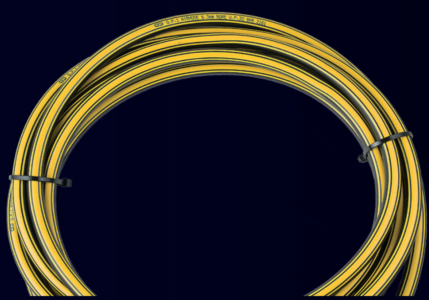
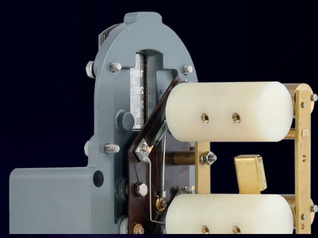
P&B Weir Electrical Ltd.

Buchholz Relays 2018

Buchholz Relays

The PBwel range of Buchholz Relays has a proven track record of many years service. As well as supplying a standard range of approved equipment, PBwel also have the capability to design new solutions for any transformer protection requirement.

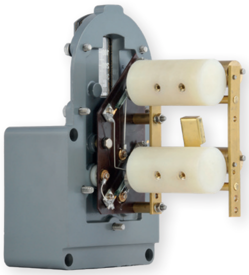




Our range includes a range of Buchholz Relays of many sizes and configurations, Dry Air Pumps and gas collectors.

INTRODUCTION

Buchholz Relays from PBwel can provide a service for many decades if maintained properly. Our Relays have been providing transformer protetion globally for many years.



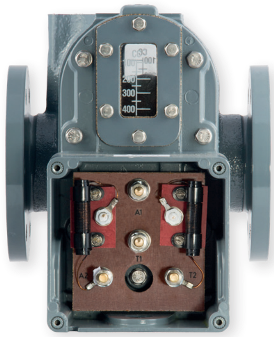
Most faults in an oil filled Transformer are accompanied by the generation of gas. By using a suitable Relay, the formation of gas can be used as a warning of a developing fault.

Once a specified volume of gas has collected within the Buchholz Relay, the alarm element will cause an alarm indication.

If there is a more serious fault within the Transformer, the trip element will function. The trip element will cease the functioning of the Transformer to protect it from further damage, and protect those working around it.

Possible causes for Alarm indication
Broken-down core bolt insulation.
Shorted laminations.
Bad contacts.
Overheating of part of the windings.

Possible causes for Trip
Earth Faults.
Winding short circuits.
Puncture of bushings.
Short circuits between phases.



Mounting Position

The relay should be mounted in the connecting pipe between the transformer and conservator tank. This pipe should be as long and as straight as possible, and must be arranged to slope upwards, towards the conservator at an angle within the limits of 3 to 7 degrees to the horizontal.

There should be a straight run on the transformer side of the relay of at least five times the internal diameter of the pipe, and at least three times this diameter on the conservator side.

A machined surface is provided on the relay body for the purpose of testing the mounting of the relay, both in the inclined direction and at right angles to the pipe where it should be horizontal.

Connections

The terminal boxes on double element relays are normally drilled and tapped M20x1.5mm for bottom entry by conduit or cable gland. Side entries and alternative thread sizes can be supplied for most types on request. Alarm and tripping circuit connections are made to 0BA terminal stems (M6) in the terminal box, and secured by 0BA nuts and washers. The maximum recommended torque value (2.8Nm) should not be exceeded when making connections.

Testing on Site

Double element relays are provided with a seperate ball valve to enable the injection of compressed air when testing on-site.

To test the operation of the alarm element, air from an air bottle should be admitted slowly so that the alarm element falls gradually until the switch operates.

To test the trip element, the valve controlling the bottle is opened quickly so that the air rushes in, depresses the flap, operating the switch. The pressure required is dependent upon the equipment used. To facilitate on-site testing, a portable Dry Air Pump is available.

Routine Testing

Relays are individually calibrated in accordance with BEBS T2 (1966). Values are recorded for loss of oil/gas collection to operate the alarm switch and steady oil flow to operate the trip switch.

The unit is also observed to ensure the trip switch operates due to a complete loss of oil. Assembled relays are pressure tested with transfomer oil at 1.4 bar for 6 hours. Electrical circuits are flash tested at 2000 volts r.m.s and the insulation resistance measured at 500 Volts is not less than 10 MΩ in air.

Although specifically designed to function with transformer oil according to BS148, succesful trials have also been conducted with Silicone coolant.

Reed Switch Type

For use in situations subject to seismic disturbances and mining activities such as blasting.

Shock and vibration acting along the tube of a conventional Mercury switch can cause the Mercury within it to move and momentarily bridge the switch electrodes, even though the switch is tilted in the open position.

This is considered to be a maloperation of the relay, in that it is caused by external influences and not by a fault within the transformer. Consequently where relays are to be used in situations as described above a more suitable alternative to the usual Mercury switch is required. Magnet operated Reed switches were selected specifically for this purpose and this choice is supported by the following type tests which were succesfully withstood.

Ability to withstand power frequency vibrations

The device having its contact electronically monitored by means of an instrument capable of registering and recording a contact closure of 1ms duration, shall be subjected to a sinusoidal vibration having a frequency of 100 Hz and an amplitude of 0.25 ± 0.05mm peak to peak (thus a maximum acceleration of 6g) in the plane of movement of the contact making arrangement for a period of 1000 hours, during which there shall be no maloperation of the contacts.

Ability to withstand power frequency vibrations

Immediately before and immediately after the vibration test, the stability of the device and its contacts under earth tremor conditions shall be proved by subjecting the device whilst being vibrated under the conditions of the vibration test above, to further vibrations superimposed on the 100Hz vibration and supplied seperately in each of the three perpendicular axes, one of which should be in the same plane as the 100Hz vibration.

These vibrations shall have a constant peak to peak amplitude of 2.5mm and shall be carried by a continuous slow sweep over the range of 0.1 to 33Hz (at which frequency the maximum acceleration will be 5.5g) in order to search out resonances.

The appearance of these relays is the same as Mercury switch types but they are distinguished from them by the symbol /VO or /Vc/o following their type markings.

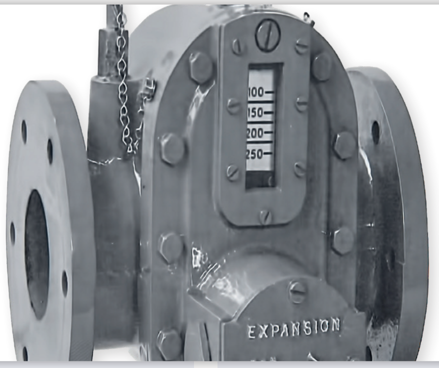
The letter V (for vibration) indicates that the relay contains Reed switches, the letter O that the contacts are normally open and the symbol c/o indicates change-over contact reeds.

Thus a type 2DE/VO is a 2" (pipe size) Double Element relay with normally open Reed switches. "Normally", in this context means with the relay full of oil.

Operation

In the double element relay, collection of gas causes the oil level with the relay to fall. This is turn causes the upper element to rotate on its pivots, bringing the magnet it carries into a position where it operates the alarm switch.

An oil surge through the relay will cause the lower element to rotate about its pivots and bring its magnet into a position so as to operate the tripping switch.



Operating characteristics

All double element relays are adjusted so that their performance lies within the limits specified in BEBS T2. Alternative values may be available upon request. These switches have Rhodium contacts located midway along the length of their glass tubes. The tubes contain an atmosphere of Nitrogen.

Connected in series with each Reed switch, and mounted within the terminal box is an inductor of approximately 30 microhenries and 0.04ohm. These inductors are intended to protect the Reed switch contacts from the effects of capacitive loads, such as those imposed by long leads or pilot cables, and must not be removed from relays in service.

Protection of Reed switch contacts against the effect of inductive loads, such as are imposed by tripping relays is achieved by means of a diode wired across each load. This diode must be rated with forward current at least as high as the steady load current and connected observing polarity so as to absorb the back e.m.f. A protection unit, designated D2, fitted with suitably rated diodes for this purpose is available.

	Single Contact	**Change-over Contact**
Type	Gunther Type 1526	Gunther Type 1621
Switch Capacity	Max. 250 VA/W	Max. 60 W/80VA
Switching Current	Max. 5A	Max. 2A
Switching Voltage (0-60Hz)	Max. 250 V	Max. 220 V
Initial Contact Resistance	Max. 100 milliohms	Max. 100 milliohms
Breakdown Voltage	Min. 600 v r.m.s	500/400 V d.c
Resonance Frequency	900Hz	-
Shock Resistance	Max. 50g (durations 11ms)	Max. 50g (durations 11ms)
Vibration Resistance	Max. 35g (50-500Hz)	Max. 35g (50-500Hz)
Temperature Resistance	-55ºC to +150ºC	-40ºC to +50ºC

Mercury Switch Type

Construction and Method of Operation

The relay consists of a lightweight container fitted with two pivoted elements.

It is situated in the pipe line between the transformer and the conservator tank, so that under normal conditions it is full of oil. The operating force relies upon the principle that when a body is immersed in a liquid it appears to lose weight.

There are no floats or open containers which can be punctured or collect sludge, with consequent loss of buoyancy.

Mercury Switches

Mercury switches employed are of a special design to prevent maloperation due to excessive transformer vibration. A sample relay of this type has been submitted to a continuous 3000 hour vibratory type test. During this test the relay was vibrated to an amplitude of 0.01 in. peak to peak at a frequency of 100Hz.

The Mercury switches were connected to sensitive detecting equipment and no maloperations were recorded. The Mercury switches are spring mounted within the switch cylinders and protected from possible damage.

Alarm and trip circuit Mercury switches will make, break and carry continuously 2 Amps at 250 Volts A.C or D.C. They will also make and carry for 0.5 sec. 10 Amps at 250 Volts A.C or D.C.

Principle of Operation

The operating mechanism consists of a solid non-metallic cylinder containing the Mercury switch, counter balanced by a smaller solid metal cylinder. Both cylinders are jointed and free to rotate about the same axis, the amount of rotation being controlled by stops.

When the relay is empty of oil, the weight of the switch cylinder predominates and the switch system rests against the bottom stop, the Mercury switch being in the closed circuit position. When the relay is full of oil, both cylinders appear to lose weight.

Due to the different densities, the switch cylinder appears to lose enough weight of the counterbalance cylinder to predominate and rotate the whole system until it reaches the top stop, with the Mercury switch in the open position.

Alarm Operation

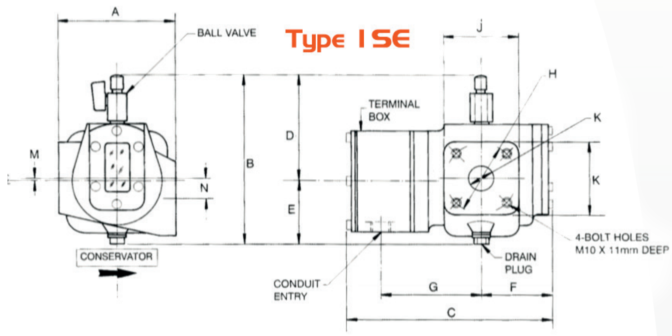
When a slight or incipient fault occurs within the transformer, the gas generated will collect in the top of the relay housing. As gas collects, the oil level will fall and increasing amounts of the alarm switch will appear above the oil level. This results in gradual restoration of the apparent lost weight, until the weight of the switch cylinder predominates.

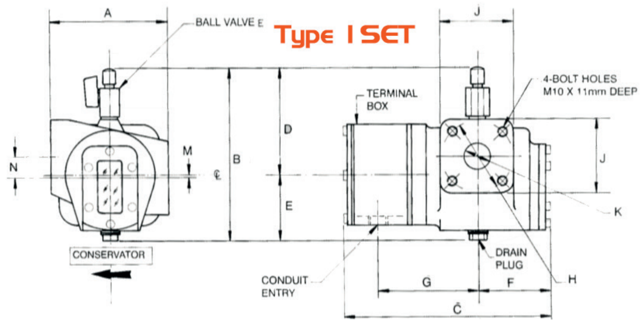
The element rotates as the oil level continues to fall and eventually the alarm switch operates.

Trip Operation

When a serious fault occurs, the generation of the gas is so rapid that an oil surge is set up through the relay. This oil flow will impinge upon the flap fitted to the trip element causing it to rotate about its axis and so bring the Mercury switch to the closed position, which in turn operates the tripping devices. In the event of serious oil loss from the transformer, both alarm and trip elements operate in turn, in the manner previously described for gas collection.

The oil level in the double element relay can be monitored against a graduated scale on the windows both sides.





Single Element and Tap-Changer Types

Single element type relays are available for 1" bore size, designated 1SE, which operate indiscriminately for gas or oil collection and are suitable for small oil filled transformer, capacitor and potential transformer protection.

A special range of single element relays are also available for Tap-changer type transformers which operate for a surge condition or loss of oil only and allow gas, normally produced during tap changing operations to pass freely. The SE relay has only one operating element and operates in the same manner as the DE relays.

A special open frame unit designated R575/1 suitable for fitting inside the header tank tapchangers which operate due to gas collection, oil loss and surge conditions is available.

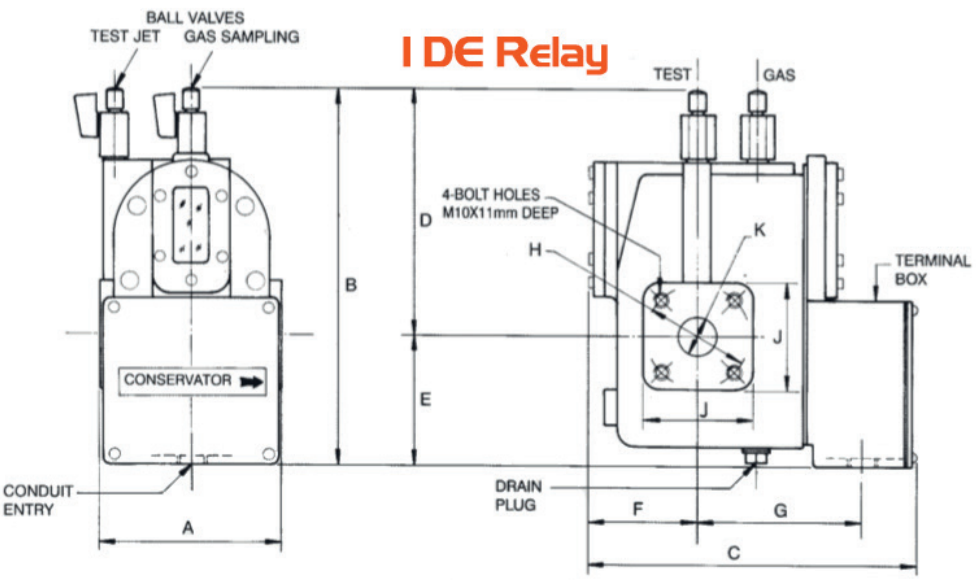
A protective diode unit type D1 can also be provided to protect Reed switches employed in single element units.

BUCHHOLZ RELAY DATA

Reed Switch Data	Single Contact	Change-over Contact
Type	Gunther Type 1526	Gunther Type 1621
Switch Capacity	Max. 250 VA/W	Max. 60 W/80VA
Switching Current	Max. 5A	Max. 2A
Switching Voltage (0-60Hz)	Max. 250 V	Max. 220 V
Initial Contact Resistance	Max. 100 milliohms	Max. 100 milliohms
Breakdown Voltage	Min. 600 v r.m.s	500/400 V d.c
Resonance Frequency	900Hz	-
Shock Resistance	Max. 50g (durations 11ms)	Max. 50g (durations 11ms)
Vibration Resistance	Max. 35g (50-500Hz)	Max. 35g (50-500Hz)
Temperature Resistance	-55ºC to +150ºC	-40ºC to +50ºC

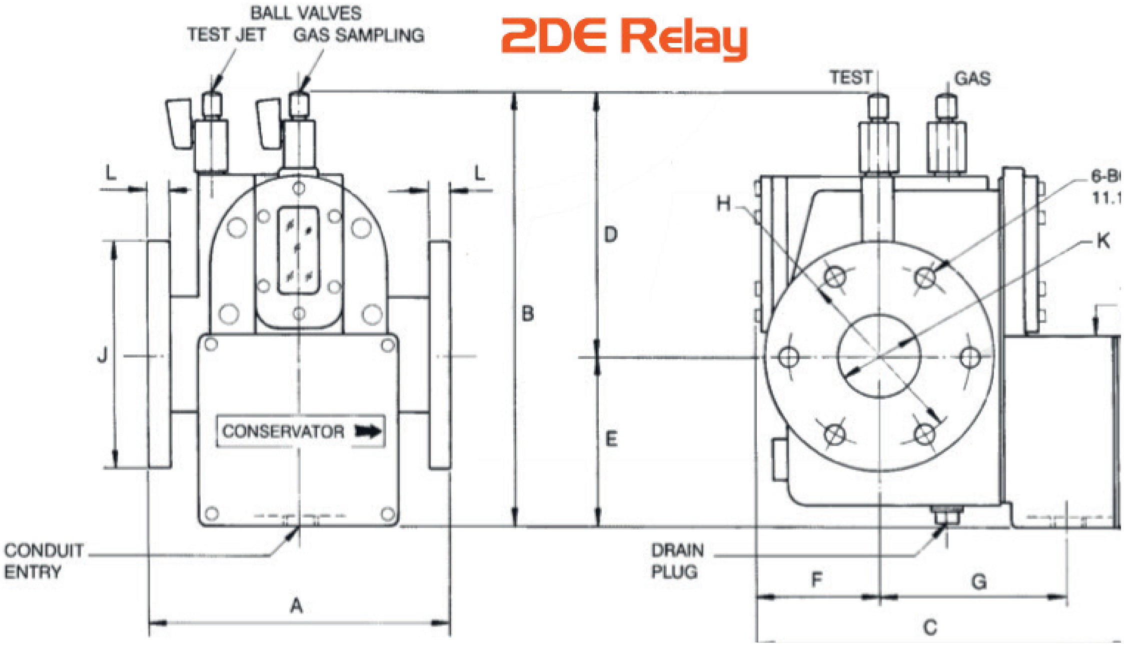
Characteristics	*Steady Oil Flow (mm/sec) to Operate Trip Element Switch*		*Oil level (cc) to operate Alarm Element Switch @ 50º Inclination*		
Model	**Pipe angle 1º Not less than**	**Pipe angle 9º Not more than**	**Min**	**Max**	**For equipment containing**
1SE	650	900	140	200	
1SE/VO	650	900	120	160	
1SE/VK/ML	900	1050	150	230	
1SET 1SET/VO	450	600	N/A	N/A	
1SET/HF	650	750	N/A	N/A	
1DE 1DE/VO 1DE/Vc/o	1000	1300	200	300	Up to 1000 litres 1000 kVA
2DE 2DE/VO 2DE/Vc/o	1100	1400	200	300	1001/10,000 litres 1001/10,000 kVA
3DE 3DE/VO 3DE/Vc/o	1200	1600	200	300	10,000/50,000 litres 10,001 kVA/99 MVA
3DE/HF2 3DE/HF2/VO	1900	2500	250	350	50,000 litres + 100 MVA +

I DE Relay

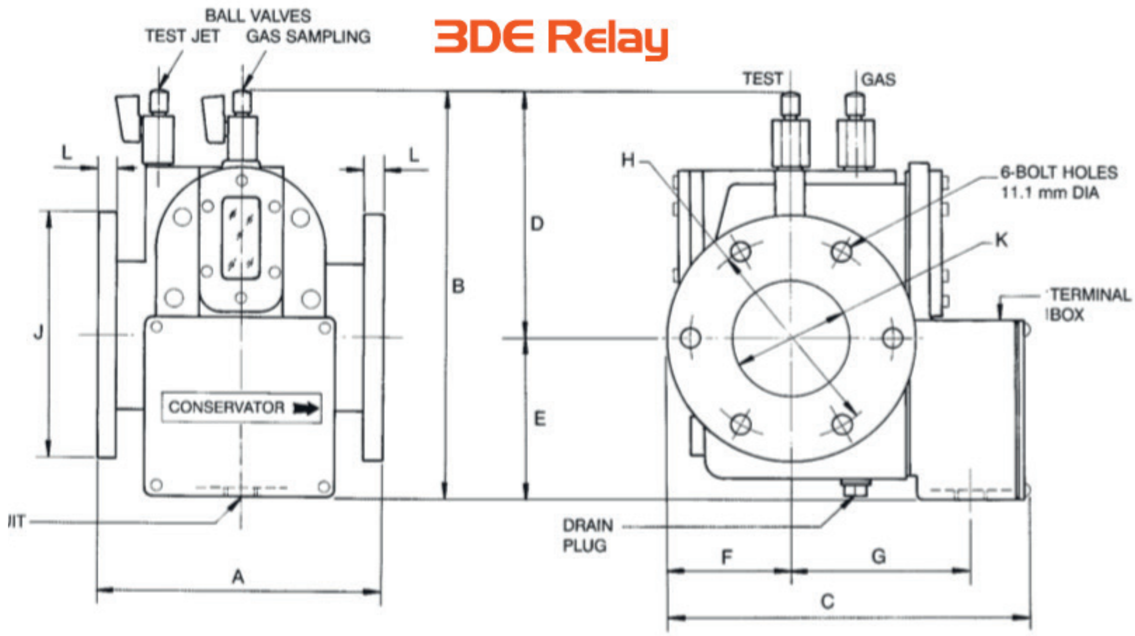


BUCHHOLZ RELAY DATA

2DE Relay



3DE Relay



Type	Dims	A	B	C	D	E	F	G	H	J	K	L	M	N
1DE	mm	127	269	232	171	98	76	114	72	76	25	-	-	-
	in.	5.0	10.6	9.13	6.75	3.9	3.0	4.5	2.84	3.0	1.0	-	-	-
2DE	mm	184	269	232	158	111	76	114	110	139	51	13	-	-
	in.	7.25	10.6	9.13	6.2	4.37	3.0	4.5	4.33	5.5	2.0	0.5	-	-
3DE	mm	184	269	234	158	111	80	114	130	160	76	13	-	-
	in.	7.25	10.6	9.21	6.2	4.37	3.15	4.5	5.12	6.31	3.0	0.5	-	-
1SE	mm	120	174	212	110	64	76	103	72	76	25	-	3.0	22
	in.	4.75	6.85	8.35	4.33	2.52	3.0	4.0	2.84	3.0	1.0	-	0.13	0.85
1SET	mm	120	174	212	104	70	76	103	72	76	25	-	3.0	22
	in.	4.75	6.85	8.35	4.1	2.75	3.0	4.0	2.84	3.0	1.0	-	0.13	0.85

DIN Relays

As well as conventional MK10 model Relays, PBwel also provide DIN style relays depending upon your requirements,.

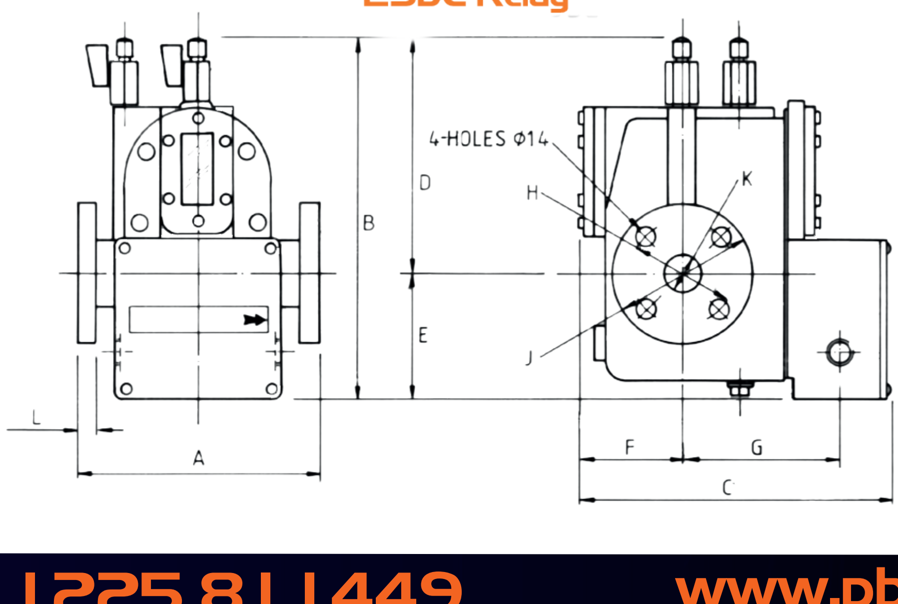
We can also supply bespoke flange sizes, paint types and numbers of fitting holes. Please contact us for more information on this service.

Characteristics

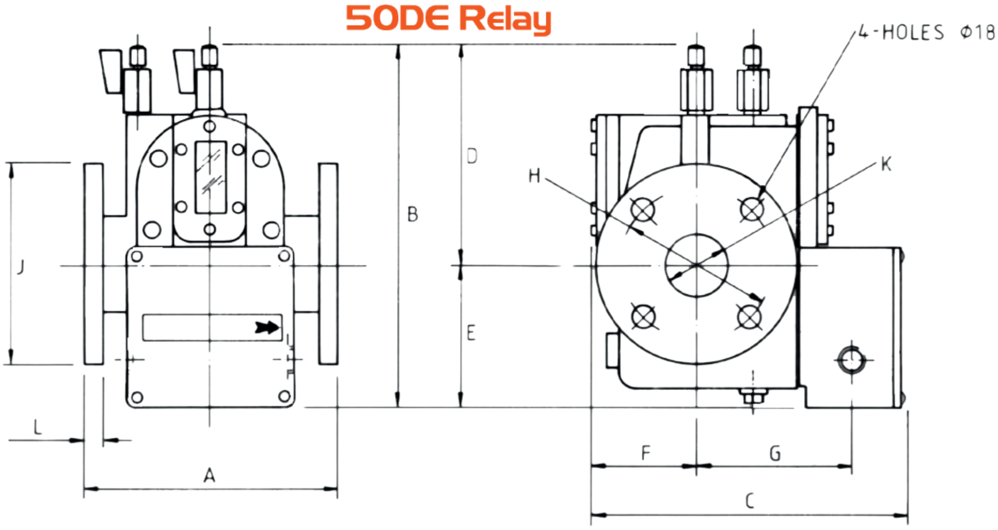
Model	*Steady Oil Flow (mm/sec) to Operate Trip Element Switch* Pipe angle 1º Not less than	Pipe angle 9º Not more than	*Oil level (cc) to operate Alarm Element Switch @ 50º Inclination* Min	Max	For equipment containing
25DE **25DE/VO** **25DE/Vc/o**	1000	1300	200	300	Up to 1000 litres 1000 kVA
50DE **50DE/VO** **50DE/Vc/o**	1100	1400	200	300	1001/10,000 litres 1001/10,000 kVA
75DE **75DE/VO** **75DE/Vc/o**	1200	1600	200	300	10,000/50,000 litres 10,001 kVA/99 MVA
75DE/HF2 **50DE/HF2/VO** **50DE/HF2/Vc/o**	1900	2500	250	350	50,000 litres+ 100 MVA +

Type	Dims	A	B	C	D	E	F	G	H	J	K	L
25DE	mm	200	269	232	171	98	76	114	85	115	25	16
	in.	7.87	10.6	9.13	6.75	3.9	3.0	4.5	3.35	4.53	1.0	0.63
50DE	mm	184	269	232	158	111	76	114	125	165	51	13
	in.	7.25	10.6	9.13	6.2	4.37	3.0	4.5	4.92	6.5	2.0	0.5
75DE	mm	184	269	254	158	111	100	114	160	200	76	13
	in.	7.25	10.6	10	6.2	4.37	3.94	4.5	6.3	7.87	3.0	0.5

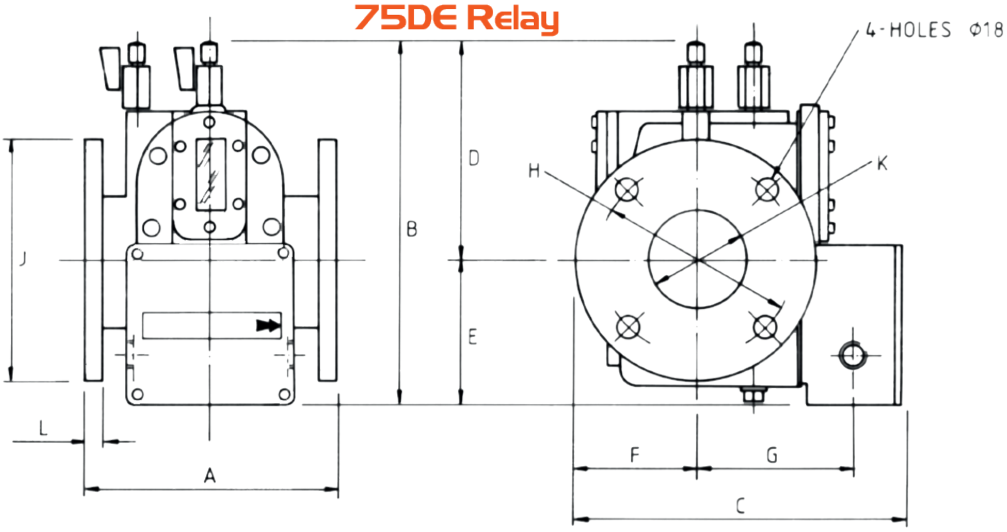
25DE Relay



50DE Relay



75DE Relay



Dry Air Pump

The Dry Air Pump from PBwel provides a portable solution for on-site testing of Gas and Oil operated Buchholz Relays.

A charge of air is created in the polycarbonate cylinder by means of a foot-operated pump. The cylinder contains an indicating silica gel which absorbs the moisture present in the air.

The pressure of the air charge is monitored on the built-in pressure gauge. When a suitable pressure has been attained, the air charge is then quickly passed to the Buchholz via a flexible tube by opening the ballvalve fitted to the cylinder. To prevent backpressure forcing oil back down the flexible pipe, a non-return valve is incorporated in the unit.

The indicating silica gel is a crystalline material, which absorbs moisture readily. The properties of the crystals can be easily regenerated by heating/drying. The crystals are impregnated with Iron compounds which give them an orange colour. Upon absorption of moisture, these crystals change from their orange colour to a pale yellow and then become colourless.

When the crystals change to pale yellow, they should be regenerated. This gel is not classifed as dangerous.

DRY AIR PUMP

PBwel

On-site testing of Buchholz Relays

These instructions are for guidance only. All testing should be carried out in accordance with substation guidelines and safety procedures.

· Place pump on stable area of ground.

· Open unit and attach flexible pipe to non-return valve outlet using suitable spanner. Do not overtighten Brass fasteners.

· Ensure that outlet valve is closed at right angle to ballvalve body.

· When access clear, connect flexible hose to TEST ballvalve upon Buchholz. Open TEST valve.

· Connect suitable test meter to Buchholz terminals in accordance with substation requirements. It is recommended that the switch resistances be measured to avoid damaging switches.

· On the ground, unfasten the foot pump. Pump air into the polycarbonate cylinder until the pressure gauge reads a value of approximately 40 p.s.i.

· Quickly open the ballvalve on the unit, and monitor the TRIP switch, which should operate and then return to its "normal" position.

· The air passed into the Buchholz during the test should be sufficient to operate the ALARM switch.

· Air should be removed from the Buchholz by opening the GAS ballvalve.

· It should be noted that where a long length flexible hose is used, the pressure might need to be increased due to the loss of pressure this causes. Repeat test as necessary with increasing pressures.

· After satisfactory testing close TEST ballvalve, remove flexible hose and replace dust caps.

· Remove test meter from Buchholz terminals and refit terminal box cover.

· Fasten foot pump and close ballvalve on unit and refit dust cap.

· Inspect silica gel and if orange colour faint, regenerate as detailed.

Technical Details

Max. Recommended Operating pressure- 60 p.s.i.g
Size- 475 x 250 x 128mm.
Weight- 8kg

The Dry Air Pump is self contained in a rugged steel case with plated fasteners and a carrying handle to ease transportation.

The provided flexible hose is 7mtr and has fittings to suit 1/8" BSP ballvalves. The hose can be transported in the case.

Damaged units can be returned to our premises for a quotation on repairs.

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