Elektromotoren und
Gerätebau Barleben GmbH

Transformer Protection Relays
(Buchholz Principle)

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Firm's history

Since its foundation the company has been passed through an eventful history with regard to ownership, affiliation and connected with these changes of firm names.

1863 Foundation of the company as sugar factory

1943 Establishment of SIEMENS Magdeburg

1948 VEB[1] Elektromotorenwerk Barleben; VEM (state-owned firm)

1951 VEB[1] Starkstromanlagenbau Magdeburg (state-owned firm)

1951 Start of manufacturing Buchholz relays at site in Barleben

1970 VEB[1] Elektrotechnik und Gerätebau Magdeburg; EGEM (state-owned firm)

1980 VEB[1] Kombinat Elektromaschinenbau Dresden
VEB[1] Elektromotorenwerk Barleben; VEM; ELMO (state-owned firm)

1990 VEM Antriebstechnik AG Dresden
Elektromotorenwerk Barleben GmbH; VEM; ELMO (public limited company)

1993 Elektromotoren und Gerätebau Barleben GmbH; EMB (privately owned company)

[1] VEB = nationally owned firm

Preface

The Buchholz relay was developed in 1921 by Max Buchholz, Oberrat at the Prussian Electric supply company - PLC in Kassel. Since that time it has been an important protection and monitoring device for liquid-cooled transformers and choke coils. It is known for its easy operation, high reliability, maintenance-free operation and extremely long life.

It is built in the cooling cycle of the appliances to be protected and responds in the event of troubles like gas accumulation, loss as well as high flow of the insulation liquid. For transformers with hermetical closure by means of a membrane (rubber sack) in the expansion tank Buchholz relays can be used also as indicating device ("Air Cell Failure Relay") of this membrane.

The company has had for more than 50 years experience in producing Buchholz relays and other protection devices for liquid-cooled appliances. It ranks among the most distinguished manufacturers of this kind of equipment.

Experiences collected and profound know-how are the sound basis for a high product quality. References from reputed transformer manufacturers and further users are proof of the high level of the products. The company is ISO 9001/2008 certified.


CERTIFICATE

ISO 9001:2008

The staff of highly qualified engineers and experienced skilled workers does their best to guarantee top quality high-precision products. The mechanical working of the casings is done on modern CNC-controlled machine tools. The final tests, where all the functions of the Buchholz relays are checked, are done with each device by using special test equipment.

The type diversity of the Buchholz relays is tailored to norms and standards as well as to special customer demands. EMB-Buchholz relays are in compliance with EN 50216. The type of relay to be used depends on nominal rating and construction features of appliance to be protected. Our range of products permits optimum adaptation to actual requirements. Buchholz relays may be used in open-air or also in indoor equipment.

1. Design features

Casing-Components (Figures 1A and 1B)

The casing is a weather-resistant casting of light alloy and is provided with a paint coat. It is supplied either with screwed or flanged ends (1). The variants of casings are shown under para. 4, further are possible on request.

The casing has sightglasses (2) for inspection of function of the switching systems. The sightglasses with scale permit reading of collected gas volume.

The relays can be equipped with lids (3, may be folded up) before the sightglasses.

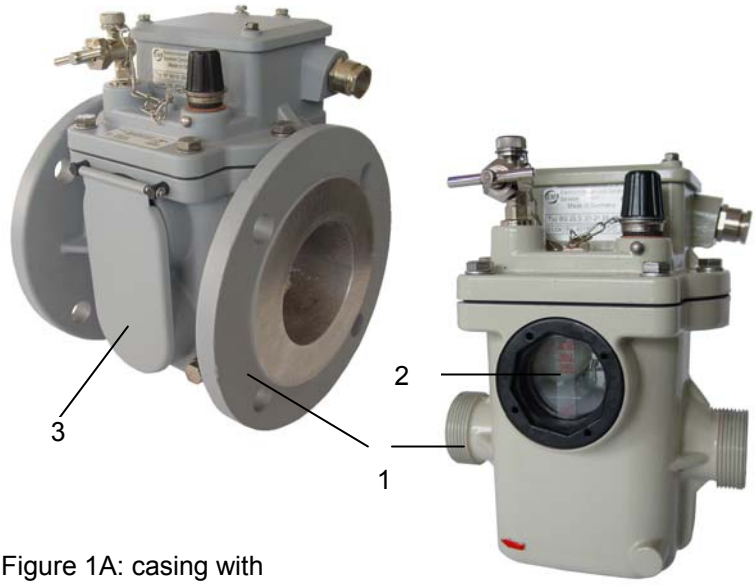


Figure 1A: casing with flange connection

Figure 1B: casing with thread connection

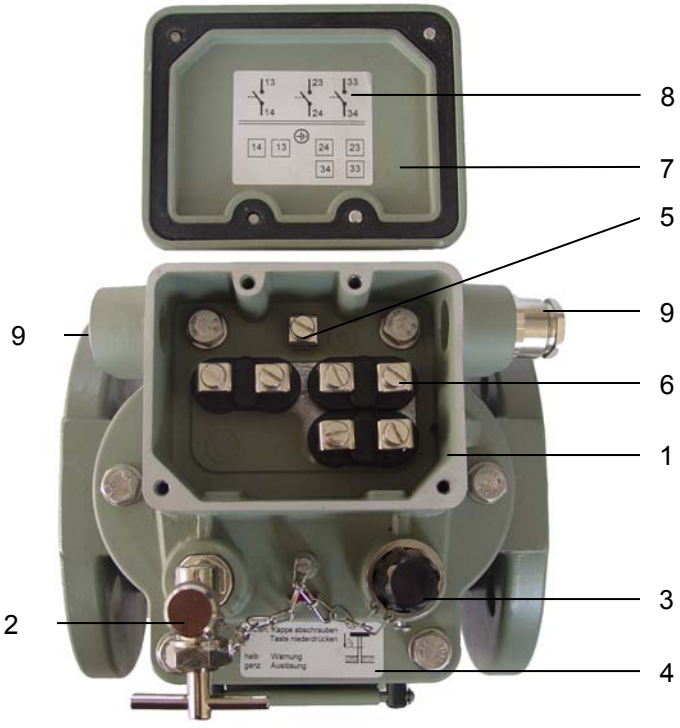


Figure 2: cover with dismantled cap

Cover-Components (Figure 2)

The cover is a weather-resistant casting of light alloy and is provided with a paint coat. Terminal box (1), test valve (2) and test key, covered by a cap nut (3) as well as a plate for operation of the test key (4) are arranged above the cover. The terminal box has an earthing contact (5) and at most eight electrical connectors (6). By the number of these connectors the design of the switching systems concerning kind and quantity of the magnet contact tubes is determined.

The aluminium cap (7) seals the terminal box. If the cap is opened the contact setting (8) can be seen. The cable may be optionally brought in through one of both cable glands (9).

Switchgear-Components (Figures 3A and 3B)

The switchgear has the following main components:

- Switching system
- Carrier, frame components
- Mechanical testing device.

Whereas the single-float Buchholz relay has only one switching system, the double-float Buchholz relay has an upper and a lower switching system. Permanent magnet and float are rigidly linked forming an unit that is movably fitted to the frame together with mechanical testing device and magnet contact tube(s).

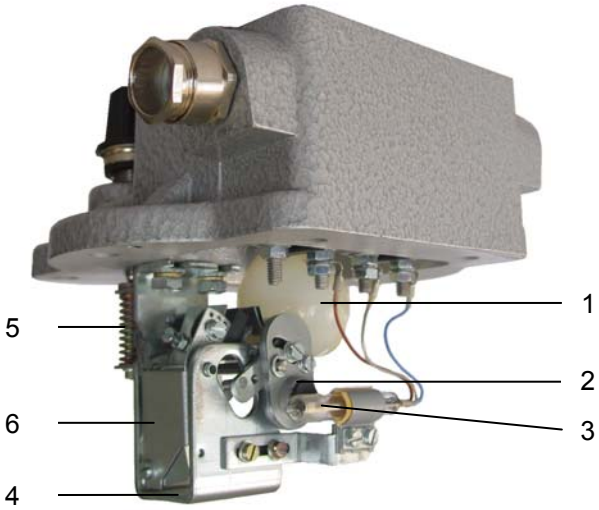


Figure 3A: Switchgear of a single-float Buchholz relay

Switchgear of a single-float Buchholz relay:

float (1)
permanent magnet(s) (2)
one or two magnet contact tubes (3)
frame (4)
mechanical testing device (5)
damper (6)

The damper is hold by a *permanent magnet*.

Switchgear of a double-float Buchholz relay:

upper float (1)
lower float (1a)
permanent magnet(s) for upper float (2)
permanent magnet(s) for lower float (2a)
one or two magnet contact tubes for upper switching system (3)
one or two magnet contact tubes for lower switching system (3a)
frame (4)
mechanical testing device (5)
damper (6)

The damper is hold by a *permanent magnet* and acts on the lower switching system.

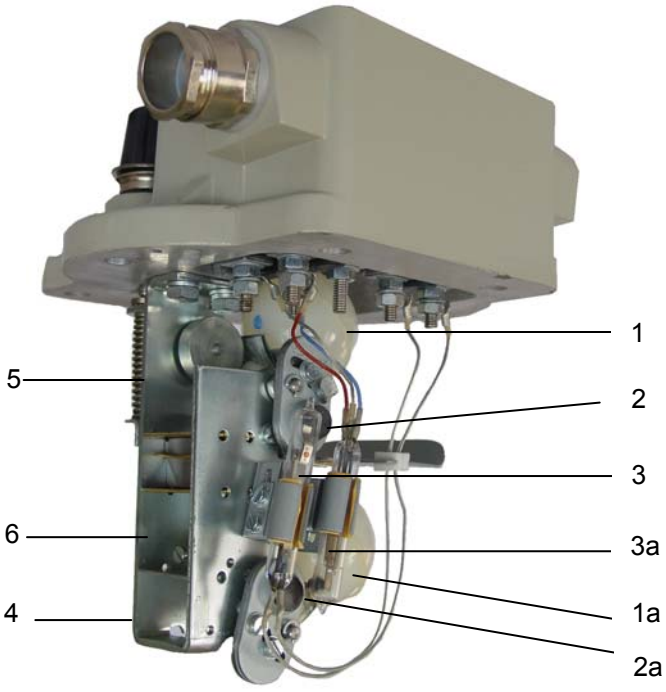


Figure 3B: Switchgear of a double-float Buchholz relay

2. Function of the Buchholz relay

In the following the function of a Buchholz relay is explained using the example of a double-float Buchholz relay. The relay is built in the connecting pipe between the transformer tank and the conservator. During normal operation it is filled completely with insulating liquid. Due to buoyancy the floats are at their top position. If a fault occurs inside the transformer, the Buchholz relay responds as follows:

Gas accumulation

Fault: Free gas is available in the insulating liquid.

Response: The gas in the liquid moves upwards, accumulates in the Buchholz relay and displaces the insulating liquid level. The moving float actuates a switch contact (magnet contact tube). An alarm signal is tripped.
The lower float is not affected as from a certain gas volume the gas flows through a piping to the conservator.

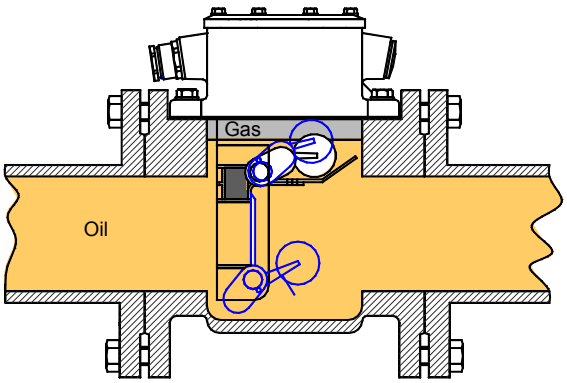


Figure 4: Gas accumulation

Insulating liquid loss

Fault: Insulating liquid loss due to leakage.

Response: As the liquid level falls the top float moves downwards. An alarm is tripped. If the liquid loss continues, conservator and piping as well as the Buchholz relay will be emptied.
As the liquid level falls, the lower float moves downwards. The moving float actuates a switch contact so that the transformer is disconnected.

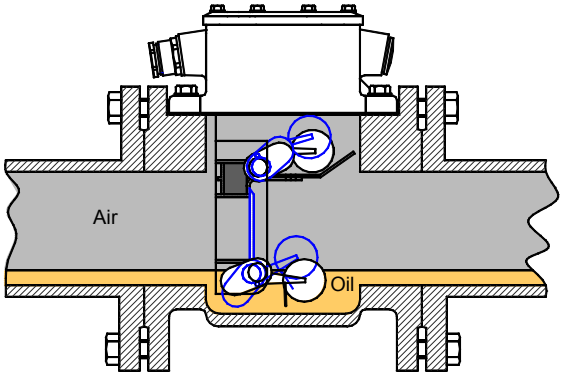


Figure 5: Insulating liquid loss

Insulating liquid flow

Fault: A spontaneous incident generates a pressure wave moving in the direction of the conservator.

Response: The liquid flow reaches the damper arranged in the liquid flow. If the flow rate exceeds the operating threshold of the damper, the latter moves in flow direction. Due to this movement a switch contact is actuated so that the transformer is disconnected.
After release of the pressure wave the lower switching system returns to its starting position.
Buchholz relays manufactured by EMB are equipped with a damper held by a permanent magnet.

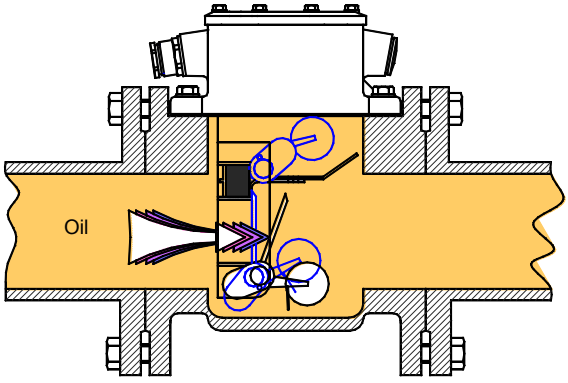


Figure 6: Insulating liquid flow

The upper and lower switching system form a functional unit in the single-float Buchholz relay. In case of a fault, the single-float Buchholz relay normally isolates the transformer immediately from the net .

3. Tests

To each Buchholz relay a works-number is given mentioned in the test certificate and on name plate. Furthermore the tests made with each Buchholz relay are documented in the test certificate.

- Dielectric strength test
  (AC 2000 V against casing)
- Leakage test
  (acc. to EN 50216-2)
- Functional test
  (switching function)
- Flow test
  (response value of the damper)

Buchholz relays are delivered in transport cardboards. In the cap nut of the test key there is a temporary lock for the switching system. This temporary lock has to be removed before the device is taken into operation.

With each device we deliver in the agreed language:

- operating instructions
- test certificate.

The following information are on name plate:

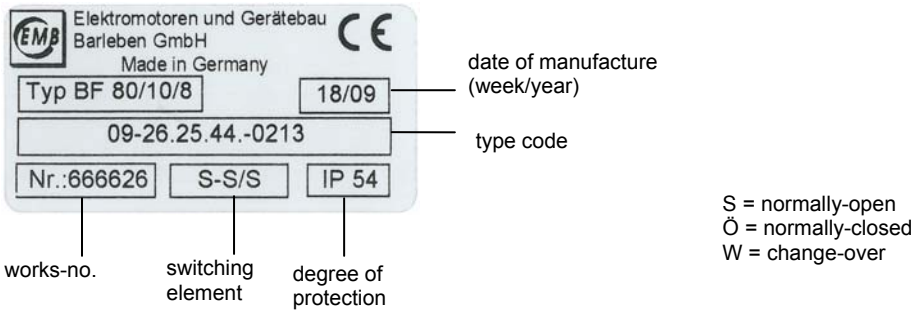


Figure 7: Flow test

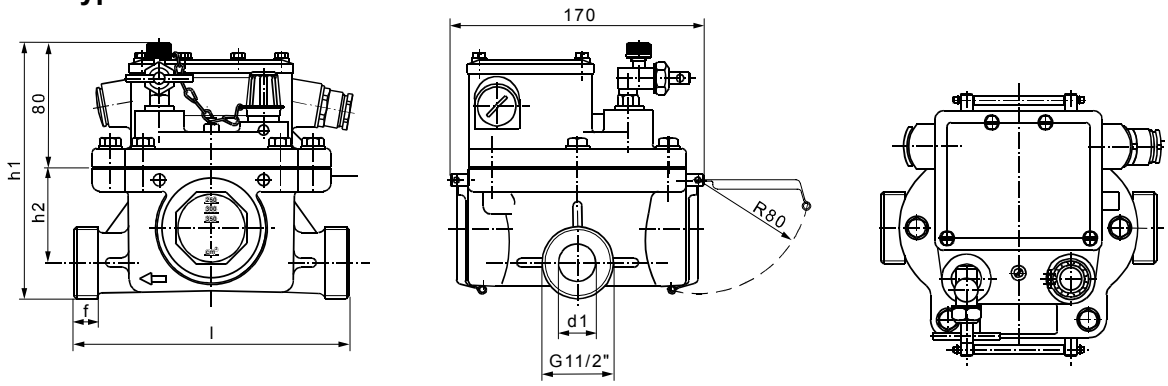
Figure 8: Functional and leakage test

4. Type list

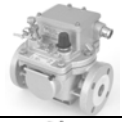
4.1. Single-float Buchholz relays with thread connection

	Type code no. Works-design. DIN-design.	Mode of connection	DN of pipe (mm) d_1	Flange dimensions (mm) d_2	d_3	d_4	d_5	f	Device dimensions (mm) l	h_1	h_2	weight (kg)	Suited for transformer ratings of
	**01 (AG 25) (CG 25)**	Connection thread G $1^1/_2$ "	**25**	-	-	-	-	16	185	170	62	3.1	≤ 1600 KVA

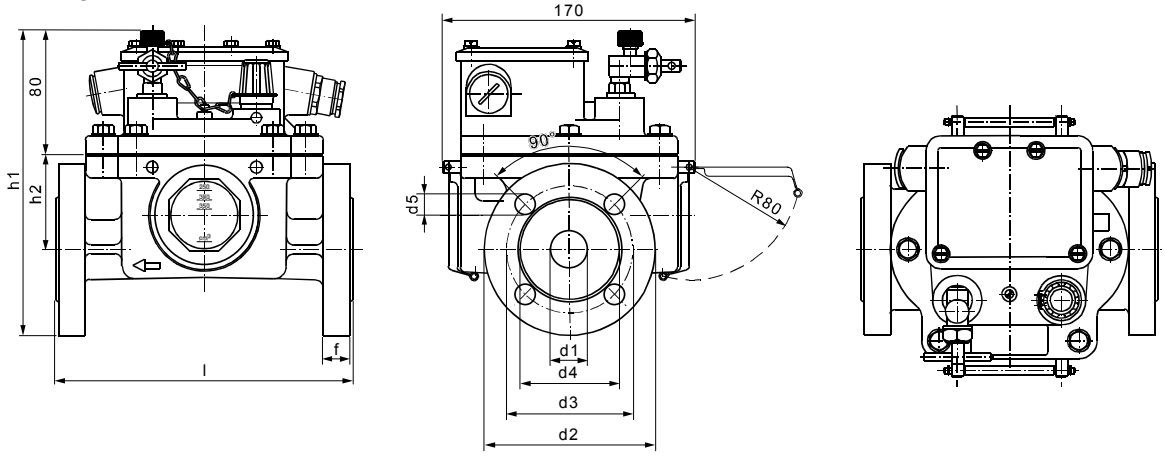
4.1.1. Type 01



4.2. Single-float Buchholz relays with flange connection

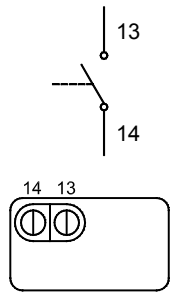
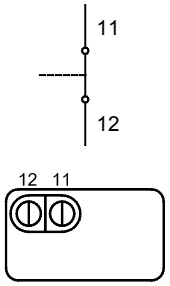
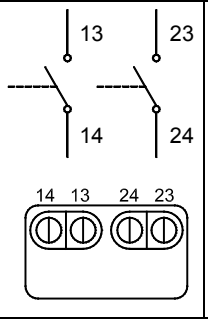
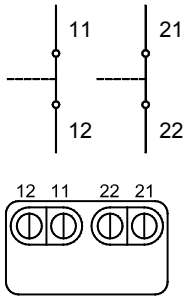
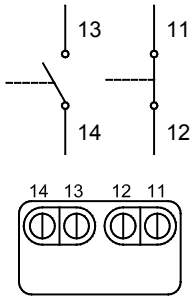
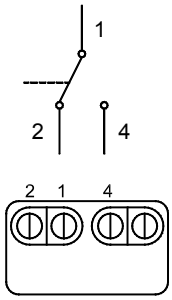
	Type code no. Works-design. DIN-design.	Mode of connection	DN of pipe (mm) d_1	Flange dimensions (mm) d_2	d_3	d_4	d_5	f	Device dimensions (mm) l	h_1	h_2	weight (kg)	Suited for transformer ratings of
	**02 (AF 25/6) (-)**	Flange 4-holes	**25**	100	75	60	12	12	185	195	62	3.6	≤1600 KVA
	**03 (AF 25/10) (-)**	Flange 4-holes	**25**	115	85	68	14	16	200	205	62	4.0	≤ 1600 KVA
	**25 (AF 25) (-)**	Flange 4-holes	**25**	100	75	--	12	10	160	195	62	3.3	≤ 1600 KVA

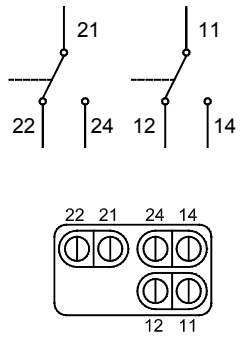
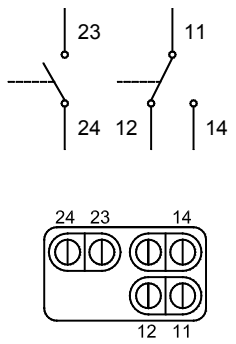
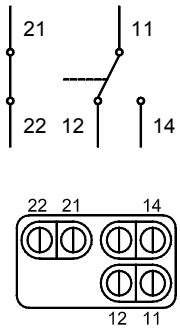
4.2.1. Type 02, 03, 25



4.3. Single-float Buchholz relays – possible switching system designs

As switching elements are used magnet contact tubes. There are **normally-closed** (NC), **normally-open** (NO) or **change-over** (CO) versions.
For coding of the switching system version see point 7. ordering data, page 23.
The magnet contact tube version is coded by the last figure of the ordering number.

...01	...02	...03	...04	...05	...06
1 NO	**1 NC**	**2 NO**	**2 NC**	**1 NO and 1 NC**	**1 CO**
					

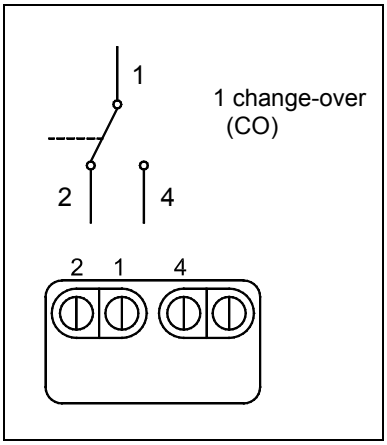
...07	...08	...09
2 CO	**1 NO and 1 CO**	**1 NC and 1 CO**
		

Explanation of symbols:

not occupied

Example: coding „ ...**0 6** “

switching system version (1 CO)



--- Graphical symbol with terminal marking

--- Terminal assignment in terminal box

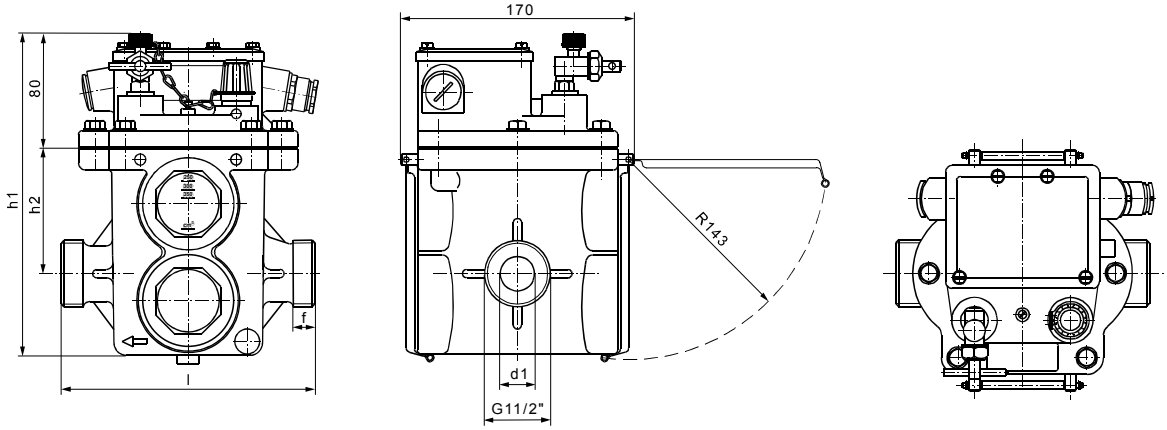
Note:
The switching systems is shown in its normal position, i.e. with the Buchholz relay filled completely with insulating liquid corresponding to trouble-free operation of the device to be monitored.

A plate showing the connection diagram and the terminal assignment is arranged inside the cap of each Buchholz relay delivered by EMB.

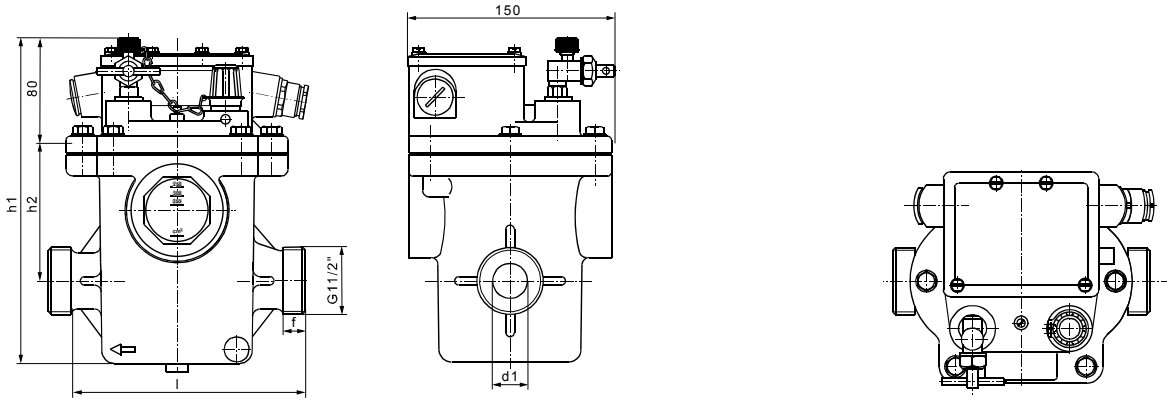
4.4. Double-float Buchholz relays with thread connection

	Type code no. Works-design. DIN-design.	Mode of connection	DN of pipe (mm) d_1	Flange dimensions (mm) d_2	d_3	d_4	d_5	f	Device dimensions (mm) l	h_1	h_2	weight (kg)	Suited for transformer ratings of
	**04 (BG 25) (DG 25)**	Connection thread G $1^1/_2$ "	**25**	-	-	-	-	16	185	235	90	4.2	≤ 5000 KVA
	**21 (BG 25 S) (-)**	Connection thread G $1^1/_2$ "	**25**	-	-	-	-	16	185	235	90	3.6	≤ 5000 KVA

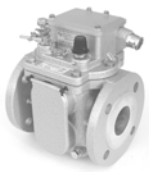
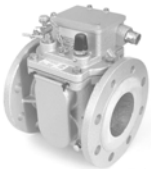
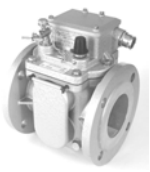
4.4.1. Type 04



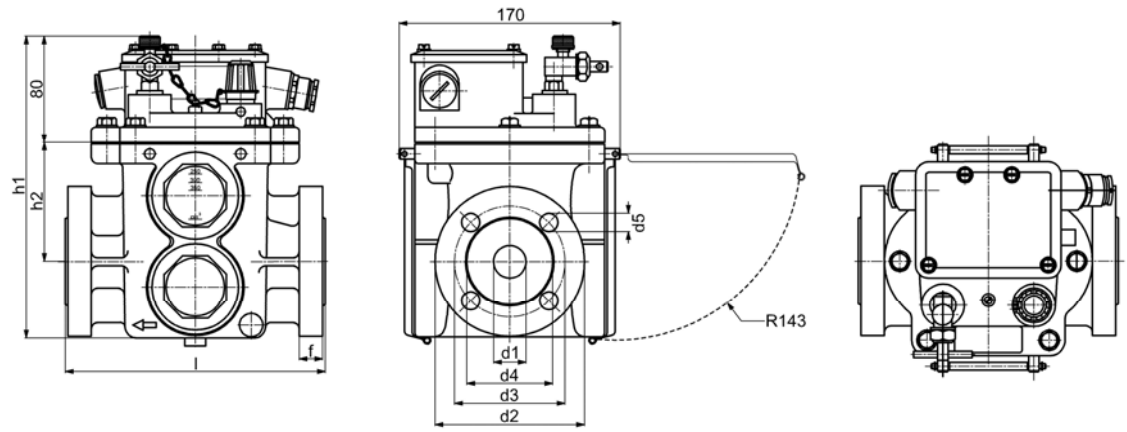
4.4.2. Type 21



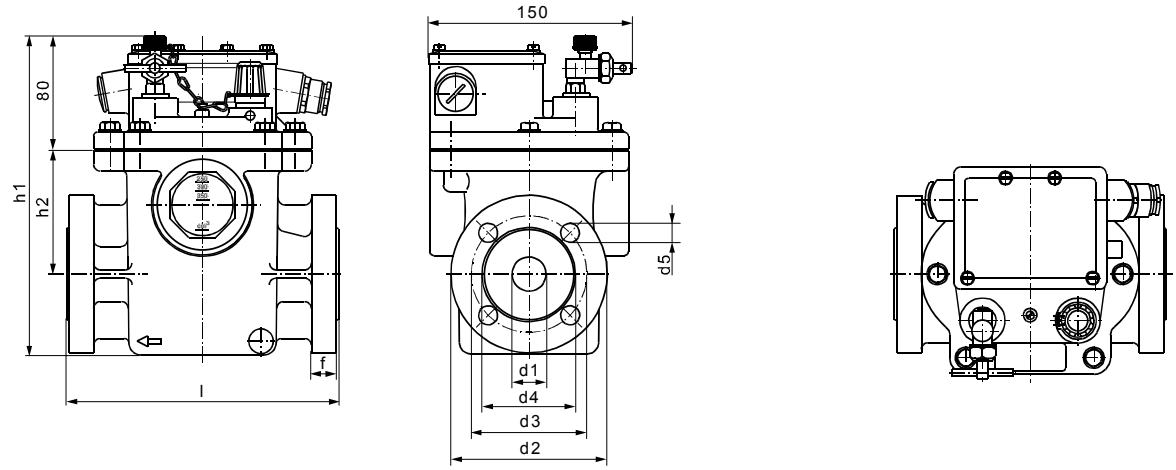
4.5. Double-float Buchholz relays with flange connection (round)

	Type code no. Works-design. DIN-design.	Mode of connection	DN of pipe (mm) d_1	Flange dimensions (mm) d_2	d_3	d_4	d_5	f	Device dimensions (mm) l	h_1	h_2	weight (kg)	Suited for transformer ratings of
	**05 (BF 25/6) (-)**	Flange 4-holes	**25**	100	75	60	12	12	185	235	90	4.4	≤ 5000 KVA
	**06 (BF 25/10) (DR 25)**	Flange 4-holes	**25**	115	85	68	14	18	200	235	90	4.8	≤5000 KVA
	**23 (BF25/10S) (-)**	Flange 4-holes	**25**	115	85	68	14	18	200	235	90	4.4	≤ 5000 KVA
	**07 (BF 50/6) (-)**	Flange 4-holes	**50**	140	110	90	14	12	185	235	80	4.6	≥ 5000 KVA ≤ 10000 KVA
	**08 (BF 50/10) (DR 50)**	Flange 4-holes	**50**	165	125	102	18	16	195	250	80	5.9	≥ 5000 KVA ≤ 10000 KVA
	**09 (BF 80/10) (-)**	Flange 4-holes	**80**	200	160	138	18	15	195	265	80	6.2	≥ 10000 KVA
	**09-26. (BF80/10/8) (DR 80)**	Flange 8-holes	**80**	200	160	138	18 M16	15	195	265	80	6.2	≥ 10000 KVA
	**24 (BF 80/6) (-)**	Flange 4-holes	**80**	190	150	130	18	15	195	260	80	6.0	≥ 10000 KVA

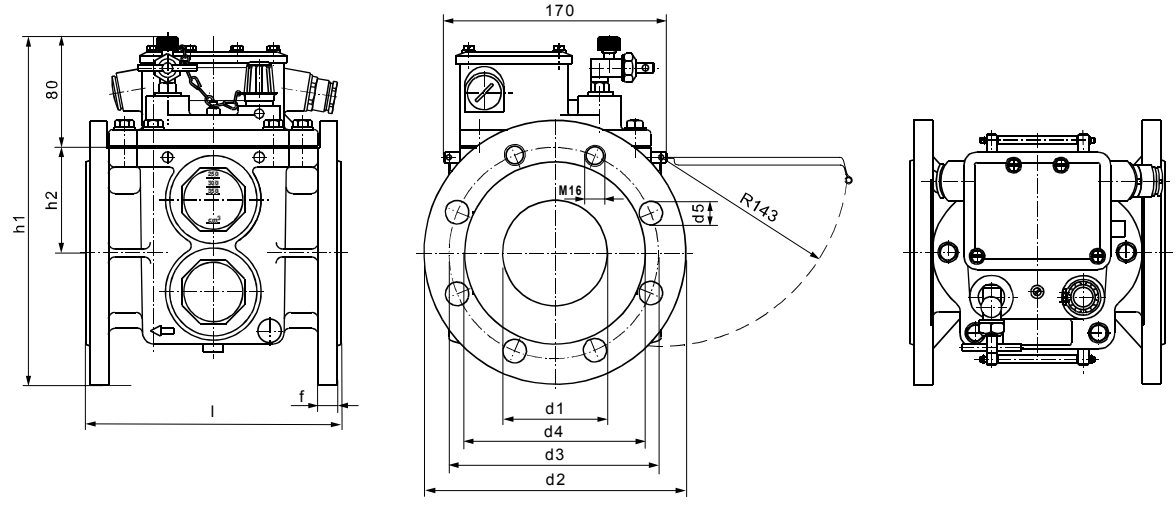
4.5.1. Type 05, 06, 07, 08, 09, 24



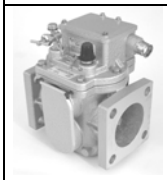
4.5.2. Type 23



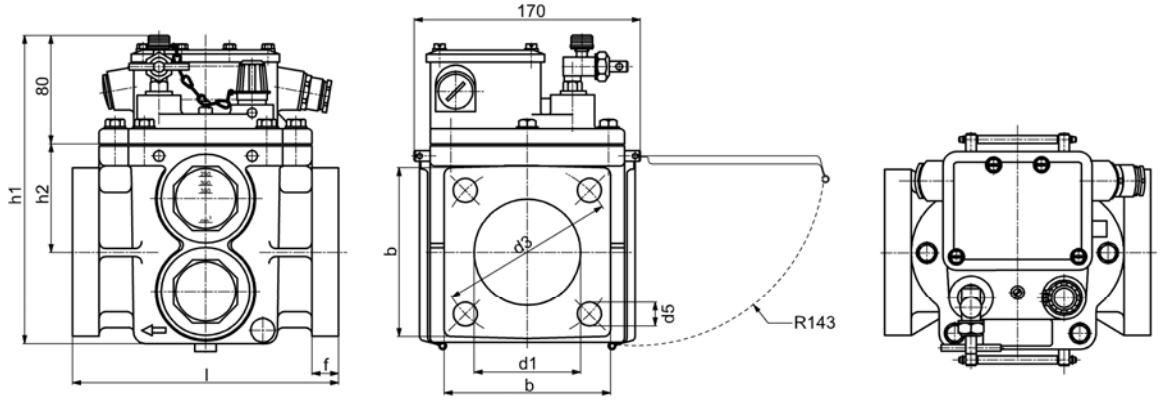
4.5.3. Type 09-26.



4.6. Double-float Buchholz relays with flange connection (square)

	Type code no. Works-design. DIN-design.	Mode of connection	DN of pipe (mm) d_1	Flange dimensions (mm) b	d_3	d_4	d_5	f	Device dimensions (mm) l	h_1	h_2	weight (kg)	Suited for transformer ratings of
	**10 (BF 80/Q) (DQ 80)**	Flange square 4-holes	**80**	125	132	-	18	20	200	235	80	5.0	≥ 10000 KVA

4.6.1. Type 10

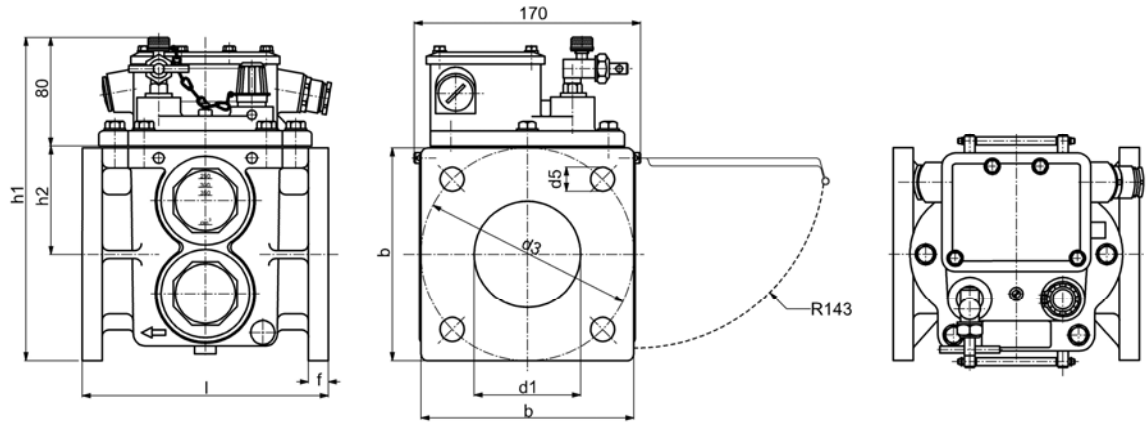


4.7. Double-float Buchholz relays with geometrical flange dimensions according to Chinese norm

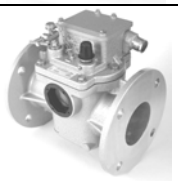
	Type code no. Works-design. DIN-design.	Mode of connection	DN of pipe (mm) d_1	Flange dimensions (mm) b	d_3	d_4	d_5	f	Device dimensions (mm) l	h_1	h_2	weight (kg)	Suited for transformer ratings of
	**63 (BC 80) (QJ-80)**	Flange square 4-holes	**80**	160	160	-	18	15	185	245	80	5.0	≥ 10000 KVA

Suited for connecting to Chinese butterfly valves (square flange). Further types on request.

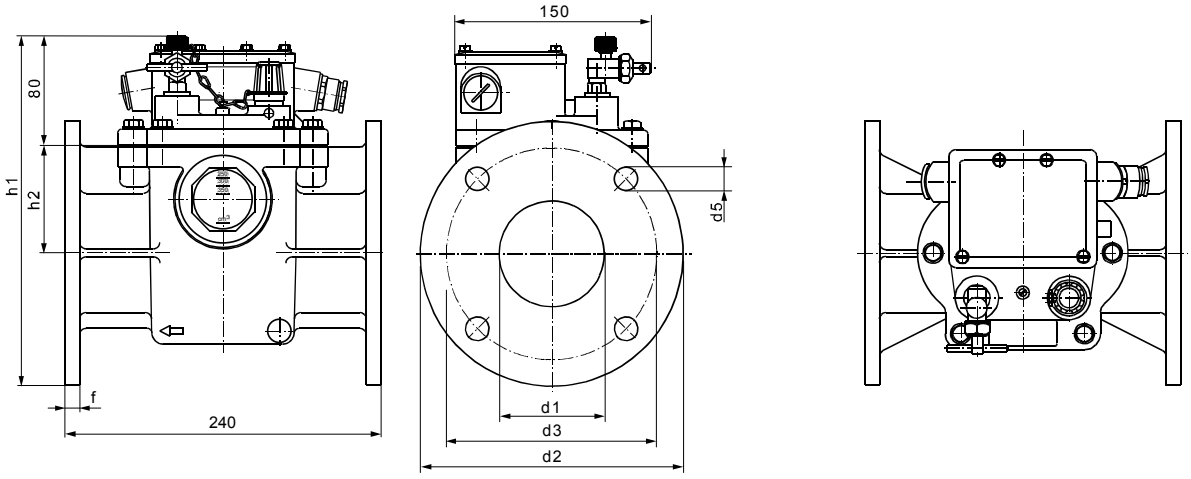
4.7.1. Type 63



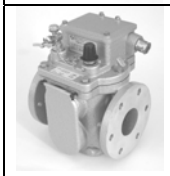
4.8. Double-float Buchholz relays with geometrical flange dimensions according to former French norm

	Type code no. Works-design.	Mode of connection	DN of pipe (mm) d_1	Flange dimensions (mm) d_2	d_3	d_5	f	Device dimensions (mm) l	h_1	h_2	weight (kg)	Suited for transformer ratings of
	**41 (NF 25)**	Flange 4-holes	**25**	115	85	14	8	240	235	90	4.2	≤ 5000 KVA
	**42 (NF 50)**	Flange 4-holes	**50**	165	125	18	11	240	250	80	5.1	≥5000 KVA ≤ 10000 KVA
	**43 (NF 80)**	Flange 4-holes	**80**	200	160	18	11	240	265	80	5.5	≥ 10000 KVA

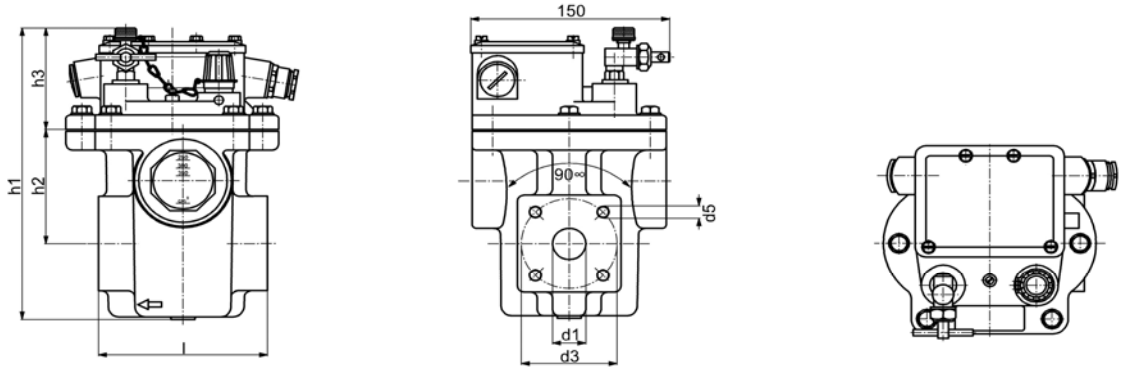
4.8.1. Types 41, 42, 43



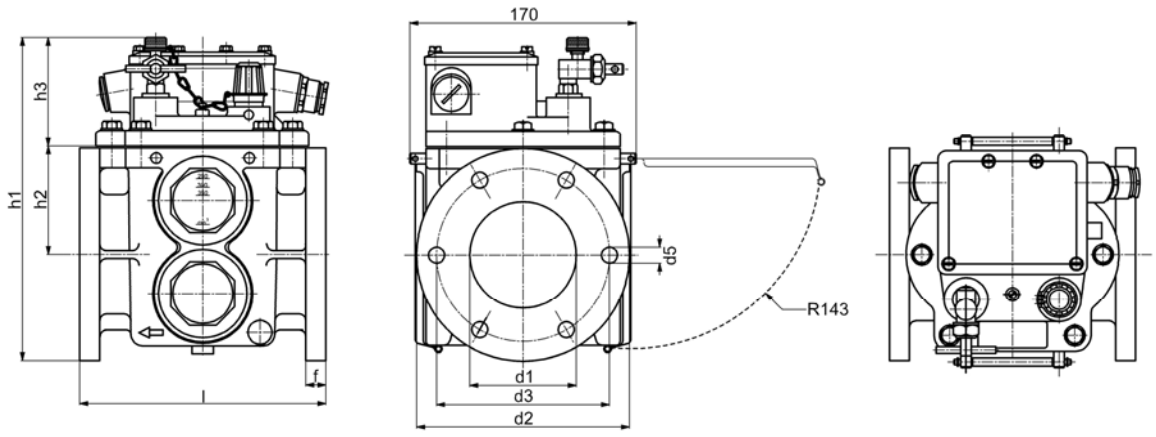
4.9. Double-float Buchholz relays with geometrical flange dimensions according to former British standard

	Type code no. Works-design.	Mode of connection	DN of pipe (mm) (inch) d_1	Flange dimensions (mm) (inch) d_2	d_3	d_5	f	Device dimensions (mm) (inch) l	h_1	h_2	h_3	weight (kg)	Suited for transformer ratings of
	**51 (BS 25)**	Flange square 4-holes	**25**	- -	72 2.83	M10 M10	-	127 5	235 9.25	90 3.54	80 3.15	3.7	≤ 5000 KVA
	**52 (BS 50)**	Flange 6-holes	**50**	140 5.51	110 4.33	12 0.47	12 0.47	185 7.28	235 9.25	80 3.15	80 3.15	4.8	≥ 5000 KVA ≤ 10000 KVA
	**53 (BS 80)**	Flange 6-holes	**80**	160 6.30	130 5.12	12 0.47	13 0.51	185 7.28	240 9.45	80 3.15	80 3.15	5.0	≥ 10000 KVA

4.9.1. Type 51

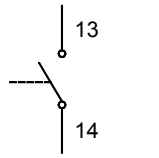
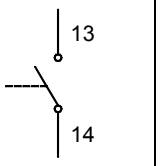
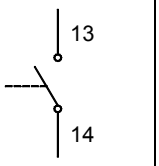
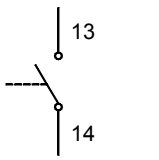
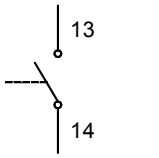
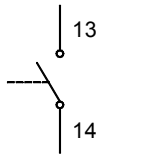
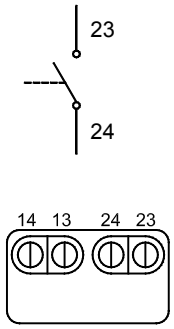
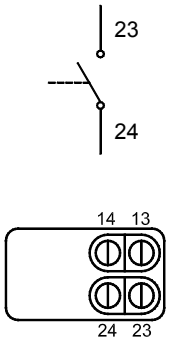
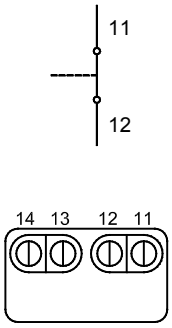
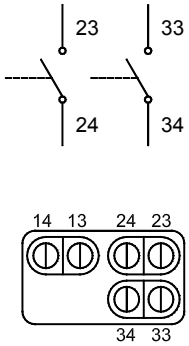
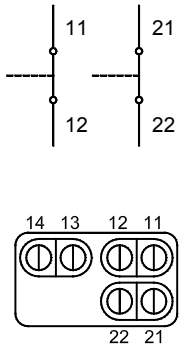
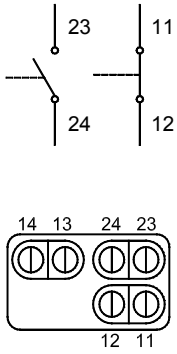


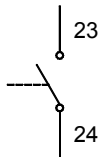
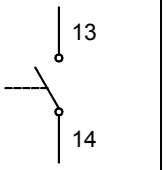
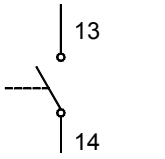
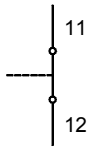
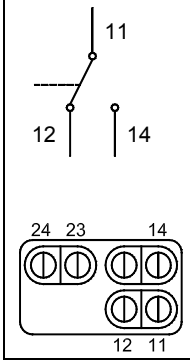
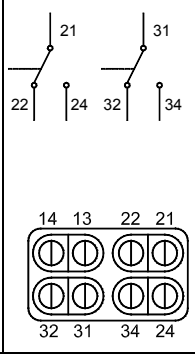
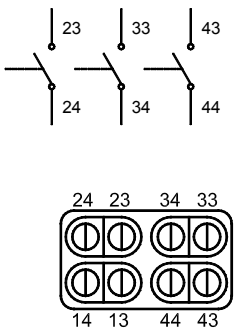
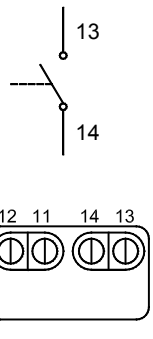
4.9.2. Types 52, 53

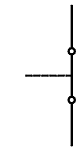
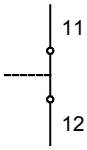
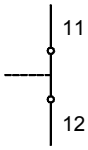
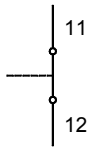
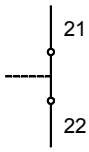
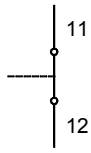
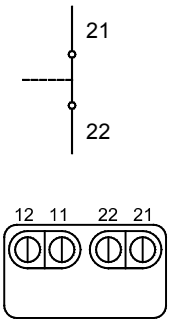
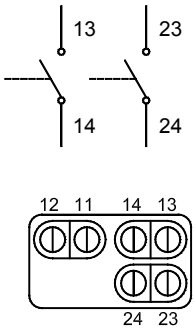
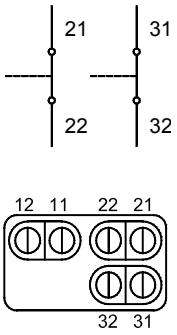
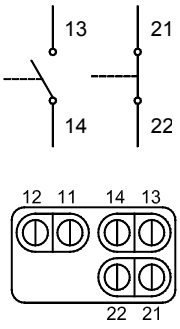
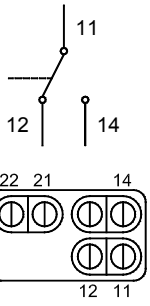
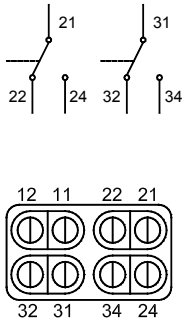


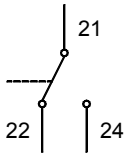
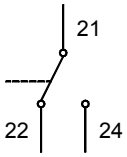
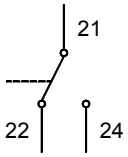
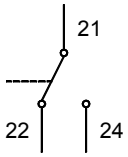
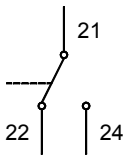
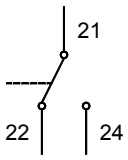
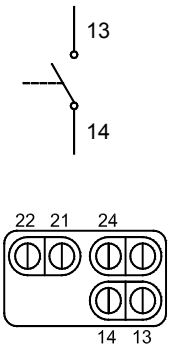
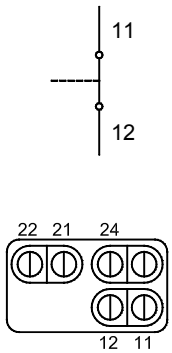
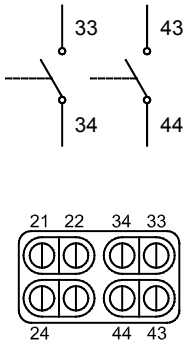
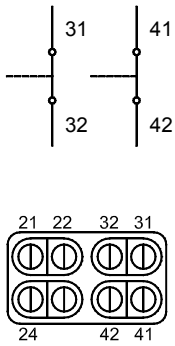
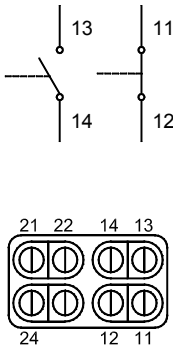
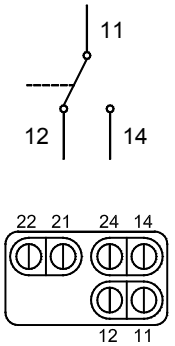
4.10. Double-float Buchholz relays - possible switching system designs

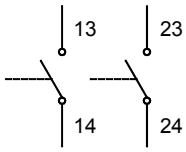
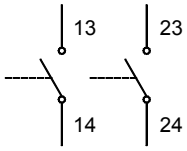
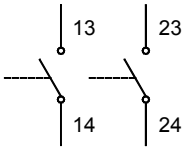
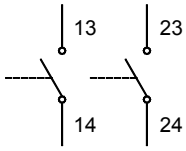
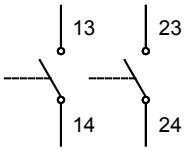
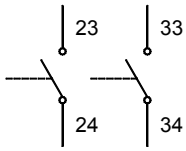
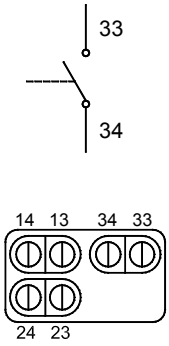
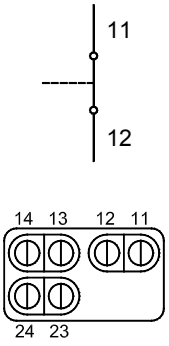
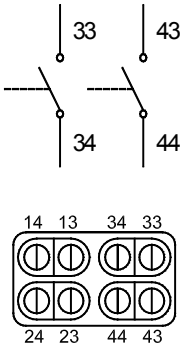
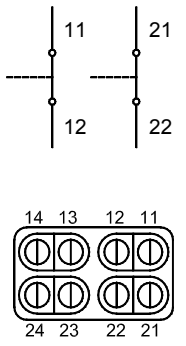
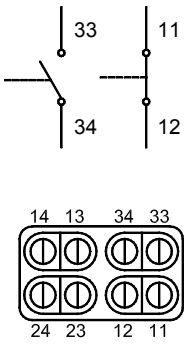
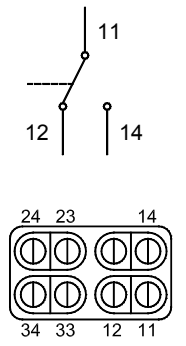
As switching elements are used magnet contact tubes. There are **normally-closed** (NC), **normally-open** (NO) or **change-over** (CO) versions.
For coding of the switching system version see point 7. ordering data, page 23.
The switching system version is coded by the last two figures of the ordering number.

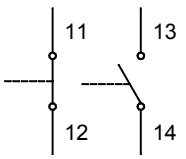
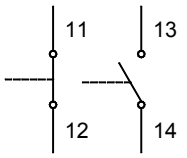
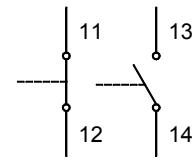
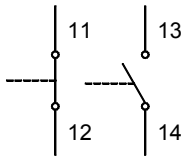
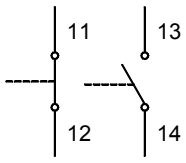
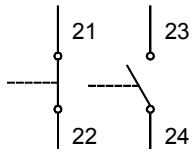
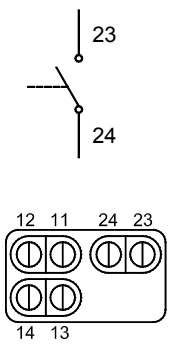
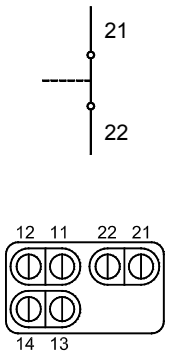
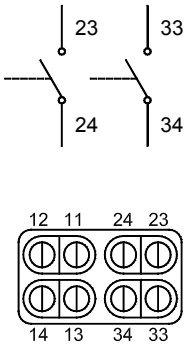
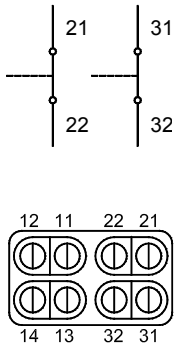
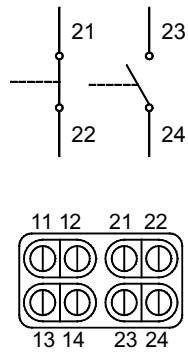
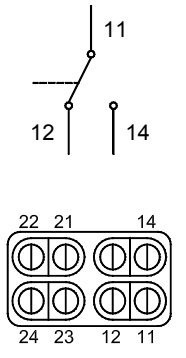
...11	BS 25...11	...12	...13	...14	...15
Alarm	**Alarm**	**Alarm**	**Alarm**	**Alarm**	**Alarm**
1 NO	**1 NO**	**1 NO**	**1 NO**	**1 NO**	**1 NO**
					
Disconnection	**Disconnection**	**Disconnection**	**Disconnection**	**Disconnection**	**Disconnection**
1 NO	**1 NO**	**1 NC**	**2 NO**	**2 NC**	**1 NO and 1 NC**
					

...16	...17	...19		...21
Alarm	**Alarm**	**Alarm**		**Alarm**
1 NO	**1 NO**	**1 NO**		**1 NC**
				
Disconnection	**Disconnection**	**Disconnection**		**Disconnection**
1 CO	**2 CO**	**3 NO**		**1 NO**
				

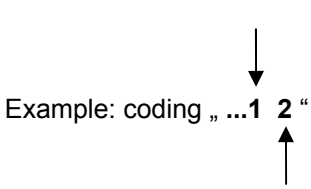
...22	...23	...24	...25	...26	...27
Alarm	**Alarm**	**Alarm**	**Alarm**	**Alarm**	**Alarm**
1 NC	**1 NC**	**1 NC**	**1 NC**	**1 NC**	**1 NC**
					
Disconnection	**Disconnection**	**Disconnection**	**Disconnection**	**Disconnection**	**Disconnection**
1 NC	**2 NO**	**2 NC**	**1 NO and 1 NC**	**1 CO**	**2 CO**
					

...31	...32	...33	...34	...35	...36
Alarm	**Alarm**	**Alarm**	**Alarm**	**Alarm**	**Alarm**
1 CO	**1 CO**	**1 CO**	**1 CO**	**1 CO**	**1 CO**
					
Disconnection	**Disconnection**	**Disconnection**	**Disconnection**	**Disconnection**	**Disconnection**
1 NO	**1 NC**	**2 NO**	**2 NC**	**1 NO and 1 NC**	**1 CO**
					

...41	...42	...43	...44	...45	...46
Alarm	**Alarm**	**Alarm**	**Alarm**	**Alarm**	**Alarm**
2 NO	**2 NO**	**2 NO**	**2 NO**	**2 NO**	**2 NO**
					
Disconnection	**Disconnection**	**Disconnection**	**Disconnection**	**Disconnection**	**Disconnection**
1 NO	**1 NC**	**2 NO**	**2 NC**	**1 NO and 1 NC**	**1 CO**
					

...51	...52	...53	...54	...55	...56
Alarm	**Alarm**	**Alarm**	**Alarm**	**Alarm**	**Alarm**
1 NC and 1 NO	**1 NC and 1 NO**	**1 NC and 1 NO**	**1 NC and 1 NO**	**1 NC and 1 NO**	**1 NC and 1 NO**
					
Disconnection	**Disconnection**	**Disconnection**	**Disconnection**	**Disconnection**	**Disconnection**
1 NO	**1 NC**	**2 NO**	**2 NC**	**1 NC and 1 NO**	**1 CO**
					

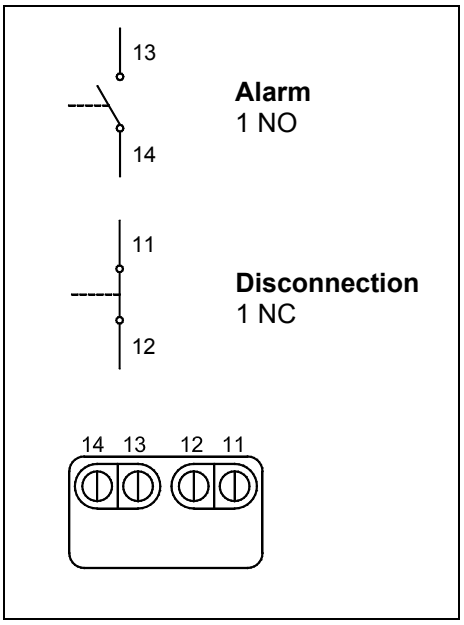
Explanation of symbols:



Example: coding „ **...1 2** “

Magnet contact tube version
Upper switching system - Alarm

Magnet contact tube version
Lower switching system - Disconnection



--- Graphical symbol with terminal marking

--- Terminal assignment in terminal box

Note:
The switching systems are shown in their normal position, i.e. with the Buchholz relay filled completely with insulating liquid corresponding to trouble-free operation of the device to be monitored.

A plate showing the connection diagram and the terminal assignment is arranged inside the cap of each Buchholz relay delivered by EMB.

4.11. Information about Buchholz relays with identification no. 23 – „Buchholz relay with damper hold in response position“

Buchholz relays with the feature “damper hold 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 button anticlockwise. When unlocking the damper, also check the insulating liquid level in the Buchholz relay. Bleed the Buchholz relay, if required.

5. Technical data

The technical data listed in table 1 are valid for all Buchholz relays manufactured by EMB. More options are mentioned in table 2 on page 21. These additional special designs should be coded with the relevant identification number when ordering Buchholz relays.

Table 1

Parameter	**Data**	**Notes**
Nominal voltage	AC 230 V DC 230 V	12 V to 250 V 12 V to 250 V
Nominal current	AC 2 A DC 2 A	0.05 A to 2 A 0.05 A to 2 A
Contact voltage capacity	AC 1000 V	--
Insulation voltage capacity	AC 2000 V	Contact against casing
Temperature range: - ambient temperature - working range * temperature of the insulation liquid * viscosity of the insulation liquid	 -40°C to +55° C -40° F to +131° F -40°C to +115°C -40° F to +239° F < 1100 mm^2/s	 Climate acc. to DIN EN 60068-2-78 : 2002-09 Others on request
Shock resistance - Earthquake / Vibration - Impact	class 4M6 2g (peak value) frequency range 2Hz to 200 Hz 25g / shock duration 11 ms	 -- --
Resistance to pressure	0.25 MPa	--
Resistance to vacuum	< 2.5 kPa	--
Insensitivity to magnetic fields	25 mT	--
Switching system: - Number of switching contacts per switching system - Switching contact - damper - Response time of damper Response of switching system in case of: - Gas accumulation - Flow of insulation liquid nominal diameter (DN) 25 mm nominal diameter (DN) 50 mm nominal diameter (DN) 80 mm	 1 magnet contact tube hold by magnets < 0.1 s 200 cm^3 to 300 cm^3 1.00 m/s ± 15% 1.00 m/s ± 15% 1.00 m/s ± 15% or 1.50 m/s ± 15% or 2.00 m/s ± 15%	 More on request -- -- -- -- Others on request Please see also ordering data on page 23.
Cable gland	M 20x1.5	Others on request
Nominal installation position	1° ascending towards expansion vessel	0° to 5°
Degree of protection	IP 54	Others on request

6. Special designs

Table 2

Explanation	**Identif. no.**
Insulation liquid silicone oil *	20
Insulation liquid based on esther *	21
Climatic version (extreme frigidal open-air climate below -40°C) *	34
Climatic version (sea climate) *	36
Degree of protection IP 56	38
Degree of protection IP 66	39
Special design approved by RWE, Germany	24
With premounted Harting-Connector (The option has to be agreed with the customer and is indicated by a letter after the identification no.)	59
Casing colour RAL 7001 (silver-grey) *	41
Casing colour RAL 7012 (basalt-grey) *	42
Casing colour RAL 7022 (umber-grey) *	43
Casing colour RAL 7033 (cement-grey) *	44
Casing colour RAL 7038 (agate-grey) *	45
Casing colour RAL 7035 (light-grey) *	46
Casing colour RAL 7016 (anthracite-grey) *	47
Casing colour RAL 9002 (grey-white) *	48
Casing colour RAL 7032 (siliceous-grey) *	49
Upper switching system equipped with **two** magnet contact tubes	35
Lower switching system equipped with **two** magnet contact tubes	25
Upper **and** lower switching system each equipped with **two** magnet contact tubes	33
Lower switching system equipped with **three** magnet contact tubes	99
Testing of the switching systems by means of compressed-air **and** test key	32
Damper hold in response position	23
With oil drain plug (only double-float Buchholz relays)	28
Special request (on special agreement with customer) *	29
NM series – Buchholz relay with analog measurement of the gas volume	60

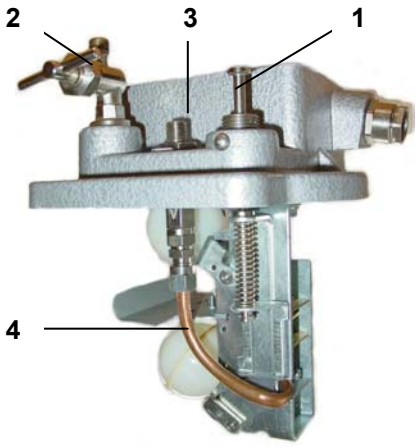
* These identification numbers you can use also for ordering gas sampling device ZG 1.2.

Casing colour: two-component polyurethane-based structural coating

Attention: For constructional reasons the following special designs are **not** combined possible in the same device:

identif.no.	with	identif. no.	identif.no.	with	identif. no.
23		32	99		23
23		33	99		32
32		33	99		33
32		25	99		35
32		35			

6.1. Explanations to identification no. 32



For Buchholz relays of special design (identif. no. 32), the mechanical function of the two switching systems can be tested by means of test button (1), and the upper switching system (alarm) can be tested by pumping in air via the test valve (2) using a suitable test pump. **Additionally**, the switching system can be tested pneumatically. To this end, air is supplied via an air supply nipple (3) provided with a check valve.

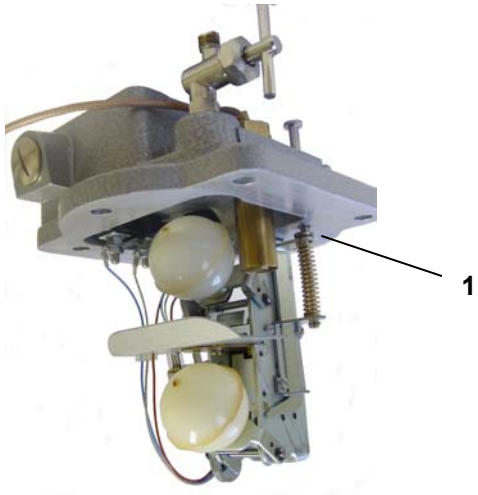
Pneumatic test of the upper switching system (alarm) using compressed air:
Air is introduced slowly into the Buchholz relay until the alarm contact is tripped when the upper float is lowered.

Pneumatic test of the lower switching system (disconnection) using compressed air:
Through the air supply nipple and the pipe (4) air is applied suddenly to the damper. When the damper responds the disconnection contact is tripped. The response value of the damper is **not** checked.

After any test using air, bleed the Buchholz relay through the test valve (2).

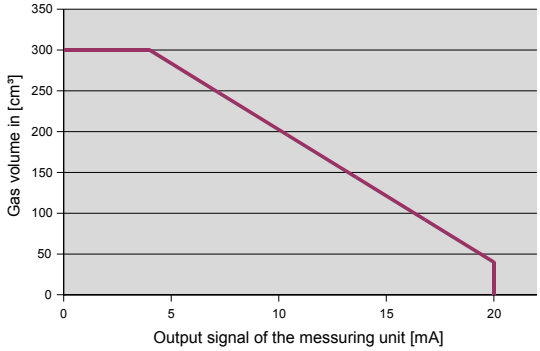
The functional test using compressed air results from British Standard B.E.B.S. T2 of 1966.

6.2. Explanations to identification no. 60



The principal construction of the Buchholz relay with floats and damper as well as their electro-mechanical functions have been maintained. **Buchholz relays of series NM are equipped additionally with a capacitive sensor (1)**. The sensor is installed in the cover of the Buchholz relay. The cover of the terminal box accommodates the electronic amplifier of the measuring unit. Sensor and amplifier are connected by a cable connector. The measured value is based on capacitance variation of the sensor caused by variation of the insulating liquid level in the Buchholz relay.

Analog measurement of the gas volume is possible between 50 cm^3 and 300 cm^3. Lower gas volumes cannot be measured reliably because of high inaccuracies. Measurements beyond this range are not necessary as in this case the upper switching system will respond. Besides, the construction of the Buchholz relay (larger gas volumes escape towards the expansion tank) does not allow such measurements. The operating point of the upper switching system (upper float) is a gas volume of 200-300 cm^3.

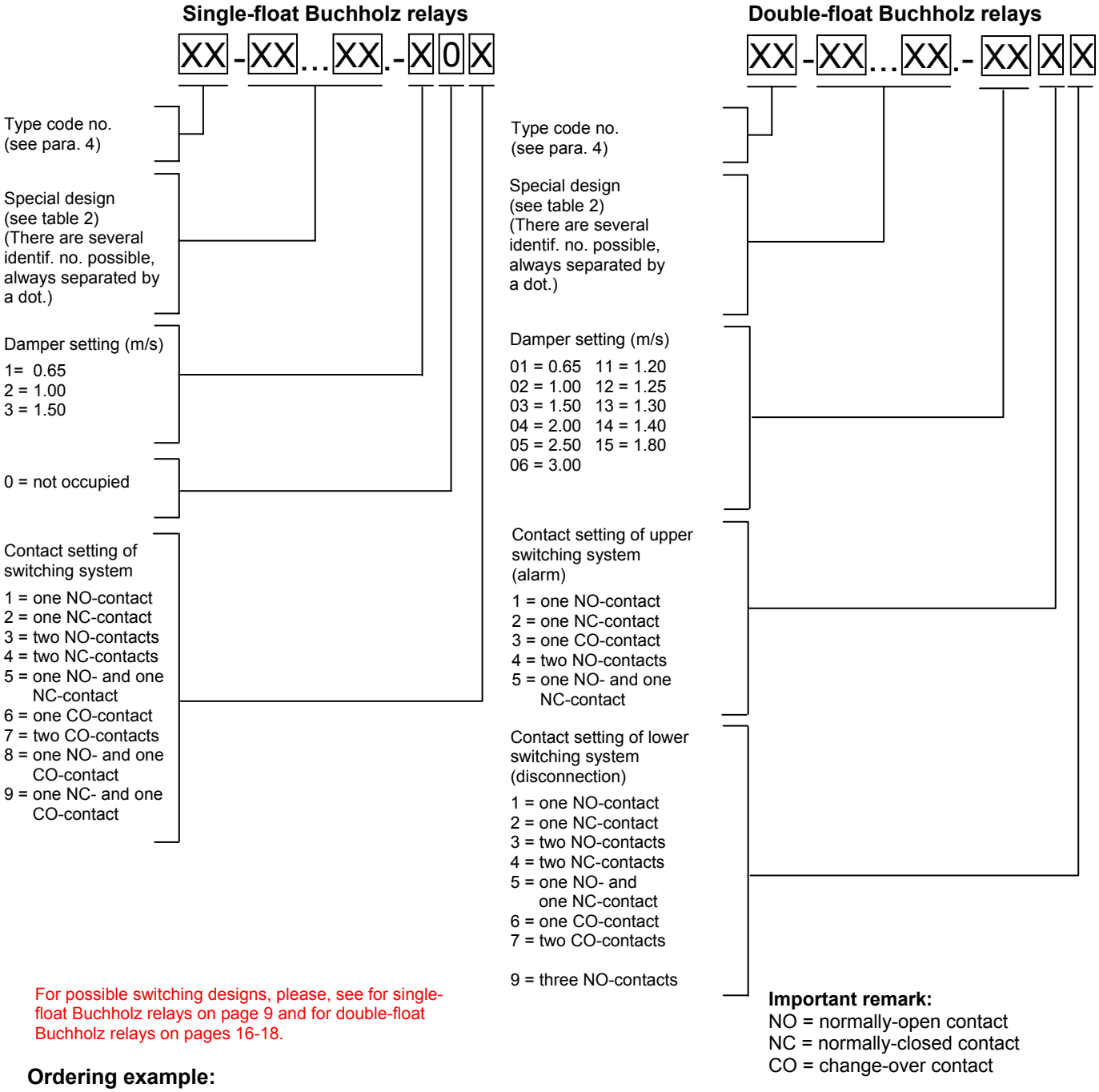


Further information:

"Technical information and operating instructions Transformer Protection Relay (Buchholz principle) Series NM"

7. Ordering data

For placing orders, please, use the following key:



For possible switching designs, please, see for single-float Buchholz relays on page 9 and for double-float Buchholz relays on pages 16-18.

Important remark:
NO = normally-open contact
NC = normally-closed contact
CO = change-over contact

Ordering example:

You need a Buchholz relay of type BF 80/Q. The damper setting should have a value of 1.50 m/s. The upper switching system should be equipped with one switching system (magnet contact tube) and the lower with two switching systems (magnet contact tubes). The device should be delivered in colour RAL 7033 and should have one oil drain plug.

This information refers to type specification also ordering data:

Type code 10-25.28.44.-0313 explanation:

10 = double-float Buchholz relay type 10 (BF 80/Q)
25 = lower switching system equipped with 2 magnet contact tubes
28 = oil drain plug
44 = colour RAL 7033
03 = damper setting of 1.50 m/s
1 = contact setting of upper switching system - 1 NO-contact
3 = contact setting of lower switching system - 2 NO-contacts

8. Additional devices for Buchholz relays

designation **description**

ZG 1.2.

Gas sampling device

The gas sampling device is mounted at the transformer and connected to the Buchholz relay by means of a pipe. It allows to sample the relay gas at normal operating level.

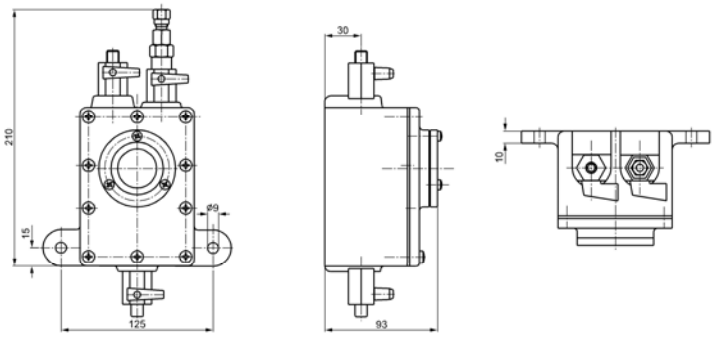
The length of the tube (pipe) will be as requested by customer.

The device can be delivered with a lockable box.

Technical data:

Gas outlet opening:	R 1/8“	others on request
Oil outlet opening:	R 1/8“	others on request
Viscosity of the insulation liquid: <1100 mm²/s		
Temperature of the insulation liquid: -40°C to +115°C		others on request
Ambient temperature:	-40°C to +55°C	others on request
Weight without tubing:	2,2 kg	
Tubing dimensions:	Ø 6x1 copper tubing	others on request
Tubing length:	< 15 m	others on request

Dimensions:



Ordering data:

90 – **XX** ... **XX** . – **X** – **XX,XXm**

type code for ZG 1.2.	special design (see table 2, page 21) (There are several identif. no. possible, always separated by a dot.)	0 = without box 1 = with box	tubing length in meter

Ordering example:

Gas sampling device 90-34.44.-0-10,50m

90 = ZG 1.2.
34 = extreme frigidal open-air climates below -40°C
44 = colour RAL 7033
0 = without box
10,50m = tubing length of 10,50 m

designation

description

ZG 3.1.

Gas testing device

The gas testing device is used to test the gas accumulated in the Buchholz relay. It can be installed directly on the test valve of the Buchholz relay or on the gas outlet tap of the gas sampler. The Buchholz gas flows through two different chemical solutions and its colour reactions allows conclusions with regard to the type of fault.

Testing by means of the gas testing device is no substitution for a gas chromatographic analysis.

Ordering data: ZG 3.1.

ZG 4.1.

Reflux lock

The device prevents that the insulation liquid gets into the Gas testing device. The device is arranged between the Buchholz relay or gas sampling device and gas testing device.

Ordering data: ZG 4.1.

ZG 5.1.
ZG 5.2.

Test pump

The test pump (manual or foot operated) serves to check the function of the upper switching system (warning) of the Buchholz relay by pumping in air. The test can be performed directly on the Buchholz relay. For that purpose, the test pump is connected to the test valve of the Buchholz relay.
When the test is performed via the gas sampling device, the test pump is connected to the gas outlet tap of the gas sampling device.

Ordering data: ZG 5.1.
ZG 5.2.

ZG 6.1.

Oil sampling device

The oil sampling device is connected with the Buchholz relay via a pipe and serves to take oil samples from the Buchholz relay (suitable for Buchholz relays with oil drain plug).
The pipe is supplied as requested by customer.

Ordering data: ZG 6.1.

designation

description

BGS

Buchholzgas-Sampler

The Buchholz gas sampler serves to safely take and transport gas samples from the Buchholz relay or the gas sampling device. Its capacity is 100 ml. The gas sampled can be stored up to five days.

Ordering data: BGS

BGT 3

Buchholzgas-Tester

The Buchholz gas tester serves to measure the hydrogen concentration of the Buchholz gases. Measurement can be performed directly on site.

For other gas testing equipment, please, contact us.

Ordering data: BGT 3

For any other information, please, ask for special reference material.

9. Further protection devices

designation

description

ÜRF 25

ÜRF 25/10

Monitoring relay for tap changer

The monitoring relay for the tap changers or oil flow relay is installed in the pipe between the tap changer head and the oil expansion vessel. It is tripped in the case of inadmissibly high oil flows towards the expansion vessel caused by tap changer faults.

Pipe diameter: 25 mm (1“)
Connection: flange

SG 25

SF 25

SF 25/10

Flow indicator

The flow indicator is a protective relay monitoring circulating oil lubrication or circulating oil cooling of machines and equipment. It indicates faults of circulating oil systems or shuts down the machine or equipment, hence preventing damage. The flow indicator operates at a very low service pressure so that it can be also installed in an oil return pipe where the oil flow is ensured by a sloping oil pipe.

Pipe diameter: 25 mm (1“)
Connection: thread or flange

For any other information or data required for placing an order, please, ask for special catalogues.