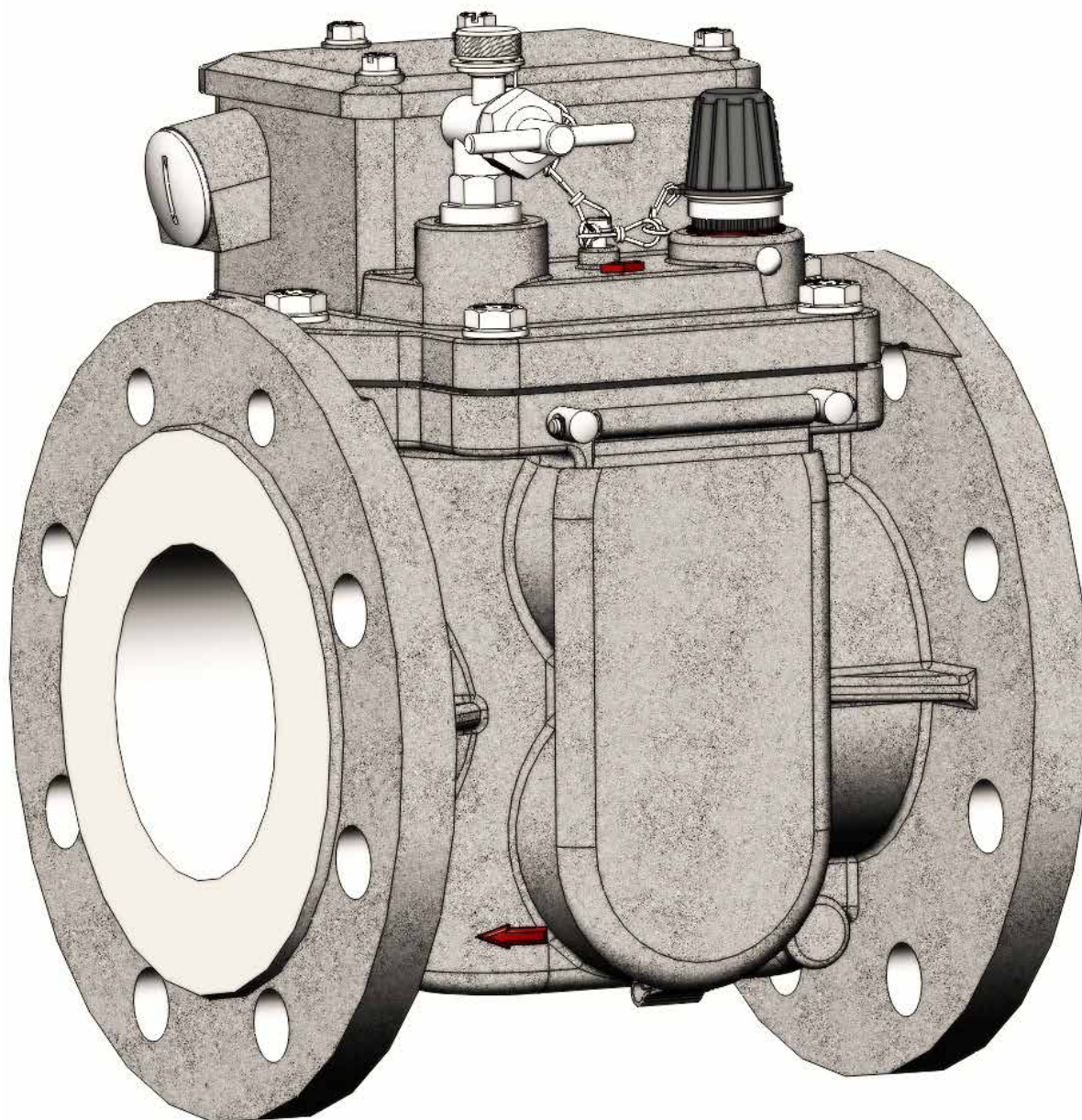




*Elektromotoren und
Gerätebau Barleben GmbH*



**OPERATING INSTRUCTIONS
Transformer Protection Relay
(Buchholz principle)**

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1 Safety instructions

Make sure that any persons installing, taking into operation and operating the Buchholz relay

- are qualified and competent and
- fully comply with these operating instructions.

Improper operation or misuse might cause danger to

- life and limb,
- the relay and other property of the operator and
- the relay's proper function.

Opening of the device will void your warranty.

Safety instructions in this manual are presented in three different forms to emphasize important information:



NOTE

This symbol refers to important information on a specific subject.



CAUTION

This symbol indicates particular risks for the device or any other property of the operator. Danger to life and limb cannot be excluded.



WARNING

This symbol indicates serious danger to life and limb. Disregarding the warning can lead to serious or even fatal injury.

2 Installation

2.1 Installation in piping

The Buchholz relay (Fig. 1/ Number 1) is installed in the pipe (Fig. 1/ no. 2) between the tank (Fig. 1/ no. 3) of the device to be protected (transformer, reactor) and the conservator (Fig. 1/ no. 4). Make sure that the pipe and the Buchholz relay have the same nominal diameters.

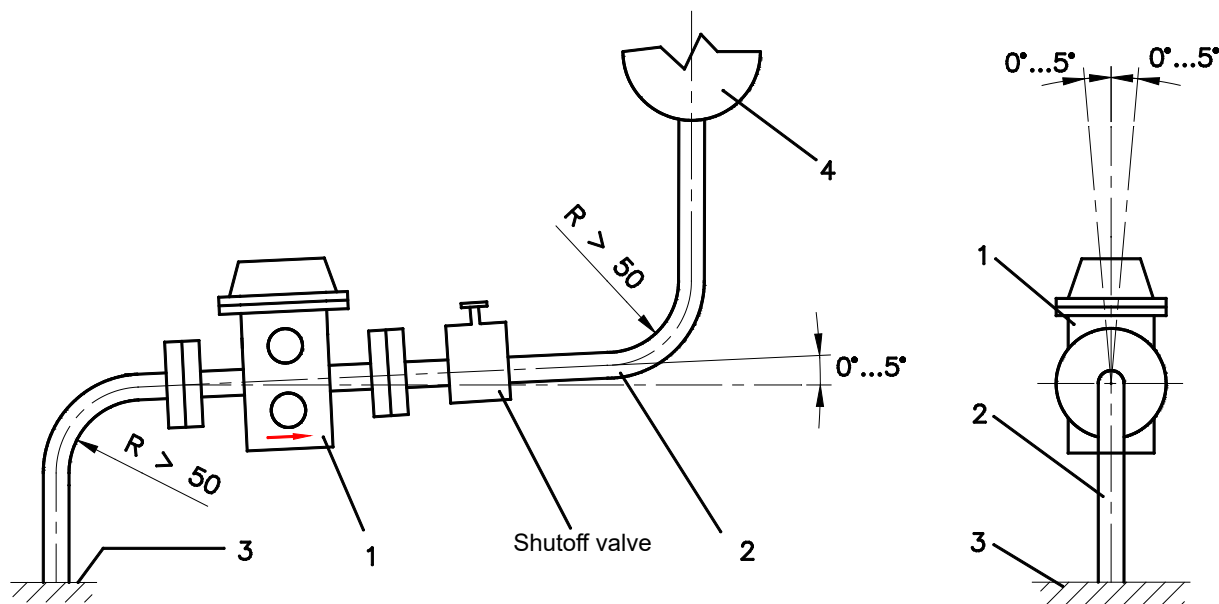


Figure 1 - Installation in piping

Make sure that

- gases produced in the insulating liquid can flow unimpeded to the Buchholz relay.
- the red arrow on the Buchholz relay points to the conservator.
- the flanges are stressed evenly when tightening the screws.
- the slope of the pipe to the conservator is between 0° and 5°.
- the position of the Buchholz relay in relation to the direction of flow does not deviate from the perpendicular by more than 5°.
- the pipe has no elbows, and bends are designed preferably with an inside pipe radius $R > 50$ mm.
- the free pipe length between the Buchholz relay and the nearest reference point does not exceed the following values:

Pipe diameter DN (mm)	25	50	80
Distance (m)	0.5	0.7	1.0

Should the distance exceed the above values, a support has to be provided in the immediate vicinity of the Buchholz relay.



CAUTION

- **Make sure during installation that no dirt, moisture or foreign matter get into the relay.**
- **The insulating liquid of the transformer/reactor may not contain conductive materials!**

2.2 Filling and bleeding of the Buchholz relay

Once the device to be protected is ready for operation and the conservator has been filled with insulating liquid, bleed the Buchholz relay completely.

Proceed as follows:

- Remove the small cap nut (Fig. 2/ no. 1) from the bleeding valve (Fig. 2/ no. 2)
- Open the bleeding valve (turn anticlockwise) and let the air escape from the Buchholz relay
- Close the bleeding valve as soon as insulating liquid comes out (clockwise rotation)
- Fit and tighten the small cap nut

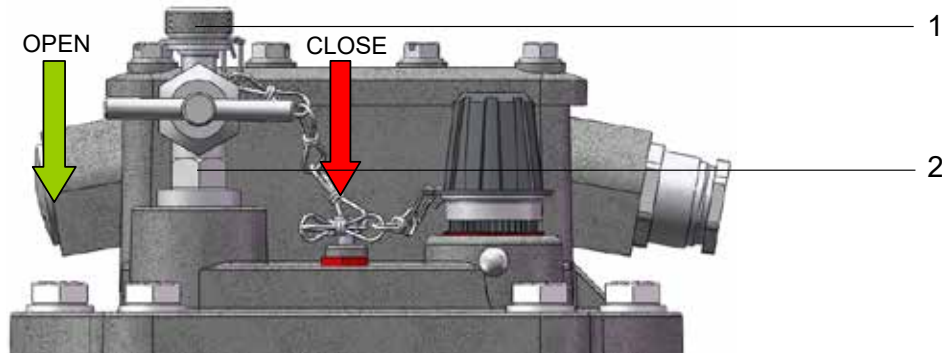


Figure 2 - Bleeding valve

2.3 Removal of transport lock

Proceed as follows:

- Remove the large cap nut (Fig. 3/ no. 1)
- Take the transport lock (Fig. 3/ no. 2) out of the large cap nut
- Fit and tighten the large cap nut **without** the transport lock

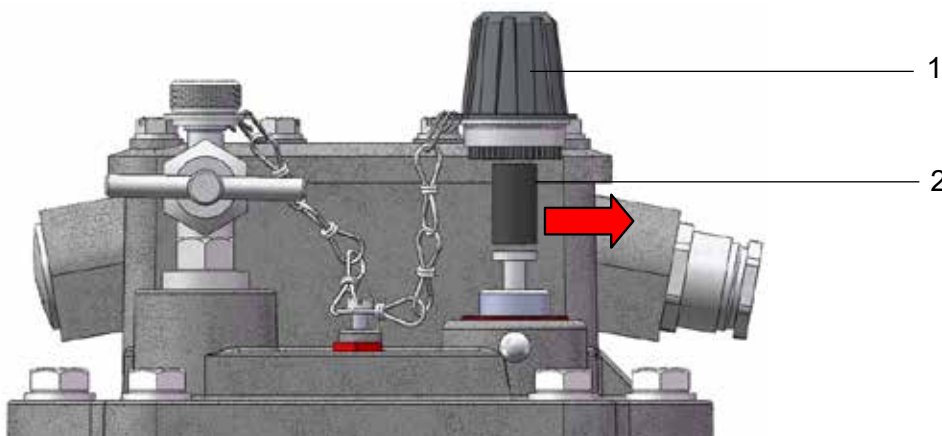


Figure 3 - Removal of transport lock



CAUTION

- Remove the transport lock before taking the Buchholz relay into operation.
- If the Buchholz relay has to be transported again, reinstall the transport lock!

2.4 Connection of signal lead

2.4.1 Electrical connection with up to 8 bushings

Multicore signal leads can be fitted in the Buchholz relay through cable glands. A conductor cross section of 1.5 mm² (copper) is recommended. The maximum conductor cross section that can be clamped is 4.0 mm².

Proceed as follows:

- Remove 4 screws M5 (Fig. 4/ no. 1)
- Remove the cap (Fig. 4/ no. 2)
- Insert the lead through the cable gland (Fig. 4/ no. 3)
- Connect the lead to the terminal studs (Fig. 4/ no. 4) (maximum torque 3 Nm)

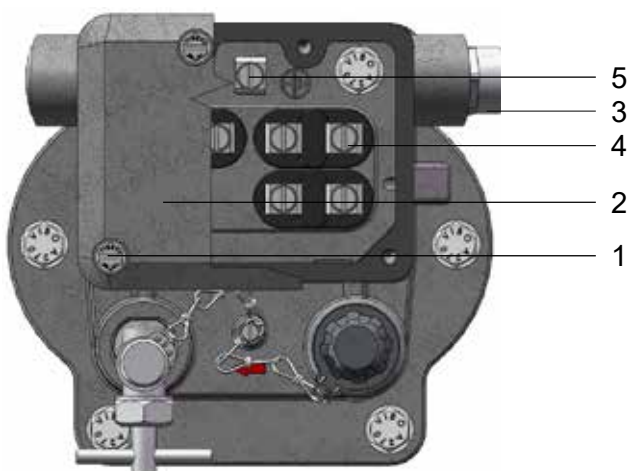


Figure 4 - Electrical connection for up to 8 bushings

Connected load of the switching systems:

Voltage: AC 5 V - max. 250 V
DC 5 V - max. 250 V

Current: AC 0,01 A - max. 6 A $\cos \varphi > 0,5$
DC 0,01 A - max. 6 A $L/R < 40 \text{ ms}$

Switching capacity: AC max. 1500 VA
DC max. 1250 W



NOTE

The inner side of the cap accommodates a plate with the graphic symbol and the connection diagram. The schemes show the switching systems in their neutral position. The neutral position is the operating condition when the Buchholz relay is filled with insulating liquid up to the required level and the device to be protected operates without any fault.



WARNING

Connect the protective conductor (green-yellow insulation) to the earth terminal (Fig. 4/ no. 5) (maximum torque 3 Nm)

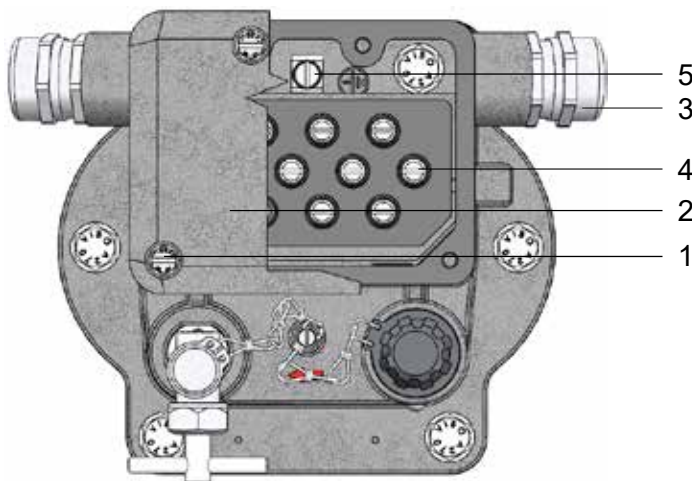
- Tighten the cable gland
- Fit the cap
- Tighten 4 screws M5 (maximum torque 3 Nm)

2.4.2 Electrical connection with more than 8 bushings

Multicore signal leads can be fitted in the Buchholz relay through cable glands. A conductor cross section of 1.5 mm² (copper) is recommended. The maximum conductor cross section that can be clamped is 4.0 mm².

Proceed as follows:

- Remove 4 screws M5 (Fig. 5/ no. 1)
- Remove the cap (Fig. 5/ no. 2)
- Insert the lead through the cable gland (Fig. 5/ no. 3)
- Connect the lead to the terminal studs (Fig. 5/ no. 4) (maximum torque 1,5 Nm)



Connected load of the switching systems:

Voltage: AC 5 V - max. 250 V

DC 5 V - max. 250 V

Current: AC 0,01 A - max. 6 A $\cos \varphi > 0,5$

DC 0,01 A - max. 6 A $L/R < 40 \text{ ms}$

Switching capacity: AC max. 1500 VA

DC max. 1250 W

Figure 5 - Electrical connection for more than 8 bushings



NOTE

The inner side of the cap accommodates a plate with the graphic symbol, the connection diagram and the maximum torque of terminal studs. The schemes show the switching systems in their neutral position. The neutral position is the operating condition when the Buchholz relay is filled with insulating liquid up the required level and the device to be protected operates without any fault.



WARNING

Connect the protective conductor (green-yellow insulation) to the earth terminal (Fig. 5/ no. 5) (maximum torque 3 Nm)

- Tighten the cable gland
- Fit the cap
- Tighten 4 screws M5 (maximum torque 3 Nm)

2.4.3 Electrical connection with premounted Harting-Connector (code 59)

Proceed as follows:

- Remove the safety catch (Fig. 6/ no. 1)
- Remove the cap (Fig. 6/ no. 2)
- Connect the plug ensuring proper alignment
- Lock the connector using the safety catch

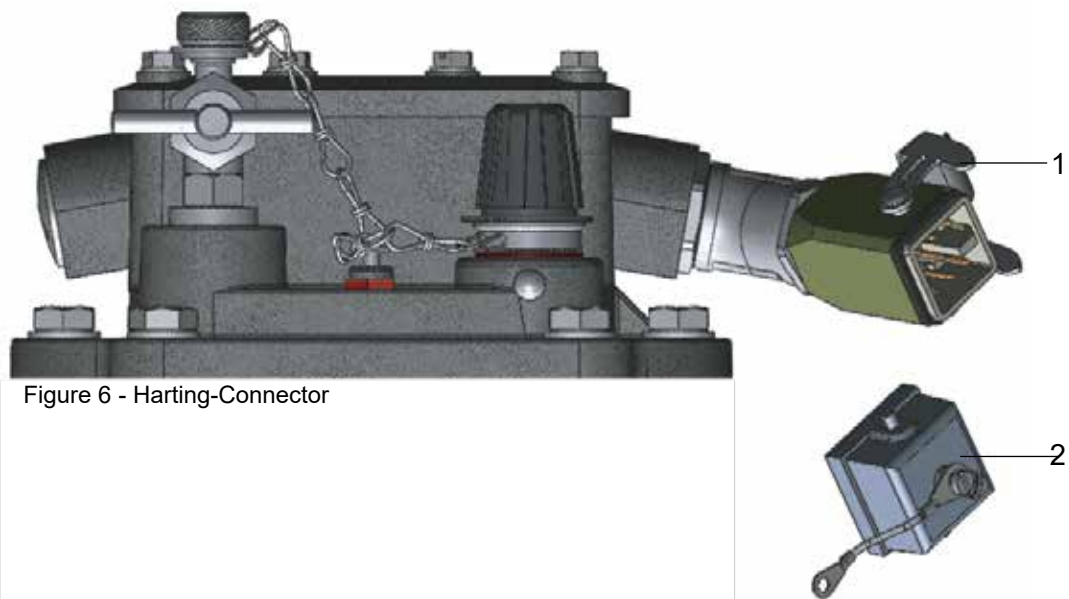


Figure 6 - Harting-Connector

3 Functional test

The test can be performed with the help of the test key (mechanically) or a special test pump (pneumatically). Perform the test while the Buchholz relay is filled with insulating liquid up to the required level.

3.1 Testing by means of test key

3.1.1 Single-float Buchholz relay

Proceed as follows:

- Remove the large cap nut (Fig. 7a/ no. 1)
- Press the test key (Fig. 7a/ no. 2) down to stop position and keep depressed
- Obtain verification of correct function from the control room
- Release the test key
- Fit and tighten the large cap nut

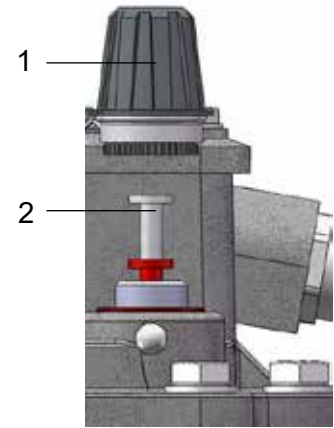


Figure 7a - Test key

3.1.2 Double-float Buchholz relay

Proceed as follows:

- Remove the large cap nut (Fig. 7b/ no. 1)
- Press the test key (Fig. 7b/ no. 2) half down and keep depressed (check of upper switching system - alarm)
- Obtain verification of correct function from the control room
- Press the test key down to stop position and keep depressed (check of lower switching system - disconnection)
- Obtain verification of correct function from the control room
- Release the test key
- Fit and tighten the large cap nut

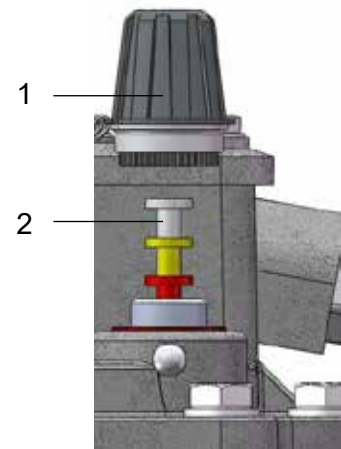


Figure 7b - Test key

3.1.3 Buchholz relay with „two-level gas alarm“ feature (code 17A)

Proceed as follows:

- Remove the large cap nut (Fig. 7c/ no. 4)
- Press the test key slowly down to position 1 (Fig. 7c/ no. 1) and keep it depressed
(Checking the upper switching system – 1st alarm)
- Obtain verification of correct function from control room
- Press the test key down halfway to position 2 (Fig.7c/ no. 2) and keep it depressed
(Checking the upper switching system – 2nd alarm)
- Obtain verification of correct function from control room
- Press the test key down to stop position (Fig. 7c/ no. 3) and keep it depressed
(Checking the lower switching system - disconnection)
- Obtain verification of correct function from control room.
- Release the test key.
- Fit and tighten the large cap nut.

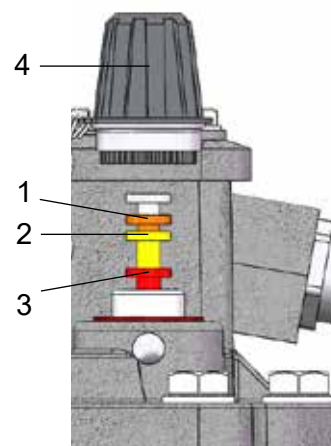


Fig. 7c - Test key



NOTE

We recommend to perform the functional test of the two-level gas alarm system (code 17A) using the test pump as described in section 3.2.

3.1.4 Buchholz relay with „damper held in response position“ feature (codes 23 and 24/24B)

Buchholz relays with the feature „damper held in response position“ are designed such that the damper after it was operated due to an unacceptable high flow rate of the insulating liquid is locked in its position and, hence is kept in this position even after the flow rate has been reduced. This means that the signal generated is maintained.

The damper has to be unlocked manually by turning the test key anticlockwise. When unlocking the damper, also check the insulating liquid level in the Buchholz relay. Bleed the Buchholz relay, if required.



CAUTION

For Buchholz relays with the code 23, 24 or 24B, the damper and hence the lower switching system have to be unlocked after the test by turning the test key anticlockwise.

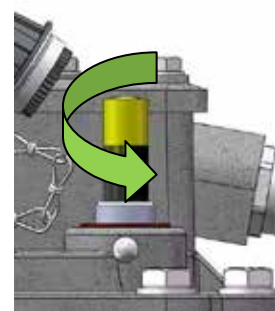


Figure 7d - Test key

3.2 Testing by means of test pump

Proceed as follows:

- Remove the small cap nut (Fig. 8/ no. 1) from the bleeding valve (Fig. 8/ no. 2)
- Fit the adapter (Fig. 8/ no. 3) of the hose (Fig. 8/ no. 4) providing the connection to the test pump on the valve nozzle (Fig. 8/ no. 5)
- Open the bleeding valve (turn anticlockwise)
- Pump air into the single-float Buchholz relay until falling of the float causes the magnet contact tube to operate, or pump air into the double-float Buchholz relay until falling of the **upper** float causes the magnet contact tube to operate
- Obtain verification of correct function from the control room
- Close the bleeding valve (turn clockwise)
- Remove the adapter from the valve nozzle
- Open the bleeding valve and let the air escape
- Close the bleeding valve as soon as insulating liquid comes out
- Fit and tighten the small cap nut on the bleeding valve

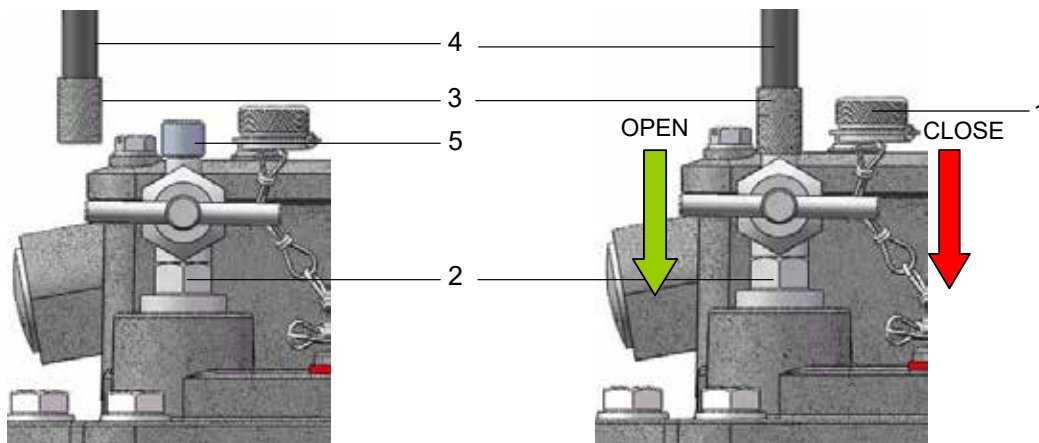


Figure 8 - Testing by means of test pump



NOTE

When the test is performed on the double-float Buchholz relay with the help of a test pump, for design reasons, only the upper switching system (alarm) is tested. Use only test pumps with suitable adapter (globe valve) supplied by EMB (ZG 5.1 or ZG 5.2).

3.3 Operating value of damper

The operating value of the damper is set and checked by the manufacturer in accordance with the order specifications.

The adjusting screw (Fig. 9/ no. 1) must not be readjusted as in this case the operating value of the damper would be changed.

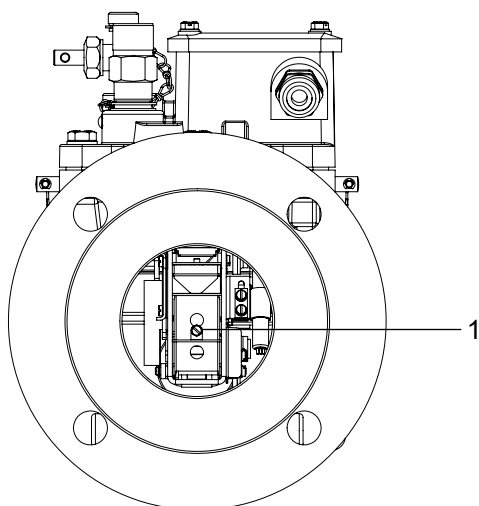


Figure 9 - Lateral view of Buchholz relay with adjusting screw

4 Buchholz relay with additional air supply nipple (code 32)

For Buchholz relays provided additionally with an air nipple (code 32), the mechanical function of the two switching systems can be tested by means of test key (Fig. 10/ no. 1), and the upper switching system (alarm) can be tested by pumping in air via the bleeding valve (Fig. 10/ no. 2) using a suitable test pump. Additionally, the switching systems can be tested pneumatically. To this end, air is supplied via an air supply nipple (Fig. 10/ no. 3) provided with a check valve. Perform the test while the Buchholz relay is filled with insulating liquid up to the required level.

Pneumatic test of the upper switching system (alarm) using compressed air:

Air is introduced **slowly** into the Buchholz relay through the air supply nipple and the pipe air until the alarm contact is made when the upper float is lowered.

Pneumatic test of the lower switching system (disconnection) using compressed air:

Through the air supply nipple and the pipe air is applied **suddenly** to the damper. When the damper responds the disconnection contact is made.

After any test using air, bleed the Buchholz relay through the bleeding valve.

This special design of EMB GmbH combines the requirement of functional testing using compressed air according to the former British standard B.E.B.S. T2 of 1966 and of functional testing using the test key according to the former German norm DIN 42566.

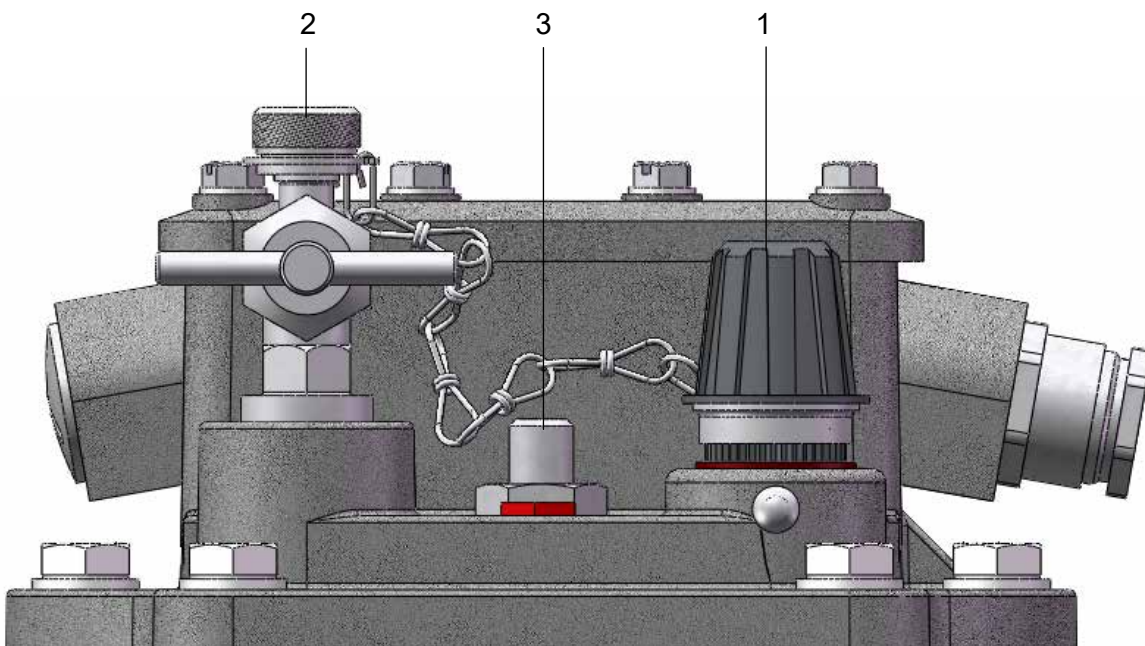


Figure 10 - Testing by means of compressed-air through additional air supply nipple



NOTE

This test serves to check the damper for correct function. The damper setting is not checked.

5 What to do in the case of gas accumulation

When a gas alarm signal is given, the gas should be checked immediately to determine the cause of the fault and avoid potential extension of damage. To this end, withdraw the gas from the Buchholz relay and analyse it.

For gas sampling and transport it is recommended to use the BGS gas sampler supplied by EMB. Alternatively, the gas can be removed with the help of the gas sampling device ZG1 .2, installed at normal operating height and connected with the Buchholz relay through a pipe.

Bleed the Buchholz relay after removal of gas.

6 Maintenance

Buchholz relays are insensitive to ambient conditions, provided these conditions were considered when selecting the particular design of the Buchholz relay. Therefore, no special maintenance is required during operation.

Buchholz relays should be inspected and tested at specified intervals as described in the maintenance instructions of the plant operator. Make sure that the functional tests described are performed.

Unless otherwise specified by the operator, EMB recommends operating the test key once a year in the framework of the scheduled maintenance operations.



CAUTION

When removing the relay, make sure that there is no insulating liquid in the device. On customers request EMB GmbH will ensure proper disposal of old relays.

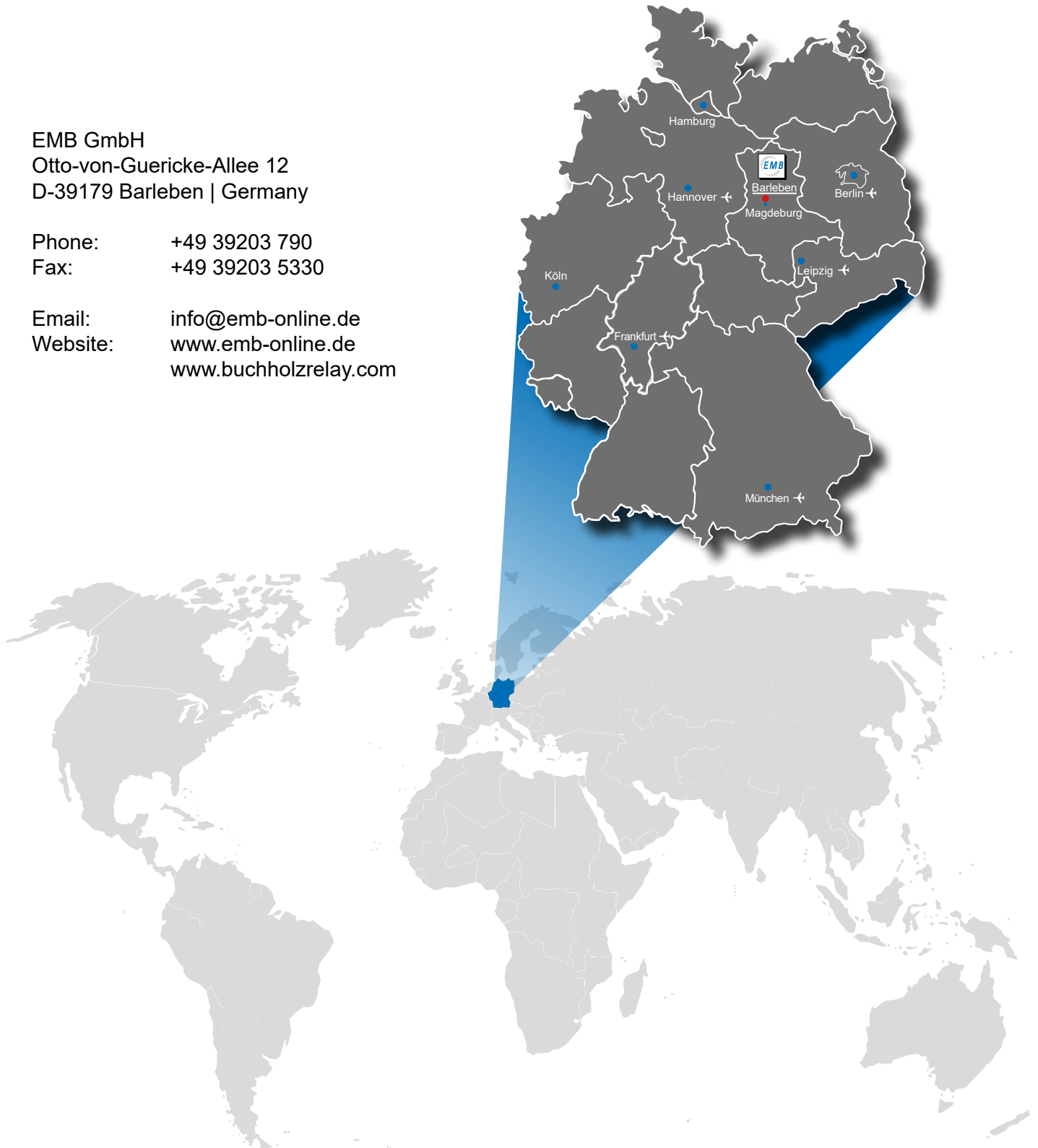


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