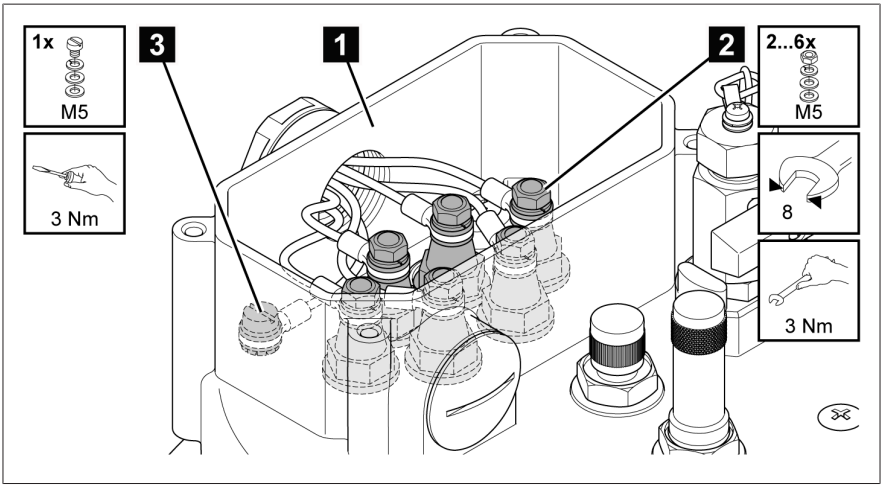


Figure 17: Terminal box

1	Terminal box	2	Reed-type switch connections, 2...6 x M5
3	M5 grounding screw		

9. Place the ring cable lug between two washers to connect the reed-type switches.
10. Fit a spring washer on the upper washer and fasten the cable to the clamp by tightening a nut.

11. Ground the device via a grounding cable with ring cable lug. To do so, loosen the grounding screw.
12. Place the ring cable lug on the grounding screw between two washers.
13. Fit a spring washer on the upper washer and tighten the grounding screw.
14. Tighten the cable gland.
15. *NOTICE!* Damage to the earthing cable. Ensure that the earthing cable is not pinched when closing the terminal box.
16. Position the cover on the terminal box and affix using the 4 screws (crosshead screwdriver).

6 Commissioning

Prior to commissioning the transformer, perform the following checks. If anything is unclear regarding the checks or troubleshooting, please contact CEDASPE S.r.l [▶Section 1.1, Page 5].

6.1 Filling with oil and performing the venting test

⚠ WARNING

Danger of explosion and danger of poisoning!
Explosive gases in the Buchholz relay can deflagrate or explode and result in death or severe injuries. Inhaling the gases released can lead to poisoning or suffocation.

- Ensure that there are no ignition sources such as naked flames, hot surfaces or sparks (e.g. caused by the build-up of static charge, electrical devices) in the immediate surroundings and that none occur.
- Do not breath in any gas released.

✓ The pipes are filled with insulating fluid.

✓ The isolation valves are fully open.

✓ The shutter valve (if installed) is open.

1. When filling with oil, watch through the inspection window to see if the float gauge pairs are rising.
2. As soon as the maximum oil level is reached in the conservator, vent the shutter valve (if installed) in accordance with the operating instructions provided.
3. To vent the Buchholz relay, remove the protective cap from the gas extraction valve (wrench size 17).
4. Turn the lever of the gas extraction valve counterclockwise to vent the device.
5. Place a cloth over the gas extraction valve to catch any insulating fluid that sprays out. As soon as insulating fluid begins to escape, turn the lever of the gas extraction valve clockwise to close the gas extraction valve.
6. Position the protective cap on the gas extraction valve, screw on hand-tight and then tighten with maximum one half turn (wrench size 17).

» The device is filled with oil and vented.

6.2 Leak test

✓ The pipes are filled with insulating fluid.
1. Check the tightness of the flange connection.
2. If the connection is not tight, check the gasket and replace it if necessary.

» The test is complete.

6.3 Testing the function of the reed-type switches

⚠ WARNING

Danger of explosion and danger of poisoning!
Explosive gases in the Buchholz relay can deflagrate or explode and result in death or severe injuries. Inhaling the gases released can lead to poisoning or suffocation.

› Ensure that there are no ignition sources such as naked flames, hot surfaces or sparks (e.g. caused by the build-up of static charge, electrical devices) in the immediate surroundings and that none occur.
› Do not breath in any gas released.

6.3.1 Gas accumulation in the device and loss of insulating fluid

The test button is used to simulate the switching of the warning contact when gas accumulates in the device and the switching of the cut-off contact when insulating fluid is lost.

i During the test, you can watch through the inspection window to see whether the float gauge pairs lower. As soon as you release the test button, the float gauge pairs rise automatically and the switches open.
The manual reset function is also tested in device versions equipped with this function.

✓ The device is filled completely with insulating fluid.
✓ The cover of the test button has been removed.

✓ The cover of the terminal box has been removed.

✓ Normal operating conditions have been checked and are in accordance with the wiring diagram [▶Section 7.1, Page 44].

1. Connect a multimeter to the terminals of the switches in the open state.
2. Push the test button down to first activate the warning contact and then the cut-off contact.
   » The multimeter receives a signal.
3. Position the cover on the test button and screw on hand-tight with maximum one half turn.

» The test is complete.

6.3.2 Gas accumulation in the device (pneumatic test)

This test is only possible with versions with a nominal pipe diameter of DN50 and DN80.

The pneumatic valve on the upper side of the device cover is used to simulate the switching of the warning contact when gas accumulates in the device.

> **i** During the test, you can watch through the inspection window to see whether the upper float gauge pair lowers.

✓ The device is filled completely with insulating fluid.

✓ The cover of the terminal box has been removed.

✓ Normal operating conditions have been checked and are in accordance with the wiring diagram [▶Section 7.1, Page 44].

1. Connect a multimeter to the terminals of the switches in the open state.
2. Loosen and remove the protective cap on the pneumatic valve by hand.
3. Connect an air pump or the 16 g CO_2 pump kit (can be delivered as an option) to the pneumatic valve (1/8" BSP external thread).
4. ⚠ DANGER! Danger of explosion due to flammable gases.Only use CO_2 or compressed air. Ensure that the pump kit is connected correctly with an air-tight seal. After expending the gas, the CO_2 gas cartridge and the pump head will be extremely cold. Wear protective gloves when using the pump kit.

5. Introduce air into the Buchholz relay until the upper float gauge pair lowers and the warning contact issues a signal.
6. Remove the air pump or the pump kit.
7. Release the air via the gas extraction valve.
8. Position the protective cap on the pneumatic valve and screw on hand-tight with maximum one half turn.

» The test is complete.

6.3.3 Gas accumulation in the device, loss of insulating fluid and insulating fluid flow speed too high (pneumatic test)

This test is only possible on device models EE25, EE2 and EE3.

During this test, compressed air or CO_2 is fed into the device via the drain valve. This moves the flap valve, which is connected to the mechanism of the lower float gauge pair. This test simulates the switching of the cut-off contact when the insulating fluid flow speed is too high and the switching of the warning contact when gas accumulates in the device.

> **i** During the test, you can watch through the inspection window to see whether the float gauge pairs lower.

✓ The device is filled completely with insulating fluid.

✓ The cover of the terminal box has been removed.

✓ Normal operating conditions have been checked and are in accordance with the wiring diagram [▶Section 7.1, Page 44].

1. Connect a multimeter to the terminals of the switches in the open state.

2. Loosen and remove the cover of the drain valve.

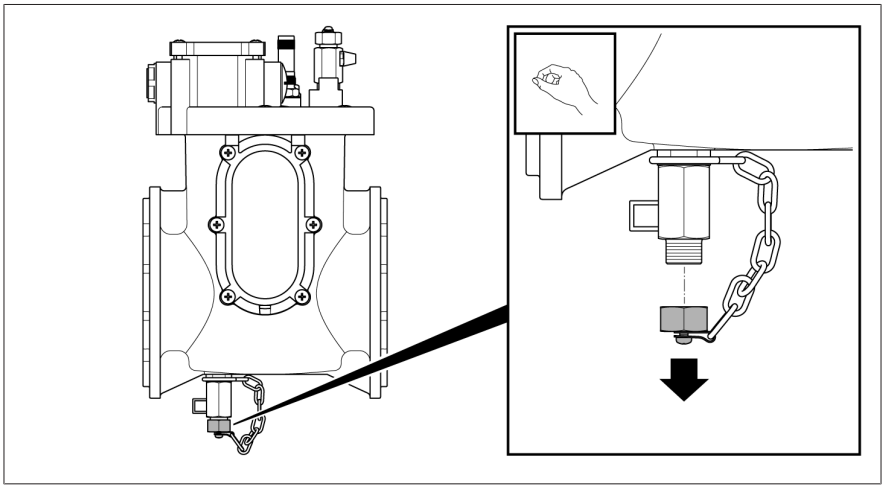


Figure 18: Loosening and removing the cover on the drain valve

3. Mount an air pump or the 16 g CO_2 pump kit (can be delivered as an option) onto the union nut on the drain valve (1/4" BSP external thread).
4. ⚠ DANGER! Danger of explosion due to flammable gases.Only use CO_2 or compressed air. Ensure that the pump kit is connected correctly with an air-tight seal. After expending the gas, the CO_2 gas cartridge and the pump head will be extremely cold. Wear protective gloves when using the pump kit.
5. Turn the lever of the drain valve counterclockwise to open the drain valve.
6. Open the pump head to introduce the gas into the Buchholz relay.
   » The cut-off contact activates first, followed by the warning contact.
7. Turn the lever of the drain valve clockwise to close the drain valve.
8. Remove the air pump or the pump kit.
9. Release the air via the gas extraction valve to vent the device and to fill it with insulating fluid.
10. *NOTICE!* When using the CEDASPE® CPR3 protective relay on transformers with a rubber bag, the CPR3 may trip: Gas bubbles migrate from the Buchholz relay via the pipe into the conservator, where the CPR3 is installed and which absorbs the gas. In this case, it is necessary to vent the CPR3 in accordance with the corresponding operating instructions to restore normal operating conditions.

11. Position the cover on the drain valve and screw on hand-tight with maximum one half turn.

» The test is complete.

7 Operation

7.1 Contact signals

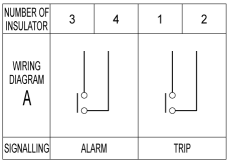
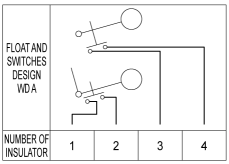
Normal operating conditions	Description of warning contact (ALARM) and cut-off contact (TRIP)	Note
	ALARM – Gas accumulation in the device: switches 3-4 closed.	Check the insulating fluid level via the inspection window. Check the transformer condition. Gas can be extracted via the gas sampling device or via the gas extraction valve.
	TRIP – Loss of insulating fluid: switches 1-2 closed.	Check the insulating fluid level via the inspection window. Check the transformer condition.
	TRIP – Insulating fluid flow speed too high: switches 1-2 closed.	The transformer may have been switched off. Check flap valve position via the inspection window. Check the transformer condition.

Table 6: Wiring diagram A signals

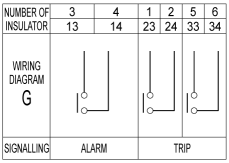
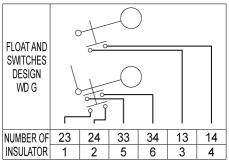
Normal operating conditions	Description of warning contact (ALARM) and cut-off contact (TRIP)	Note
 	ALARM – Gas accumulation in the device: switches 3-4 or switches 13-14 closed (switch designations dependent on the device version).	Check the insulating fluid level via the inspection window. Check the transformer condition. Gas can be extracted via the gas sampling device or via the gas extraction valve.
	TRIP – Loss of insulating fluid: switches 1-2 and 5-6 or switches 23-24 and 33-34 closed (switch designations dependent on the device version).	Check the insulating fluid level via the inspection window. Check the transformer condition.
	TRIP – Insulating fluid flow speed too high: switches 1-2 and 5-6 or switches 23-24 and 33-34 closed (switch designations dependent on the device version).	The transformer may have been switched off. Check flap valve position via the inspection window. Check the transformer condition.

Table 7: Wiring diagram G signals

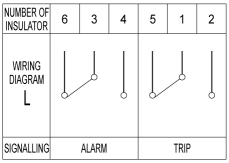
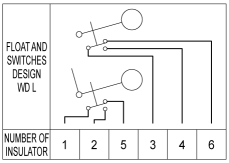
Normal operating conditions	Description of warning contact (ALARM) and cut-off contact (TRIP)	Note
 	ALARM – Gas accumulation in the device: switches 3-4 closed.	Check the insulating fluid level via the inspection window. Check the transformer condition. Gas can be extracted via the gas sampling device or via the drain valve.
	TRIP – Loss of insulating fluid: switches 1-2 closed.	Check the insulating fluid level via the inspection window. Check the transformer condition.
	TRIP – Insulating fluid flow speed too high: switches 1-2 closed.	The transformer may have been switched off. Check flap valve position via the inspection window. Check the transformer condition.

Table 8: Wiring diagram L signals

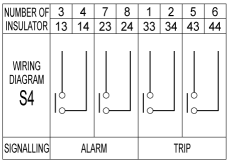
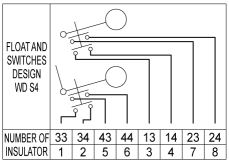
Normal operating conditions	Description of warning contact (ALARM) and cut-off contact (TRIP)	Note
	ALARM – Gas accumulation in the device: switches 3-4 and 7-8 or switches 13-14 and 23-24 closed (switch designations dependent on the device version).	Check the insulating fluid level via the inspection window. Check the transformer condition. Gas can be extracted via the gas sampling device or via the gas extraction valve.
	TRIP – Loss of insulating fluid: switches 1-2 and 5-6 or switches 33-34 and 43-44 closed (switch designations dependent on the device version).	Check the insulating fluid level via the inspection window. Check the transformer condition.
	TRIP – Insulating fluid flow speed too high: switches 1-2 and 5-6 or switches 33-34 and 43-44 closed (switch designations dependent on the device version).	The transformer may have been switched off. Check flap valve position via the inspection window. Check the transformer condition.

Table 9: Wiring diagram S4 signals

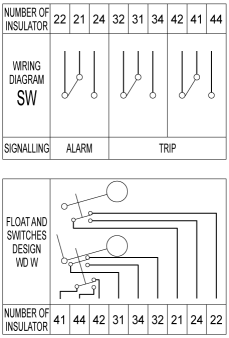
Normal operating conditions	Description of warning contact (ALARM) and cut-off contact (TRIP)	Note
	ALARM – Gas accumulation in the device: switches 21-24 closed.	Check the insulating fluid level via the inspection window. Check the transformer condition. Gas can be extracted via the gas sampling device or via the gas extraction valve.
	TRIP – Loss of insulating fluid: switches 31-34 and 41-44 closed.	Check the insulating fluid level via the inspection window. Check the transformer condition.
	TRIP – Insulating fluid flow speed too high: switches 31-34 and 41-44 closed.	The transformer may have been switched off. Check flap valve position via the inspection window. Check the transformer condition.

Table 10: Wiring diagram SW signals

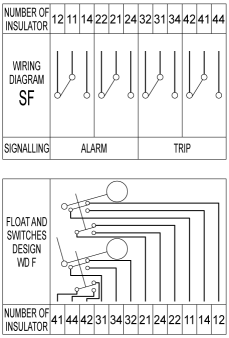
Normal operating conditions	Description of warning contact (ALARM) and cut-off contact (TRIP)	Note
	ALARM – Gas accumulation in the device: switches 11-14 and 21-24 closed.	Check the insulating fluid level via the inspection window. Check the transformer condition. Gas can be extracted via the gas sampling device or via the gas extraction valve.
	TRIP – Loss of insulating fluid: switches 31-34 and 41-44 closed.	Check the insulating fluid level via the inspection window. Check the transformer condition.
	TRIP – Insulating fluid flow speed too high: switches 31-34 and 41-44 closed.	The transformer may have been switched off. Check flap valve position via the inspection window. Check the transformer condition.

Table 11: Wiring diagram SF signals

7.2 Releasing blocked flap valve

If the Buchholz relay is equipped with the reset function, the lower float gauge pair and the flap valve are blocked and remain in this position if there is a loss of insulating fluid or the flow speed is too high. In this case, you must release the lower float gauge pair and the flap valve manually to restore normal operating conditions.

1. Loosen and remove the cover of the test button by hand.
2. Press the test button down fully and release it slowly.
3. Use a multimeter to check if normal operating conditions exist and are in accordance with the wiring diagram [▶Section 7.1, Page 44].
4. Position the cover on the test button and screw on hand-tight with maximum one half turn.

» The device is reset.

8 Maintenance and inspection

Maintenance

The device is maintenance-free.

Inspection

Depending on the conditions of use of the device and the national regulations in the respective country of use, the transformer manufacturers can specify different inspection intervals.

› Observe the inspection intervals defined in CIGRE Publication No. 445 "Guide for Transformer Maintenance" or the inspection intervals specified by the transformer manufacturer.

During each transformer inspection, check the following:

1. Check the external condition of the device for contamination, damage (e.g. broken glass, electrical connection) and corrosion.
2. Vent the device [▶Section 6.1, Page 38].
3. Check the tightness of the flange connection [▶Section 6.2, Page 39].
4. Check that the device is functioning correctly [▶Section 6.3, Page 39].

8.1 Draining the insulation fluid

If you have to drain insulating fluid from the Buchholz relay for inspection work or maintenance work on the transformer, proceed as follows:

Device version	Screw	Wrench size	Torque
DN25	M8	13	5 Nm
DN50, DN80, DN100 (special version)	1/4"	17	15 Nm

Table 12: Open-end wrench specifications

1. Remove the drain plug (open-end wrench; see table above for wrench size).
   » The insulating fluid flows out of the Buchholz relay.
2. Capture the insulating fluid in a suitable container.
3. Tighten the drain plug (open-end wrench; see table above for wrench size and torque).

4. Check tightness.

If the Buchholz relay is equipped with a drain valve in the base of the device, as an option you can drain the insulating fluid from the base via the gas sampling device in accordance with the corresponding operating instructions.

9 Disposal

Observe the national disposal regulations in the country of use.

9.1 SVHC information in accordance with the REACH regulation

This product complies with the provisions of European Regulation 1907/2006/EC dated December 18, 2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH).

The following components of the product contain > 0.1% [w/w] of the SVHC substance lead (CAS no. 7439-92-1):
- Aluminum alloy
- Brass alloy

10 Technical data

Basic materials	
Housing/cover	Cast aluminum, 2-layer paint system (epoxy and polyurethane), standard RAL 7031 or 7033 (other colors on request)
Inspection window	Hardened glass

Specifications	
Setup	Indoors and outdoors, tropic-proof
Ambient air temperature	-50 °C...+80 °C
Storage temperature	-40 °C...+80 °C
Operating temperature	-40 °C...+115 °C
Insulating fluid temperature	-25 °C...+105 °C (up to +115 °C in transformer overload operation) Temperature ranges for alternative insulating fluids on request
Degree of protection	IP65 in accordance with DIN EN 60529
Weight including terminal box	Approx. 5.5 kg (DN80)
Nominal diameter of the pipe, flange version	DN25: Flange with 4 drill holes DN50, DN80: Flange with 4, 6 or 8 drill holes DN100: Flange with 8 drill holes
Gas accumulation volumes (warning contact, ALARM)	DN25: 150 cm^3 ±50 cm^3 DN50, DN80: 300 cm^3 ±100 cm^3 DN100 (special version): 300 cm^3 ±100 cm^3 Refer to attached drawings for deviating volumes
Gas accumulation for loss of insulating fluid (cut-off contact, TRIP)	Once the warning contact has switched and before the insulating fluid level has reached the lowest point of the pipe
Flow speed (mineral insulating oil)	Standard: 100 cm^3/s ±15% cm^3/s On request: 65 cm^3/s ±15% cm^3/s;150 cm^3/s ±15% cm^3/s; 200 cm^3/s ±15% cm^3/s

Reed-type switches	
Number and type	Max. 4 normally open contacts or max. 4 change-over contacts Special version: 6 normally open contacts
Nominal voltage	24...240 V DC Up to 230 V AC
Max. current AC/DC	Normally open contact: 2 A Change-over contact: 1 A
Min. switched current	Normally open contact: 10 mA Change-over contact: 5 mA
Breaking capacity DC	Normally open contact: 24...240 V DC 250 W L/R < 40 ms Change-over contact: 24...240 V DC 130 W L/R < 40 ms
Breaking capacity AC	Normally open contact: Up to 230 V AC 400 VA cosφ > 0.5 Change-over contact: Up to 230 V AC 250 VA cosφ > 0.5
Insulation resistance	1,000 MΩ/500 V DC

Terminal box	
Cable inlet gland	M20 x 1.5/M25 x 1.5 (adapter)
Connection terminals	M5 thread
Protective conductor connection	M5 screw

Insulating fluid

- Unused insulating oils derived from petroleum products[1)] in accordance with IEC 60296 and ASTM D3487 (equivalent standards on request)
- Unused insulating oils derived from other virgin hydrocarbons in accordance with IEC 60296, or blends of these oils with petroleum products[1)] in accordance with IEC 60296, ASTM D3487 or equivalent standards on request
- Alternative insulating fluids, such as natural and synthetic esters or silicone oils, on request

[1)] Gas-to-liquid oils (GTL oils) are understood in this context as petroleum products

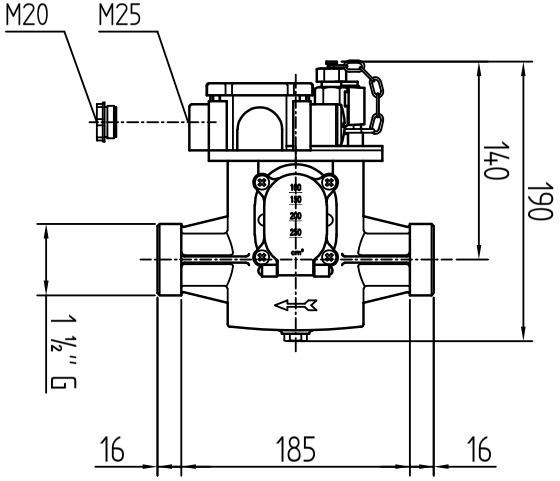
11 Drawings

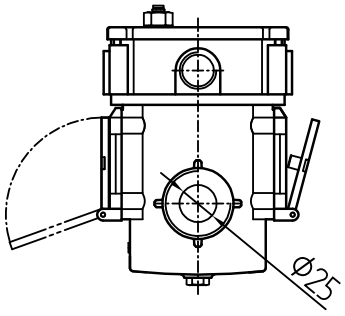
The product may have been altered since this document was published.

	DATE	NAME	DOCUMENT NO.	
DFTR.	05/04/23	Castellini S.	5203-catalogue	
CHKD.	05/04/23	Giorgi A.	CHANGE NO.	SCALE
STAND.	05/04/23	Giorgi A.	02	1:5

DIMENSION IN mm EXCEPT AS NOTED

GAS ACTUATED RELAY
TYPE EB24





SERIAL NUMBER

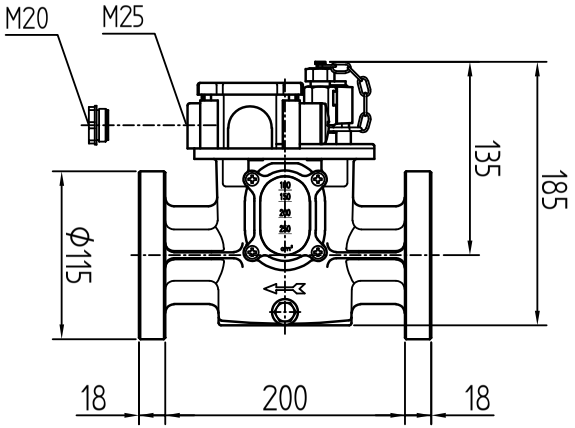
MATERIAL NUMBER

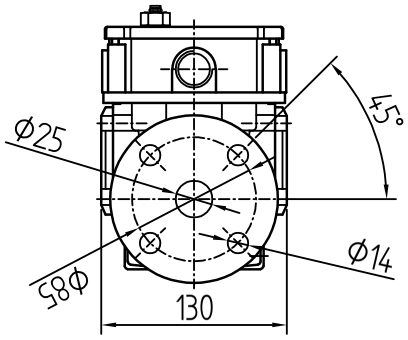
SHEET 1/1

	DATE	NAME	DOCUMENT NO.	
DFTR.	05/04/23	Castellini S.	3517-catalogue	
CHKD.	05/04/23	Giorgi A.	CHANGE NO.	SCALE
STAND.	05/04/23	Giorgi A.	02	1:5

DIMENSION IN mm EXCEPT AS NOTED

GAS ACTUATED RELAY
TYPE EB25





MATERIAL NUMBER

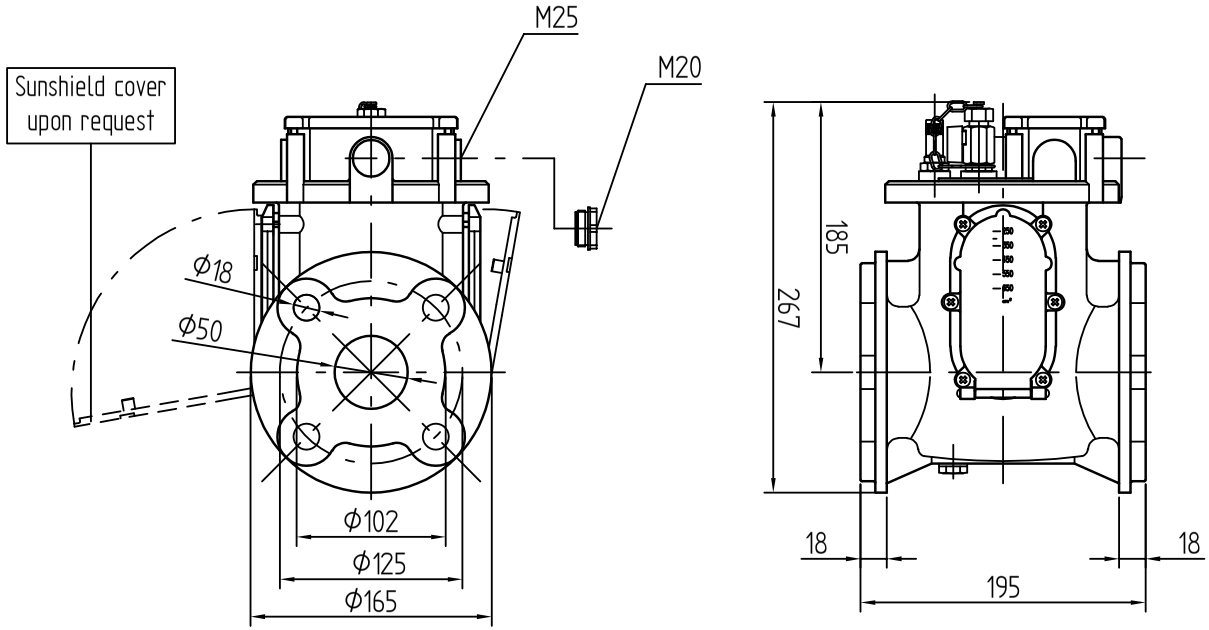
SERIAL NUMBER

SHEET 1/1

	DATE	NAME	DOCUMENT NO.	
DFTR.	05/04/23	Castellini S.	5171-catalogue	
CHKD.	05/04/23	Giorgi A.	CHANGE NO.	SCALE
STAND.	05/04/23	Giorgi A.	02	1:5

DIMENSION IN mm EXCEPT AS NOTED

GAS ACTUATED RELAY
TYPE EB50



SERIAL NUMBER

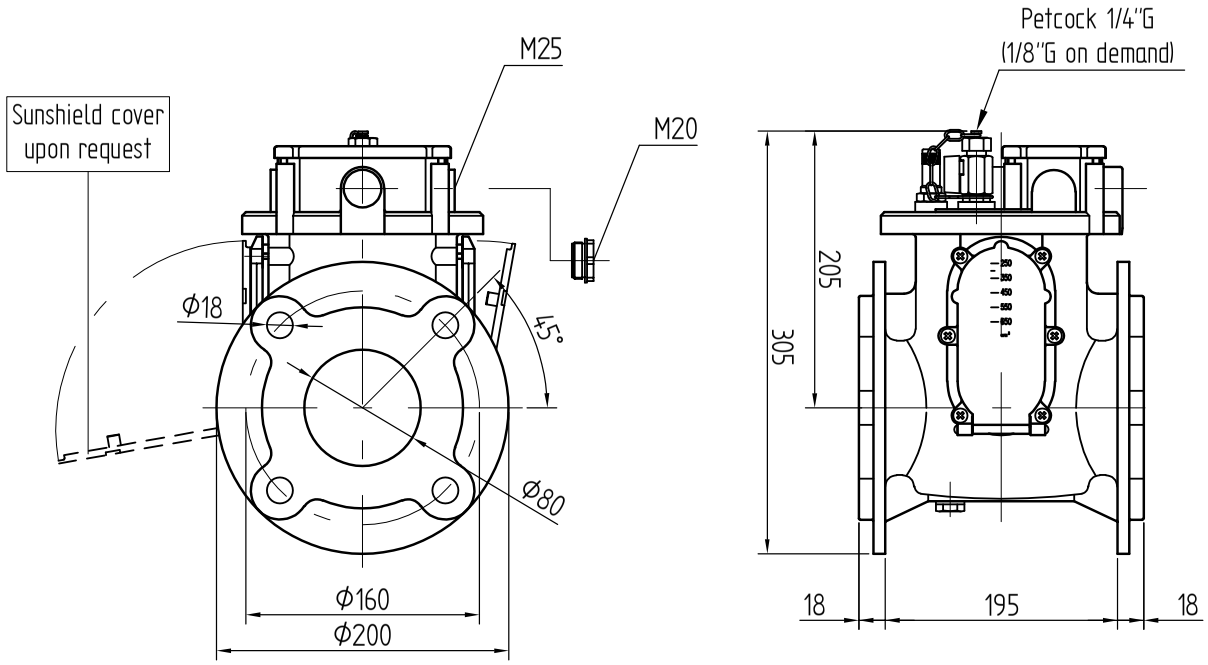
MATERIAL NUMBER

SHEET 1/1

	DATE	NAME	DOCUMENT NO.	
DFTR.	05/04/23	Castellini S.	5170-catalogue	
CHKD.	05/04/23	Giorgi A.	CHANGE NO.	SCALE
STAND.	05/04/23	Giorgi A.	02	1:5

DIMENSION IN mm EXCEPT AS NOTED

GAS ACTUATED RELAY
TYPE EB79

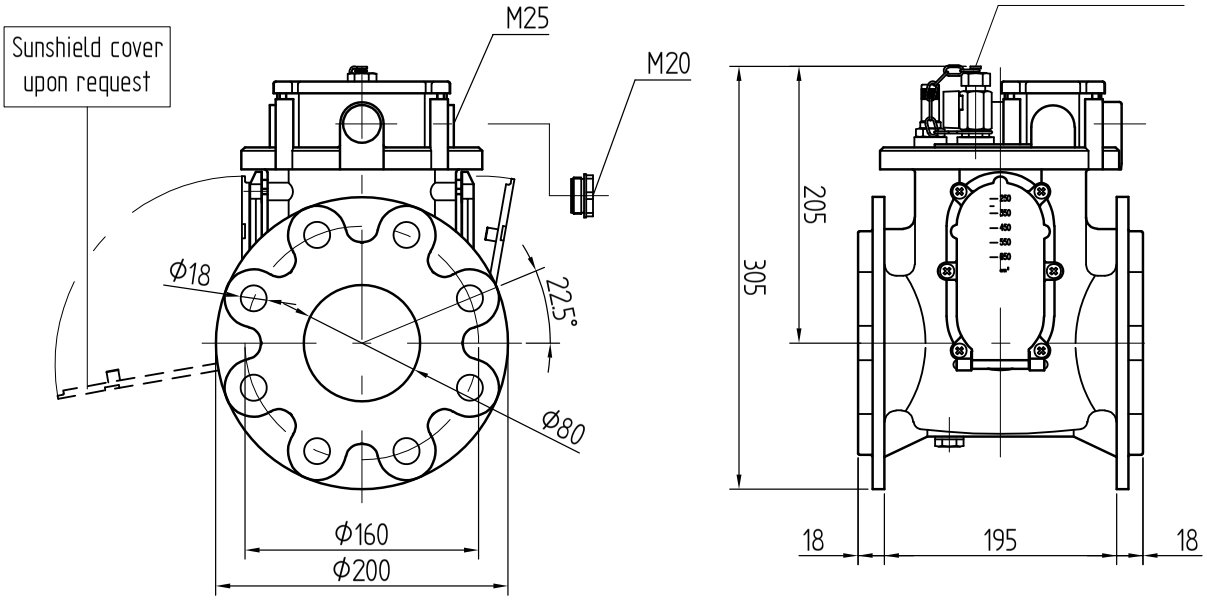


SERIAL NUMBER	MATERIAL NUMBER	SHEET
		1/1

	DATE	NAME	DOCUMENT NO.	
DFTR.	05/04/23	Castellini S.	5172-catalogue	
CHKD.	05/04/23	Giorgi A.	CHANGE NO.	SCALE
STAND.	05/04/23	Giorgi A.	02	1:5

DIMENSION IN mm EXCEPT AS NOTED

GAS ACTUATED RELAY
TYPE EB80



SERIAL NUMBER

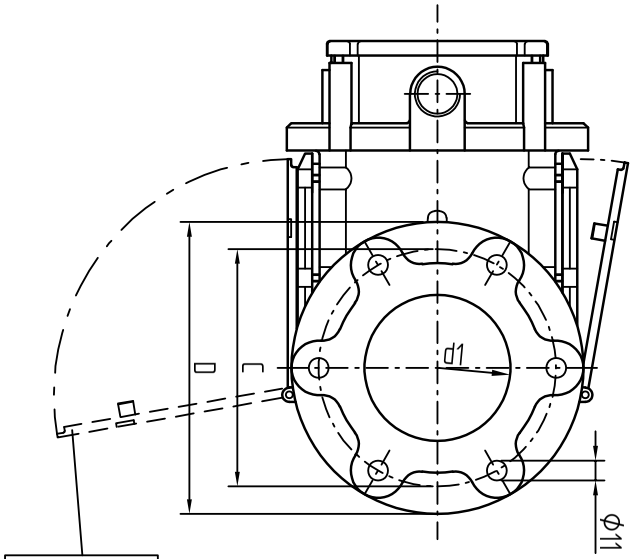
MATERIAL NUMBER

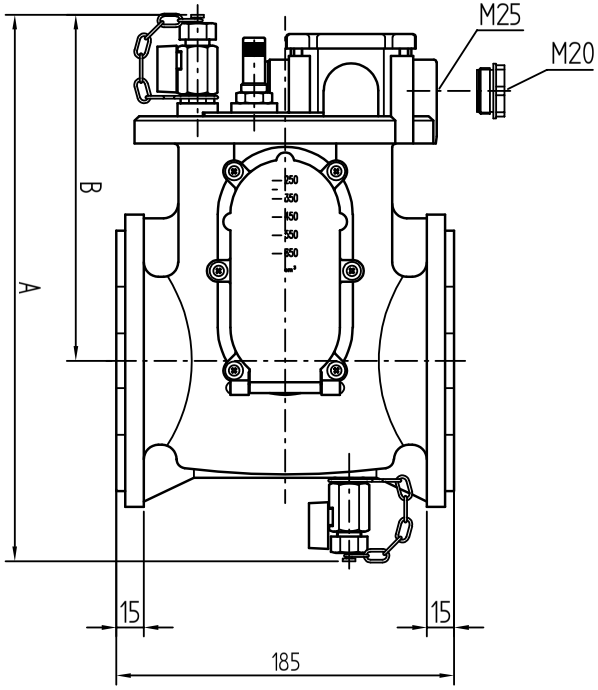
SHEET 1/1

	DATE	NAME	DOCUMENT NO.	
DFTR.	05/04/23	Tripepi R.	3852-catalogue	
CHKD.	05/04/23	Giorgi A.	CHANGE NO.	SCALE
STAND.	05/04/23	Giorgi A.	04	1:5

DIMENSION IN mm EXCEPT AS NOTED

GAS ACTUATED RELAY
TYPE EE2/EE3





Mod./Size	d1	A	D	C	B	Weight (Kg)
EE2	51	288	140	110	180	≃ 4.5
EE3	76	310	160	130	195	≃ 5

MATERIAL NUMBER

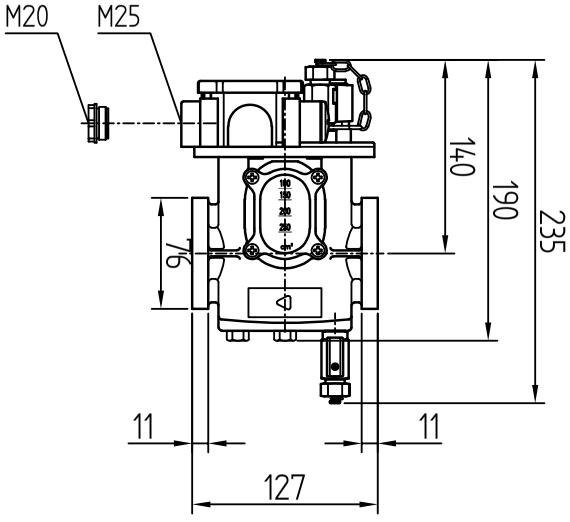
SERIAL NUMBER

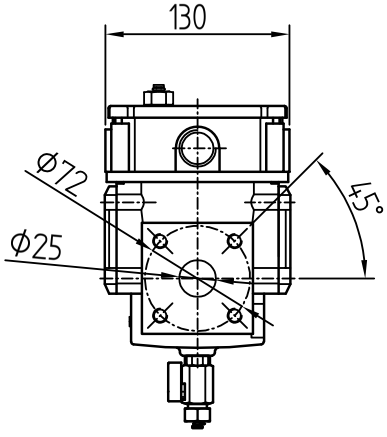
SHEET 1/1

	DATE	NAME	DOCUMENT NO.	
DFTR.	05/04/23	Castellini S.	4721-catalogue	
CHKD.	05/04/23	Giorgi A.	CHANGE NO.	SCALE
STAND.	05/04/23	Giorgi A.	02	1:5

DIMENSION IN mm EXCEPT AS NOTED

GAS ACTUATED RELAY
TYPE EE25





SERIAL NUMBER

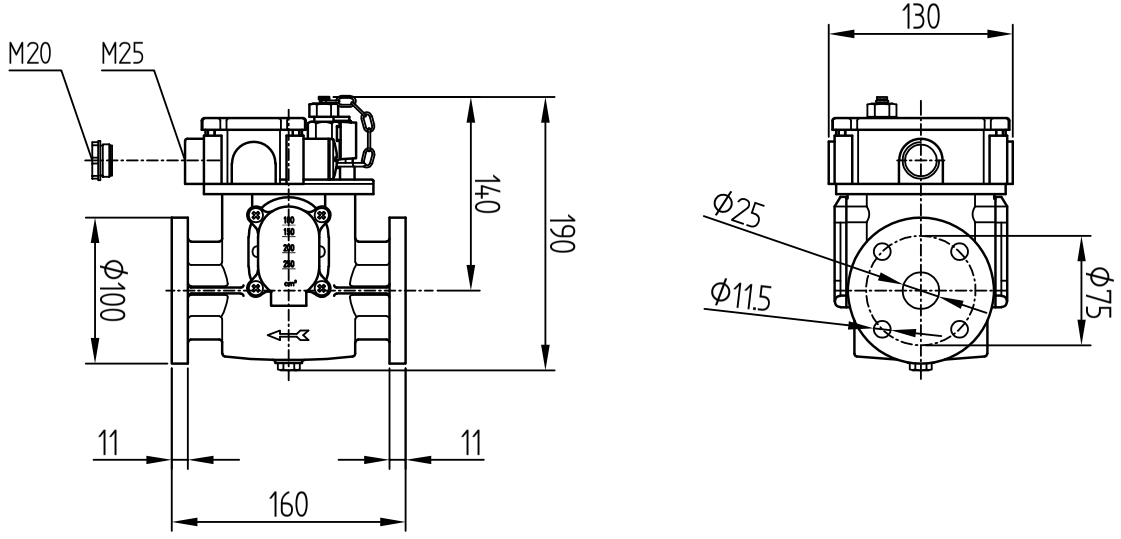
MATERIAL NUMBER

SHEET 1/1

	DATE	NAME	DOCUMENT NO.	
DFTR.	05/04/23	Castellini S.	3856-catalogue	
CHKD.	05/04/23	Giorgi A.	CHANGE NO.	SCALE
STAND.	05/04/23	Giorgi A.	02	1:5

DIMENSION IN mm EXCEPT AS NOTED

GAS ACTUATED RELAY
TYPE ET25



SERIAL NUMBER

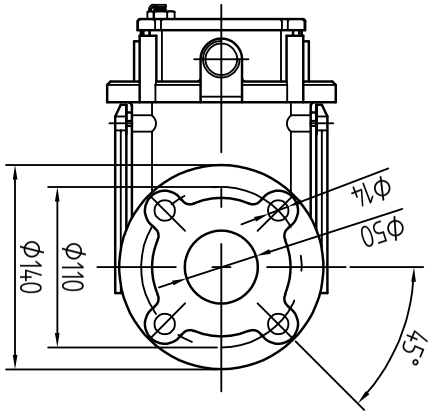
MATERIAL NUMBER

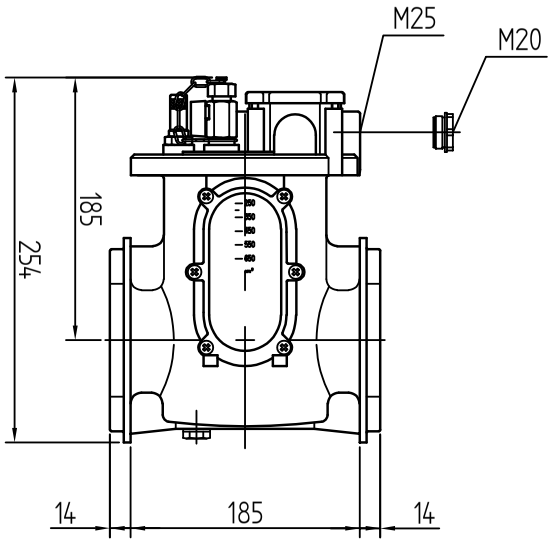
SHEET 1/1

	DATE	NAME	DOCUMENT NO.	
DFTR.	05/04/23	Castellini S.	4282-catalogue	
CHKD.	05/04/23	Giorgi A.	CHANGE NO.	SCALE
STAND.	05/04/23	Giorgi A.	02	1:5

DIMENSION IN mm EXCEPT AS NOTED

GAS ACTUATED RELAY
TYPE ET50





SERIAL NUMBER

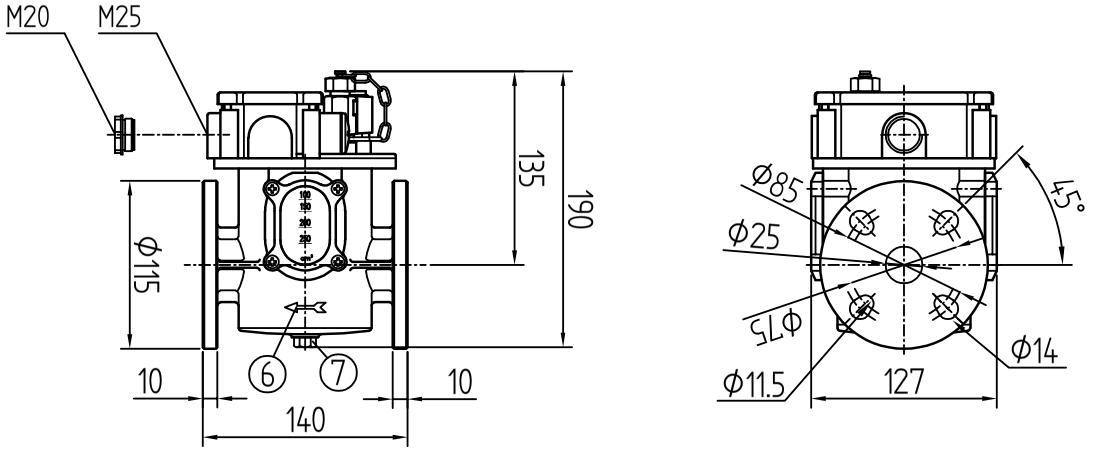
MATERIAL NUMBER

SHEET 1/1

	DATE	NAME	DOCUMENT NO.	
DFTR.	05/04/23	Castellini S.	3951-catalogue	
CHKD.	05/04/23	Giorgi A.	CHANGE NO.	SCALE
STAND.	05/04/23	Giorgi A.	04	1:5

DIMENSION IN mm EXCEPT AS NOTED

GAS ACTUATED RELAY
TYPE EU26



SERIAL NUMBER

MATERIAL NUMBER

SHEET 1/1

Glossary

Ambient air temperature
Permissible temperature of the air in the surroundings of the equipment in operation on which the device is installed.

Insulating fluid temperature
Permissible temperature of the insulating fluid in the product or directly on the product.

Operating temperature
Permissible temperature in the immediate surroundings of the device during operation taking ambient influences, for example due to the equipment and installation location, into consideration.

Storage temperature
Permissible temperature for storing the device in an unmounted state or in a mounted state so long as the device is not in operation.

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