OPERATING INSTRUCTIONS
Transformer Protection Relay
NM Series (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 (Figure 1/Number 1) is installed in the pipe (Fig. 1/2) between the tank (Fig. 1/3) of the device to be protected (transformer, reactor) and the conservator (Fig. 1/4). Make sure that the pipe and the Buchholz relay have the same nominal diameters.

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:

<table>
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<tr>
<th>Pipe diameter DN (mm)</th>
<th>25</th>
<th>50</th>
<th>80</th>
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<td>Distance (m)</td>
<td>0.5</td>
<td>0.7</td>
<td>1.0</td>
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</table>

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. 2/1) from the bleeding valve (Fig. 2/2)
- 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 on the bleeding valve

2.3 Removal of transport lock

Proceed as follows:

- Remove the large cap nut (Fig. 3/1)
- Take the transport lock (Fig. 3/2) out of the large cap nut
- Fit and tighten the large cap nut without the transport lock

CAUTION

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

2.4.1 Upper and lower switching system

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 cross section that can be clamped is 4.0 mm².

Proceed as follows:

- Remove 4 screws M5 (Fig. 4/1)
- Remove the dust hood (Fig. 4/2)
- Disconnect the sensor from the amplifier unit by pulling out the M8 line protection plug (LS plug) (Fig. 5/3).

**CAUTION**

Hold the LS plug by the serrated handpiece and pull out without twisting. The plug may be damaged when twisting it.
• Remove 4 screws M5 (Fig. 6/4)
• Remove the cap (Fig. 6/5)
• Insert the lead through the cable gland (Fig. 6/6)
• Connect the lead to the terminal studs (Fig. 6/7) (maximum torque 3 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

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 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. 6/8) (maximum torque force 3 Nm)

• Tighten the cable gland
• Fit the cap
• Tighten 4 screws M5 (maximum torque force 3 Nm)
• Connect the sensor to the amplifier by fitting the LS-plug
• Fit the dust hood
• Tighten 2 screws M5
2.4.2 Functional test of the analogue measuring unit

The sensor (Fig. 7/1) is installed in the cover of the Buchholz relay. The cap of the terminal box accommodates the electronic amplifier and evaluation unit of the measuring device. In as-delivered state both parts are connected by the cable (Fig. 7/2) and the LS plug (Fig. 7/3). Operating voltage supply (DC 24 V) as well as signal transmission are through the amplifier output (Fig. 7/4).

![Figure 7 - Cap of the terminal box](image)

Proceed as follows:

- Insert the three-core cable with integral M12 angle socket into the M12 plug connector of the amplifier output (Fig. 7/4). (It is recommended to use the three-core cable with integrated M12 angle socket of IP 67 degree of protection that is supplied together with the equipment!).
- Adapt the length of the three-core cable and connect the cable as specified (e.g. transformer control box, bus systems, separate power supply).

**CAUTION**

Before performing a dielectric strength test on the Buchholz relay disconnect the sensor from the amplifier and the amplifier from the voltage supply!
Connected load of analogue measuring unit:

Voltage: DC 24 V
Current: max. 50 mA

Figure 8 - Analogue measuring unit
3 Switching system design options

Magnet contact tubes are used as switching elements. These are normally-open (NO), normally-closed (NC) and change-over (CO) contacts. The magnet contact tube design can be derived from the last two digits of the type code. For coding, see Catalogue, Transformer Protection Relays, Ordering data/Type code, Section 12.2.

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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.

**Explanation of symbols:**

Example: coding "...1 2"

- Magnet contact tube(s) design
- Upper switching system - Alarm
- Lower switching system - Disconnection

- Alarm 1 NO

- Graphic symbol with terminal marking

- Disconnection 1 NC

- Connection diagram in terminal box
4 Functional test

The test can be performed with the help of a 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.

4.1 Functional test of the upper and lower switching systems

4.1.1 Testing by means of test key

Proceed as follows:

- Remove the large cap nut (Fig. 9/1)
- Press the test key (Fig. 9/2) 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
4.1.2 Testing by means of test pump

Proceed as follows:

- Remove the small cap nut (Fig. 10/1) from the bleeding valve (Fig. 10/2)
- Fit the adapter (Fig. 10/3) of the hose (Fig. 10/4) providing the connection to the test pump on the valve nozzle (Fig. 10/5)
- Open the bleeding valve (turn anticlockwise)
- Pump air into the 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 10 - Testing by means of test pump](image)

**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).
4.2 Functional test of the analogue measuring unit

The measuring unit is checked for correct function by changing the insulating liquid level in the Buchholz relay and hence the output signal. The insulating liquid level in the Buchholz relay can be changed by pumping air in.

Proceed as follows (please, see figure 10):

- Remove the small cap nut (Fig. 10/1) from the bleeding valve (Fig. 10/2)
- Fit the adapter (Fig. 10/3) of the hose (Fig. 10/4) providing the connection to the test pump on the valve nozzle (Fig. 10/5)
- Open the bleeding valve (turn anticlockwise)
- Pump air into the Buchholz relay
- The output signal of the measuring unit becomes smaller with increasing air volume and finally remains constant at 4 mA.
- Close the bleeding valve (turn clockwise).
- Remove the adapter from the valve nozzle
- Open the bleeding valve and let the air escape
- The output signal of the measuring unit becomes larger and finally remains constant.
- Close the bleeding valve as soon as insulating liquid comes out
- Fit and tighten the small cap nut on the bleeding valve

⚠️ NOTE

0 mA means error in the measuring unit!

⚠️ NOTE

Use only test pumps with suitable adapter (globe valve) supplied by EMB (ZG 5.1 or ZG 5.2).
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.
Due to technical improvement of our products, the information contained in this catalogue is subject to change without notice. We would like to apologize for printing errors which have not been found despite intensive proof-ready. We assume no liability for such errors. Thank you for your understanding.

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