GAS-ACTUATED RELAYS
Buchholz Type
According to
CENELEC EN 50216-2 Standard
And
GAS SAMPLING DEVICE
GAS-ACTUATED RELAYS BUCHHOLZ TYPE

BG 25  BR 25  BR 50  BR 80

BS 25  BS 50  BS 80
GAS-ACTUATED RELAYS BUCHHOLZ TYPE
Minimum clearance to remove the mechanism from the body:

BG 25

Weight: 2.1 kg

BR 25

Weight: 2.9 kg
Minimum clearance to remove the mechanism from the body:

**BR 50**

- Weight: 4.9 kg
- Minimum clearance: 330 Min
- Dimensions: 195 x 195 x 128
- Available with 8 holes

**BR 80**

- Weight: 5.8 kg
- Minimum clearance: 400 Min
- Dimensions: 270 x 193 x 140
- Available with 6 holes
BS 25

Minimum clearance to remove the mechanism from the body: 300 Min

Weight: 2.2 kg

BS 50

Minimum clearance to remove the mechanism from the body: 330 Min

Weight: 4.1 kg
BS 80

Minimum clearance to remove the mechanism from the body: 300 Min

Weight: 4.3 kg

NF 25

Minimum clearance to remove the mechanism from the body: 300 Min

Weight: 3.0 kg
Minimum clearance to remove the mechanism from the body:

**NF 50**

- 300 Min
- Dimensions: 248 x 172 x 15
- Weight: 4.8 kg

**NF 80**

- 330 Min
- Dimensions: 248 x 172 x 15
- Weight: 5.5 kg
Minimum clearance to remove the mechanism from the body:

**C 01**

- 300 Min
- 218
- 160
- 140

**C 1**

- 300 Min
- 218
- 160
- 10

Weight:

- **C 01**: 2.2 kg
- **C 1**: 2.3 kg
Minimum diameter to remove the mechanism from the body

Weight: 5.9 kg
The generation of gas in an oil filled transformer is a clear indication of a problem. The gas may be a result of the following:

- Decomposition/degradation of solid, or liquid insulation inside the transformer due to overheating, or arcing.
- From the outside towards the pipeline.
- From the oil itself due to unsatisfactory de-gassing prior to filling.

Rapid oil movement in the pipeline towards the conservator is caused by an internal arc, short circuit, or hot spot which must be correctly addressed.

Oil leaks from the transformer are environmentally unacceptable and a fire hazard will lead to transformer failure.

To indicate any of the above malfunctions Comem as the result of 40 years experience with these products has developed a new “Buchholz” relay to comply fully with the latest CENELEC EN 50216-1 and EN 50216-2 standards.

The new relay incorporates the very latest technology in its construction.

**PRINCIPLE OF OPERATION**

The Buchholz relay is sited in the pipework between the transformer and its conservator and it is filled with oil during normal transformer operation. When gas is generated in the transformer it rises towards the conservator and collects in the upper chamber of the relay.

The oil level drops and the top float triggers alarm switch.

Gas shall not freely pass from the relay body and escape into the pipework before the alarm contact has operated.

The trip contact shall operate at a steady oil flow as indicated in Table 3.

This operation shall not be adversely affected when the alarm contact has already closed and gas is escaping freely.

In the event of an oil leak the Buchholz relay will only operate after the conservator has exhausted all of its oil. In order to check this eventuality it is recommended that an RDR MK II automatic shutter valve is fitted between the Buchholz and the conservator.

Specific information on this product are available on request.

**CONSTRUCTION**

The new Comem Buchholz relay is an assembly of two machined aluminium alloy castings that effect a perfect oil seal.

1) The main body of the relay is fitted with tempered glass inspection windows with graduated scale markings in cubic centimetres to indicate the internal volume. The oil drain plug is located at the bottom of the main body.

2) The top cover carries the frame which contains the moving parts of the relay. These comprise the two floats and their associated switches encapsulated in glass bulbs, one calibrated flow valve and two permanent magnets.

The cover also carries:

(4) a gas discharge valve with G1/8" in male thread with protective cap.

(5) A valve for pneumatically testing the alarm and insulation circuits, with protective cap.

(2) A push rod for mechanically tripping the alarm and the insulation circuits, with protective cap.

A terminal box which as standard contains 4 numbered M6 terminals and one earth terminal.
EXTERNAL COATING AND PROTECTION

To the external aluminium alloy parts is given a phosphate treatment prior to applying one coat of vinyl enamel, colour RAL 7001. This treatment has proved more than satisfactory over the years for the majority of applications including desert and tropical situations. However, in particularly severe applications (>500h salt fog) such as applications in corrosive atmospheres (acids) a suitable epoxy primer is recommended. (This should be discussed at the time of selection).

All external brass fittings are plated and all nuts are made in stainless steel.
RELAY SELECTION
The size and type of relay to be used will depend on the transformer rating and oil volume. Suggestions are given in the following table but the final choice is often as a result of the transformer manufacturers experience.

<table>
<thead>
<tr>
<th>MVA TRANSFORMER POWER</th>
<th>NOMINAL DIAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 5</td>
<td>25</td>
</tr>
<tr>
<td>From 5 up to 20</td>
<td>50</td>
</tr>
<tr>
<td>From 20 up to 50</td>
<td>80</td>
</tr>
<tr>
<td>Over 50</td>
<td>100</td>
</tr>
</tbody>
</table>

TECHNICAL DATA

- The relay pipework is typically mounted at 2.5 degrees to the horizontal. A positive inclination of up to 5 degrees to the horizontal axis is admissible.
- Operating pressure - 1 bar, tested to 2.5 bar for 2 minutes at 100 deg C.
- Gas volume to trip alarm:

<table>
<thead>
<tr>
<th>BUCHHOLZ RELAY TYPE</th>
<th>GAS VOLUME NECESSARY TO TRIP THE ALARM</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG 25, BR 25, NF 25, C 01 , C 1</td>
<td>100÷200</td>
</tr>
<tr>
<td>NF 50, NF 80</td>
<td>100÷200</td>
</tr>
<tr>
<td>BR 50 , BR 80, C 4</td>
<td>150÷250</td>
</tr>
<tr>
<td>BS 25</td>
<td>170÷230</td>
</tr>
<tr>
<td>BS 50, BS 80</td>
<td>250÷300</td>
</tr>
</tbody>
</table>

- Rate of oil flow in m/s to trip insulation. In the following table standard values are highlighted with an 'O' available, on request with an 'X' and not available with a '/'. +/- 15% tolerance at 20°C with oil viscosity according to IEC296.

<table>
<thead>
<tr>
<th>INSIDE PIPE DIAMETER</th>
<th>1,0 m/s</th>
<th>1,5 m/s</th>
<th>2,0 m/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>O</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>50</td>
<td>O</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>80</td>
<td>O</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>100</td>
<td>//</td>
<td>O</td>
<td>X</td>
</tr>
</tbody>
</table>

- The relay operates within 0.5 seconds.
- Oil temperature between -25 and +115 deg C.
- Ambient temperature between -25 and +60 deg C.
- Degree of Protection IP65 to EN 60529.

SWITCH ELECTRICAL DATA
Rated switch current is 2 A r.m.s. with max. 10 A r.m.s. as short term 30 ms current value. Breaking power is specified in the following table:

<table>
<thead>
<tr>
<th>VOLTAGE</th>
<th>CURRENT</th>
<th>BREAKING POWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>220 V d.c. (min. 12 V)</td>
<td>2 A for 10000 maneuvers</td>
<td>250 W, L/R &lt; 40 ms</td>
</tr>
<tr>
<td>230 V a.c. (min. 12 V)</td>
<td>6 A for 10000 maneuvers</td>
<td>400 VA, cos ϕ &gt; 0.5</td>
</tr>
</tbody>
</table>

Dielectric contact voltage as specified in the following table:

<table>
<thead>
<tr>
<th>SHORT TERM INDUSTRIAL FREQUENCY LEAKAGE TEST kV/1 min. (r.m.s)</th>
<th>RESISTANCE VOLTAGE PER PULSE kV (peak)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between circuits and ground</td>
<td>2.5</td>
</tr>
<tr>
<td>Across open contacts</td>
<td>1.0</td>
</tr>
</tbody>
</table>
**TESTING**

The following Type Tests have been performed on the relay:

- Measurement of the volume of gas necessary to trip the alarm.
- 500 hr salt fog.
- Electromagnetic Field Test. Relay does not trip in field strength up to 25 mT (ref EN 50216-2).
- Stationary sinusoidal mechanical vibrations. Tests according to EN 60721-3-4 standards have been performed.
  a) class 4M4 (4M6 on request) vibration test applied in sites where vibrations are transmitted from machinery and vehicles. Not suitable for machines exposed to high vibration and shock levels. Three-axis movement was impressed to the relay using special equipment with stationary sinusoidal vibrations from 2 to 200 Hz. Movement had a constant 3 mm (6 mm peak-peak) amplitude in the range from 2 to 9 Hz whereas above this frequency it had constant 10 m/s² acceleration. The alarm and release switches did not trip.
  b) non-stationary vibration tests with vertical shock with 100 m/s² acceleration with type I spectrum (duration 11 ms) as shown in the graph below. Alarm and release contacts did not trip. On demand we are able to manufacture Buchholz relays with special features and test values higher than the ones stated above.

![Example duration of a sinusoidal half pulse](image)

**ROUTINE TESTS**

The following Routine Tests are applied to all relays.

- Hydraulic seal test in mineral oil at 90 deg C and 100 kpa pressure for 30 minutes.
- Contact operation via mechanical push rod.
- Contact operation by lowering the oil.
- Rate of oil flow to trip contacts.
- Electrical withstand test between contacts (as shown in table 5).
- Electrical withstand test between contacts and earth (as shown in table 5).

An individual routine Test Report is shipped with each relay.

**RELAY OPERATING TEST**

The following site Tests can be performed when the relay is installed on the transformer

The Alarm and Trip contacts can be tested manually by the push rod (2) - mechanical test, or (only for alarm contact) by the introduction of air into the relay through valve (5) - pneumatic test.

A bicycle pump can be utilised for this test or a kit article n° 5400806002 is available from Comem.

To effectively test the rate of flow of oil is a complex test requiring specialised equipment. Should this test be required other than as a type test then Comem can perform this on request at the time of the order.

**INSTALLATION INSTRUCTIONS**

The following installation procedures must be observed for proper relay operation:

- The red arrow on the relay must point towards the conservator.
- The relay must always be full of oil, which means that the minimum oil level in the conservator must be higher than the relays breather valve.
- The recommended inclination of the relay pipework is 2.5 degrees from the horizontal.
- The pipe from the transformer to the relay must exit the transformer at the highest point.
- The pipeline upstream from the relay has to be straight and with a length equal to 5-10 times the pipeline diameter, at least.
  Down stream from the relay, pipeline length has to be 3 times the pipeline diameter, only. It must rise up towards the conservator.
RELAY ORDER FORM

Chosen size and model (see drawings and table 1):

<table>
<thead>
<tr>
<th></th>
<th>BG 25</th>
<th>BR 25</th>
<th>BR 50</th>
<th>BR 80</th>
<th>BR 80</th>
<th>BS 25</th>
<th>BS 50</th>
<th>BS 80</th>
<th>NF 25</th>
<th>NF 50</th>
<th>NF 80</th>
<th>C 01</th>
<th>C 1</th>
<th>C 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐</td>
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</tr>
</tbody>
</table>

Electric contact layout (meaning with relay filled with oil and operating):

![Diagram Type A](image1)
![Diagram Type B](image2)
![Diagram Type C](image3)

Chosen seals:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

**TYPE OF DIELECTRIC**

<table>
<thead>
<tr>
<th>AMBIENT TEMPERATURE/OIL</th>
<th>MINERAL</th>
<th>SILICONE</th>
<th>ESTERIZED</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>NBR</td>
<td>VITON/NBR</td>
<td>//</td>
</tr>
<tr>
<td>Ambien t -25° ÷ 60° C</td>
<td>Standard version</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil -25° ÷ 115° C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>//</td>
<td>VITON</td>
<td>VITON</td>
</tr>
<tr>
<td>Ambient -10 ÷ 60° C</td>
<td>Special version</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil -10° ÷ 115° C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>NBR/VITON</td>
<td>NBR/VITON</td>
<td>NBR/VITON</td>
</tr>
<tr>
<td>Ambient -40° ÷ 60° C</td>
<td>NBR/VITON</td>
<td>NBR/VITON</td>
<td>NBR/VITON</td>
</tr>
<tr>
<td>Oil -40° ÷ 115° C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(NBR/VITON: meaning: parts in contact with oil in VITON, parts not in contact with oil in NBR)  

Paint finish:

<table>
<thead>
<tr>
<th></th>
<th>Standard</th>
<th>Corrosive environments</th>
<th>Other special finishes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
GAS SAMPLING DEVICE WITH APPLICATION OF THE BUCHHOLZ RELAY OIL DRAIN COCK

PRINCIPLE OF OPERATION

The presence of gas inside an oil filled transformer is always a sign of malfunction and one of the tasks of the Buchholz relay is to signal this presence. Analysis of the evolved gas can often give good indication of the type of malfunction but accessing the Buchholz relay during live operation of the transformer can be hazardous.

The gas sampling device has been designed to overcome this problem by siting the unit remote from the Buchholz and in a readily accessible position typically on the side of the transformer.

CONSTRUCTION

The Comem gas sampling device is manufactured from an aluminium alloy casting with the following fittings:

- A tempered glass inspection window with graded markings for volume indication.
- A gas sampling valve (2).
- A bleed valve (3).
- A gas inlet valve for pneumatic testing (5).
- A valve for draining oil from the relay (this can be mounted on the right or left hand side of the body (6) or (7). As a routine test all castings are tested by injecting ambient air at 2.5 bar for 2 minutes.

A certificate to this effect is supplied with the unit.

For the sake of standardisation the device is fitted with the left and right hand valve supports but only one valve.

Customer can then choose which side he prefers.

- With fittings for outside dia. 10 tubes, code 1RDPG00005 (standard);
- with fittings for outside dia. 6 tubes, code 1RDPG00006 (on request);
- with fittings for outside dia. 8 tubes, code 1RDPG00007 (on request).
DESCRIPTION OF OPERATION

During normal operation the Buchholz relay is full of oil and is connected to the gas sampling device via pipelines 10 and 11.

Valves (8), (2) and (9) are open.

Valves (3), (4), (6) or (7) are closed.

The gas sampling device is consequently also full of oil.

Sampling procedures are as follows:

A - To sample oil: open valve (6) or (4).

B - To sample gas if the relay has signalled alarm or tripped the transformer:

Open valve 4 and let the oil in the device flow out. This draws any gas from the relay via valve (8), tube (11) and valve (2) into the body of the gas. The progress of this operation can be checked through the inspection window. When the desired amount of gas has been collected close valves (2) and (4) and open valve (3) to take the sample.

C - To test satisfactory operation of the alarm and trip circuits proceed as follows:

Close valve (2) then drain all the oil from the device by opening valves (3) and (4). Attach an air pump (bicycle pump) or kit from Comem 5400806002 to valve (5). Close valves (3) and (4) and pump fast whilst simultaneously opening valve (2). The air will then pass into the upper chamber of the Buchholz relay via pipeline (11) lowering the floats and consequently closing their contacts. If you wish to test the lower float then first the valve between the relay and the conservator must be closed to prevent air from flowing directly into the conservator.

OPERATION STARTING

Caution: After commissioning ensure the Buchholz relay and the sampling device are both filled with oil.