

## 6 EQUIPMENT - CATALOGUES

### 6.1 Buchholz relay "EMB" BF80/10; 09-26-211

Transformer protection relays (Buchholz Principle) 2/98E

Installation, operating maintenance instruction BEDENGL

### 6.2 Oil temperature indicator "MESSKO" type MT – ST 160 SK/TT

Winding temperature indicator "MESSKO" type MT – ST 160 W

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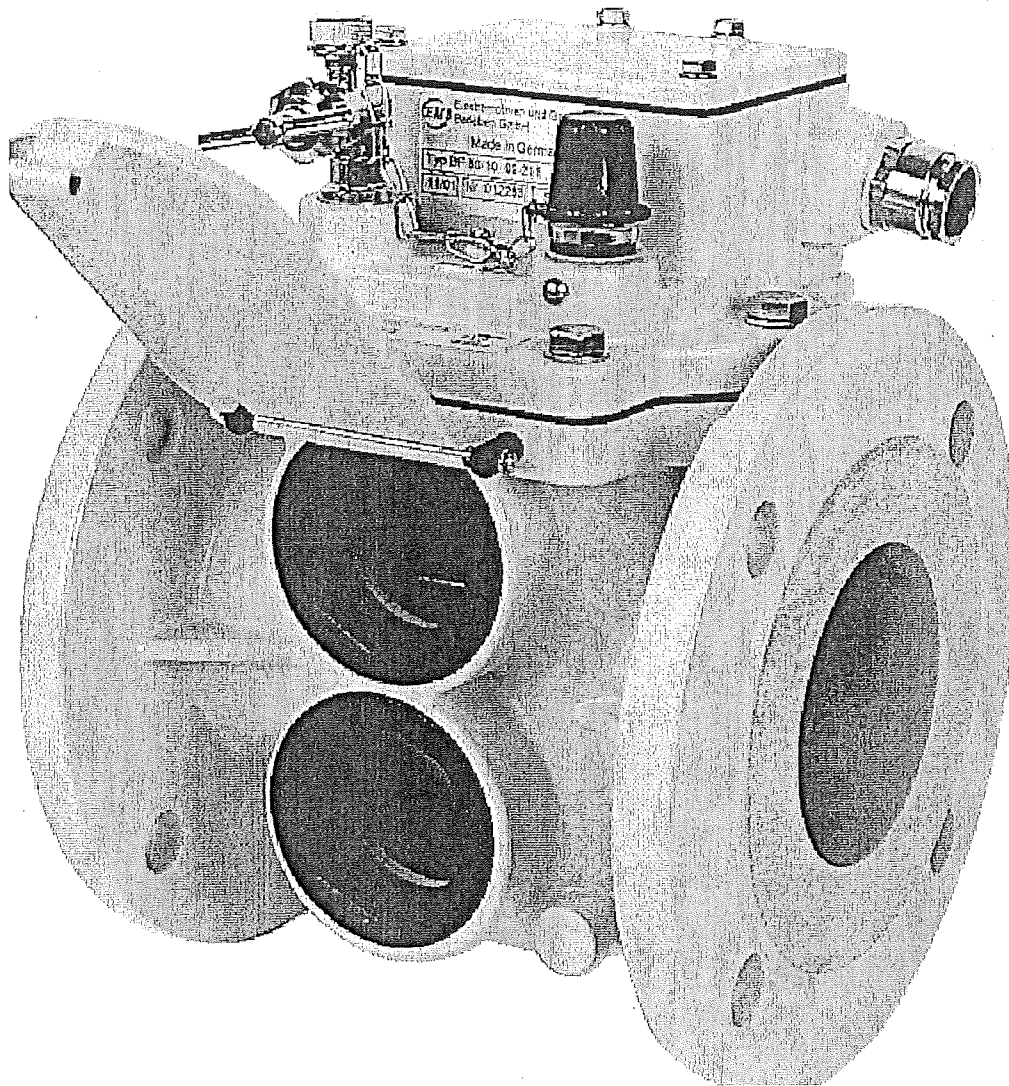
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**Transformer Protection Relays  
(Buchholz Principle)**

# Elektromotoren und Gerätebau Barleben GmbH

## 1. Application

The Buchholz relay is a protective unit in compliance with DIN 42566 and EN 50216 and serves to supervise liquid-insulated appliances with expansion vessel, such as transformers or choke coils.

Design of the relay is such that it responds in the event of troubles inside of the appliance to be protected. 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 indoor and open-air equipment.

## 2. Design features

Essential components are:

### Casing (Fig. 1)

The casing (4) is a weather-proof casting of light alloy supplied either with screwed or flanged ends (5). The casing has sightglasses (2; 3) for inspection of switching systems. The sightglasses with scale divisions permit reading of collected gas volume. The relays can be equipped with lids (may be folded up) before the sightglasses.

### Cover (Fig. 2)

The cover (2) is a weather-resistant casting of light alloy. Terminal box (3), test valve (4) and test key, covered by a cap nut (10), are arranged above the cover. The terminal box has an earthing contact (7) and the electrical connectors (9). The cap (5) seals the terminal box. If the cap is folded up the contact setting (6) can be seen. The cable may be optionally brought in through one of both armoured cable entries (1; 8).

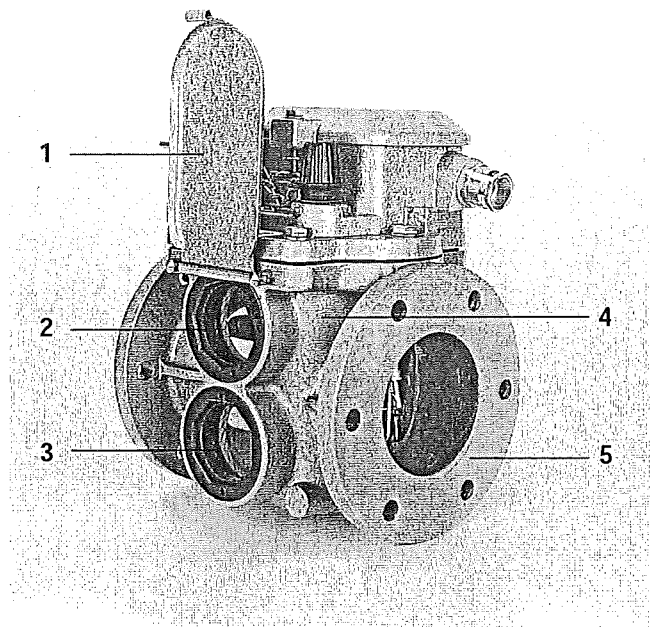


Fig. 1 Casing with cover

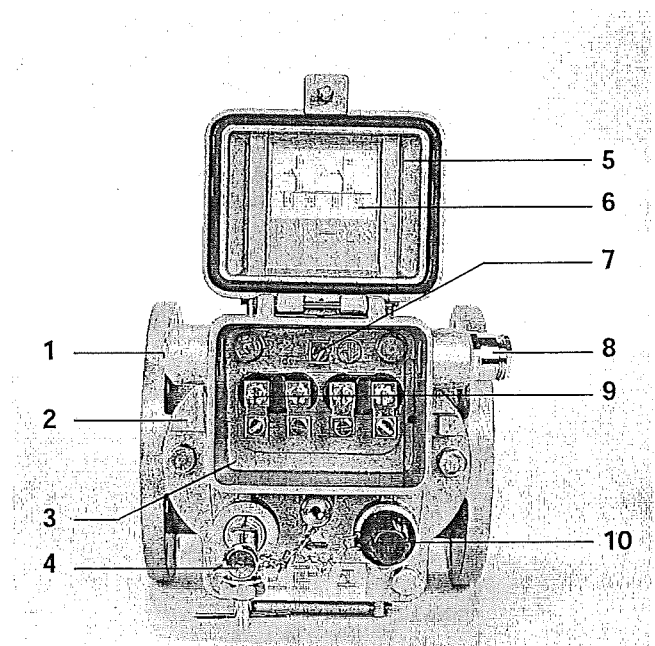


Fig. 2 Cover with cap folded up

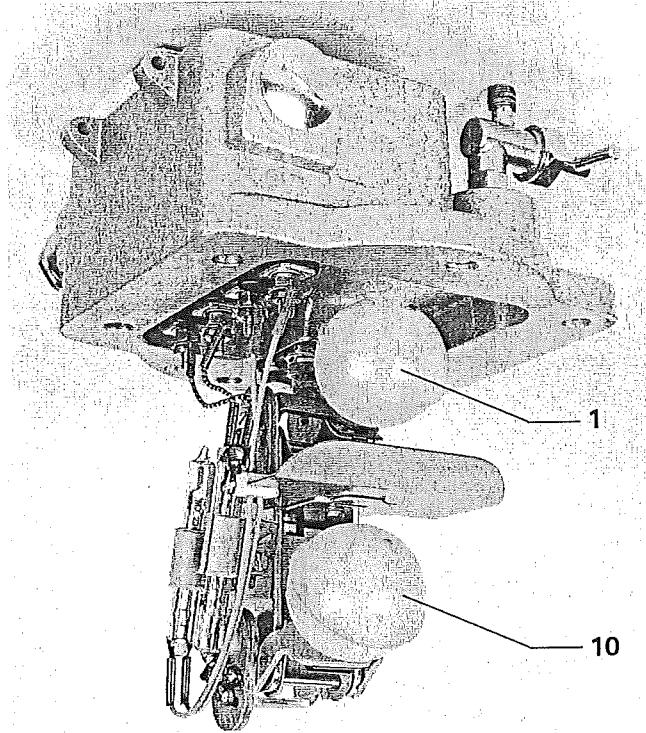


Fig. 3 a

### Switchgear (Fig. 3 a and 3 b)

The switchgear has the following main components:

- Function element(s), switching system(s)
- Carrier, frame
- Mechanical testing device

The single- float Buchholz relay has only one switching system (see para. 3). The double- float Buchholz relay has an upper and a lower switching system (see para. 3).

The upper switching system comprises:

- One float (1)
- One permanent magnet(6)
- One (two) magnet contact tube(s) (8)

The lower switching system comprises:

- One float (10)
- One permanent magnet (9)
- One (two) magnet contact tube(s) (7)
- One damper (4)

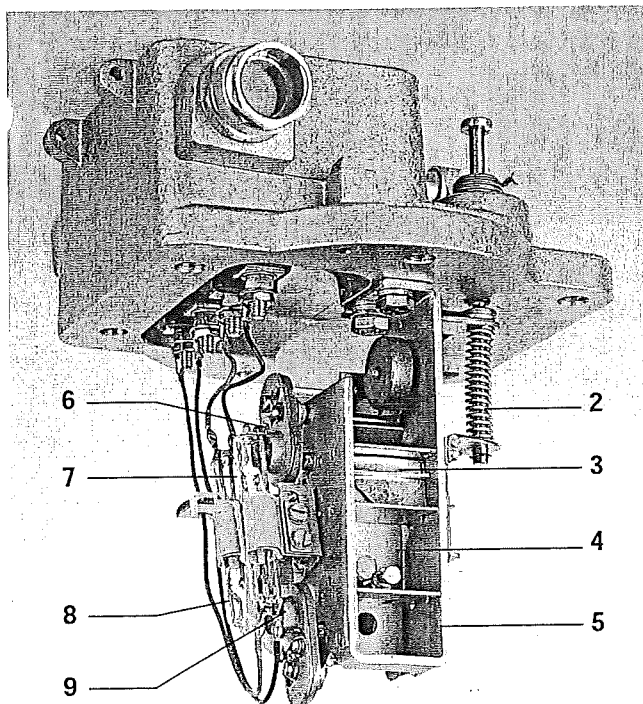


Fig. 3 b

The permanent magnet and the float are rigidly linked forming an unit that is movably fitted to the frame together with mechanical testing device and magnet contact tube(s).

The damper is fixed by further permanent magnets (3) and acts on the lower switching system.



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## 3. Function

The example of the double-float Buchholz relay is used to explain the function.

The Buchholz relay is installed in the connection pipe between boiler and expansion vessel of transformer. When in normal operation, the relay is completely filled with insulating liquid. Due to buoyancy, floats are in their uppermost positions. If troubles occur inside the transformer, the Buchholz relay responds as follows:

### Gas accumulation (Fig. 4)

**Trouble:** Local overheating provokes gradual decomposition of liquid and solid insulation material plus formation of gas.

**Reaction:** Gases move to the top, accumulate in the Buchholz relay and displace the insulation liquid. The liquid level falls and the upper float comes down as well. The permanent magnet coupled to this float slides along a magnet contact tube. A contact is operated by the permanent magnet as soon as the float reaches its response position. A warning signal is released. Design of the Buchholz relay is such that only a certain gas volume can be received. Further development of gas lowers the liquid level to the height of the inner wall of upper pipeline. The following gases may flow off towards the expansion vessel. The position of lower float remains constant.

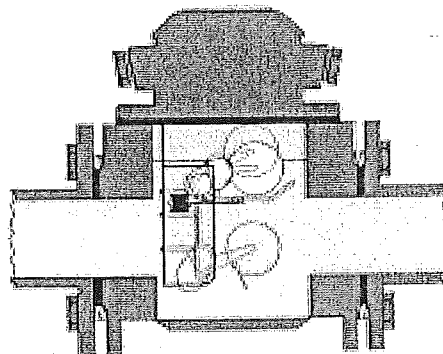


Fig. 4

### Loss of insulation liquid (Fig. 5)

**Trouble:** Leaks causing loss of insulation liquid.

**Reaction:** The upper float moves down according to falling liquid level. The switching system operates on the same principle known from gas accumulation. If the liquid loss continues, expansion vessel and connection tube get discharged through the Buchholz relay. The falling liquid level causes drop of lower float. The latter is coupled to a permanent magnet that slides along a magnet contact tube. When the lower float reaches its response position, a contact is operated by the permanent magnet. A cut-out signal is released.

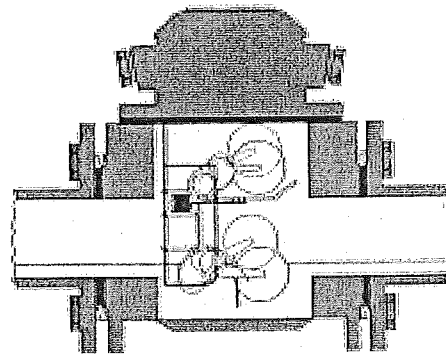


Fig. 5

### Flow of insulation liquid (Fig. 6)

**Trouble:** Decomposition gases are produced rapidly or even vigorously as a result of high-energy discharges. The resultant pressure waves cause a strong flow of insulation liquid towards the expansion vessel.

**Reaction:** The flow meets the damper arranged in the fluid flow. If the flow velocity exceeds the responsiveness of damper, the latter moves abruptly in flow direction, thereby forcing the lower float into its response position so that the contact is operated. A cut-out signal is thereby released.

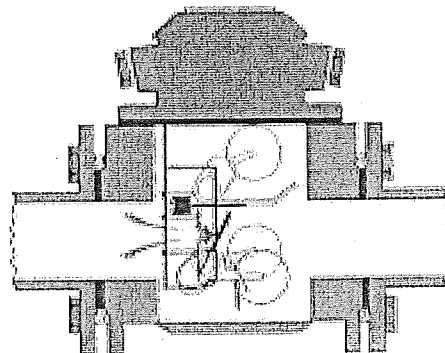
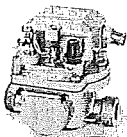
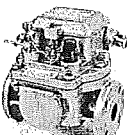
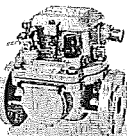


Fig. 6

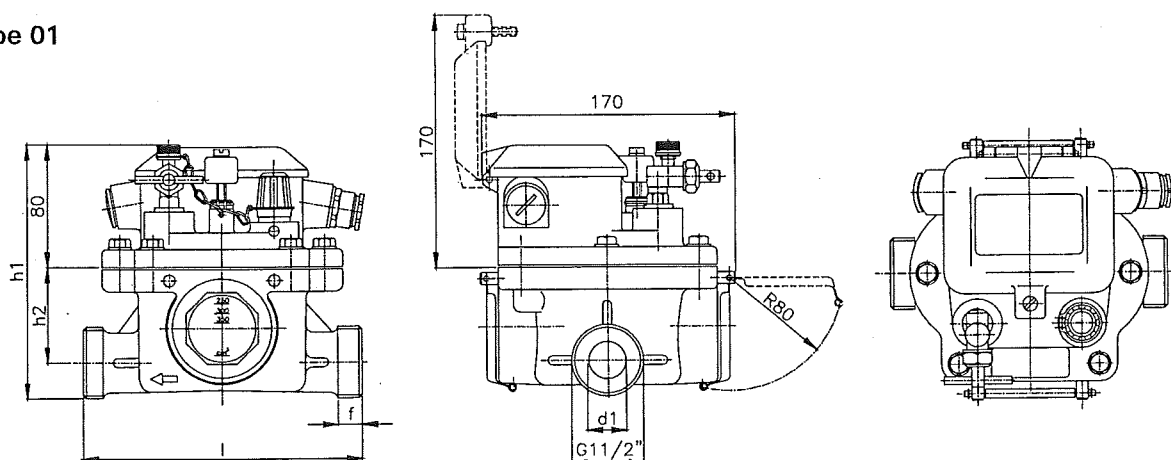
The top and bottom switching systems form a functional unit in the single-float Buchholz relay. In case of a fault, the single-float Buchholz relay normally isolates the transformer immediately from the mains system.

## 4. Type list

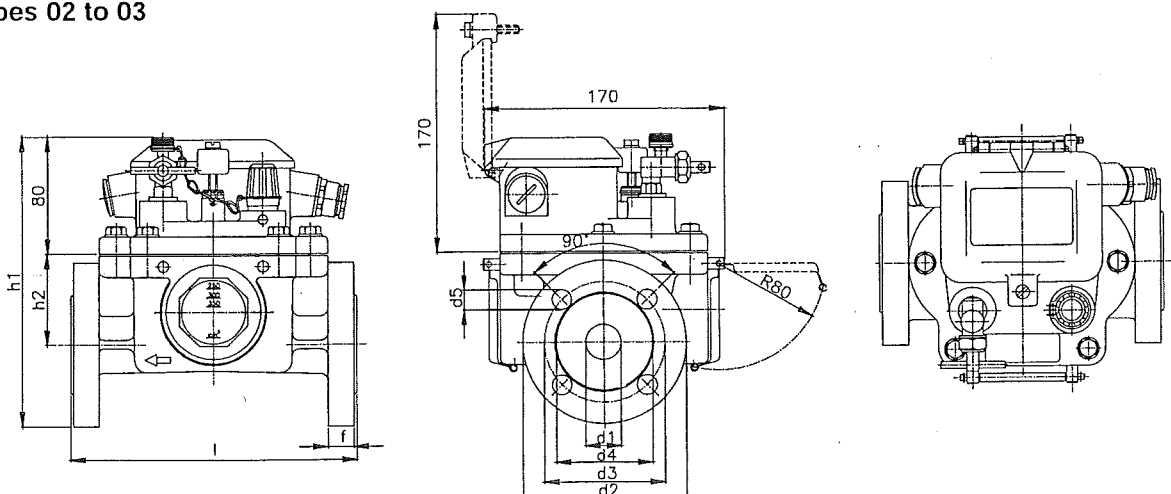
### 4.1. Single-float Buchholz relays according to DIN 42566

	Type code no. (works-design.) (DIN-design.)	Mode of connection	DN of pipe (mm) $d_1$	Flange dimensions (mm)					Relay dimensions (mm)				weight (kg)	Suited for transformer ratings of
				$d_2$	$d_3$	$d_4$	$d_5$	$f$	$b$	$l$	$h_1$	$h_2$		
	<b>01</b> (AG 25) (CG 25)	Connection thread G 1 1/2 A	<b>25</b>	-	-	-	-	16	170	185	170	62	3.5	≤ 1600 KVA
	<b>02</b> (AF 25/6) (-)	Flange 4-holes	<b>25</b>	100	75	60	12	12	170	185	195	62	3.9	≤ 1600 KVA
	<b>03</b> (AF 25/10) (-)	Flange 4-holes	<b>25</b>	115	85	68	14	16	170	200	205	62	4.2	≤ 1600 KVA

#### 4.1.1. Type 01

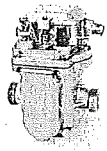
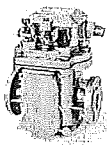
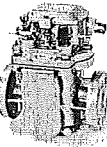
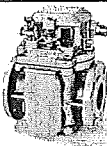
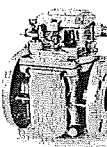
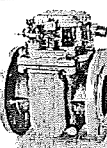
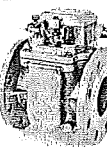
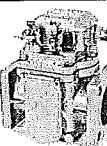


#### 4.1.2. Types 02 to 03

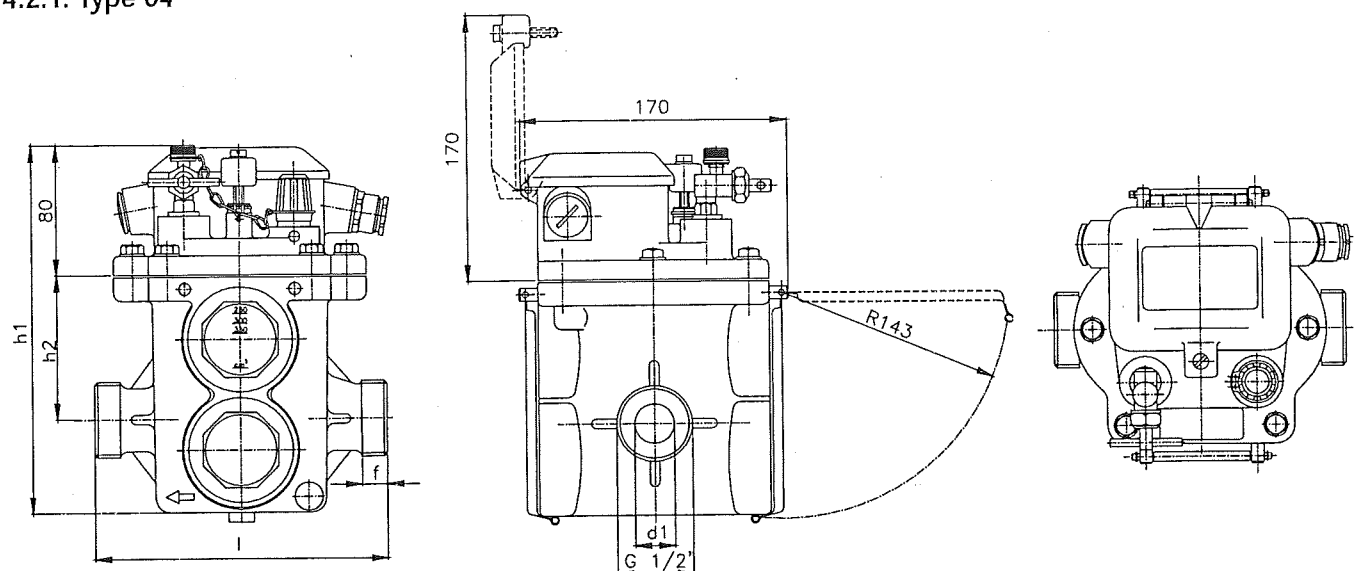


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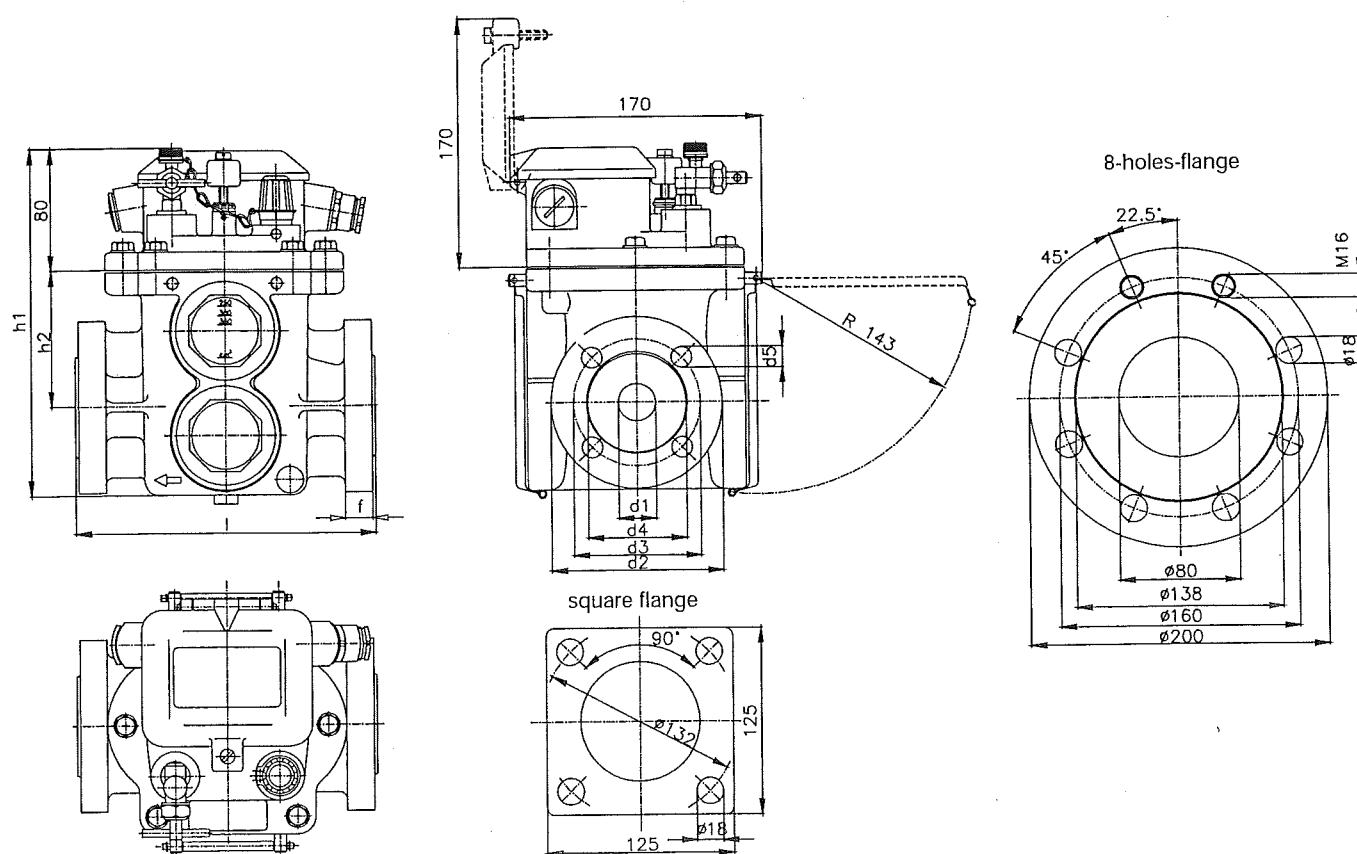
## 4.2. Double-float Buchholz relays according to DIN 42566

	Type code no. (works-design.) (DIN-design.)	Mode of connection	DN of pipe (mm) d <sub>1</sub>	Flange dimensions (mm)					Relay dimensions (mm)				weight (kg)	Suited for transformer ratings of
				d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	d <sub>5</sub>	f	b	l	h <sub>1</sub>	h <sub>2</sub>		
	<b>04</b> (BG 25) (DG 25)	Connection thread G1 1/2 A	<b>25</b>	-	-	-	-	16	170	185	235	90	4.5	≤ 5000 KVA
	<b>05</b> (BF 25/6) (-)	Flange 4-holes	<b>25</b>	100	75	60	12	12	170	185	235	90	5.0	≤ 5000 KVA
	<b>06</b> (BF 25/10) (DR 25)	Flange 4-holes	<b>25</b>	115	85	68	14	18	170	200	235	90	5.5	≤ 5000 KVA
	<b>07</b> (BF 50/6) (-)	Flange 4-holes	<b>50</b>	140	110	90	14	12	170	185	235	80	5.4	≥ 5000 KVA ≤ 10000 KVA
	<b>08</b> (BF 50/10) (DR 50)	Flange 4-holes	<b>50</b>	165	125	102	18	16	170	195	250	80	6.3	≥ 5000 KVA ≤ 10000 KVA
	<b>09</b> (BF 80/10) (-)	Flange 4-holes	<b>80</b>	200	160	138	18	15	170	195	265	80	6.2	≥ 10000 KVA
	<b>09-26</b> (BF 80/10/8) (DR 80)	Flange 8-holes	<b>80</b>	200	160	138	18 M16	15	170	195	265	80	6.2	≥ 10000 KVA
	<b>10</b> (BF 80/Q) (DQ 80)	Flange square 4-holes	<b>80</b>	125	132	-	18	20	170	200	235	80	5.0	≥ 10000 KVA

#### 4.2.1. Type 04



#### 4.2.2. Types 05 to 10



## 5. Special design

Special designs are available for use under conditions for which the Buchholz relays of standard design are not sufficient. Special features are summarized in table 1.

Table 1

identif. no.	Explanation
20	Silicone oil is used as insulation liquid
21	Midel oil is used as insulation liquid
22	Climatic version (suited for tropical or extrem frigid open-air climates)
23	damper hold in response position
24	special design approved by RWE Energie AG, Germany
25	switching system equipped with two magnet contact tubes
26	Type 09 with eight-hole flange as per DIN 2501, nominal pressure 1 MPa
28	Buchholz relay with oil drain plug
29	Customer requests on the basis of conditions agreed with the manufacturer
30	Special design approved by VKR, Germany

## 6. Technical data

Table 2

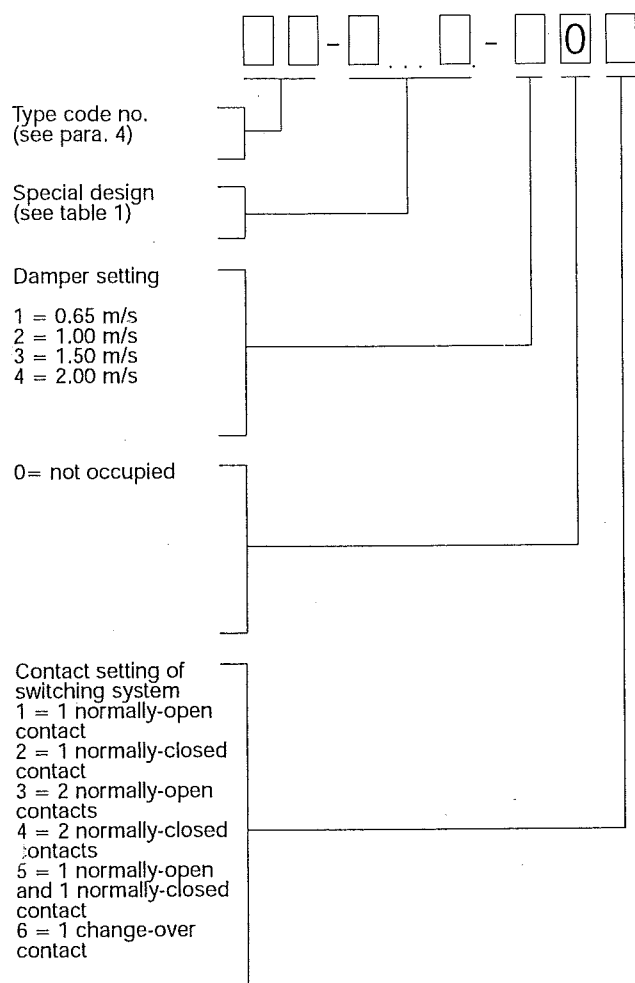
Parameter	Data	Notes
Nominal voltage	AC 230V DC 230V	12V to 250V 12V to 250V
Nominal current	AC 2 A DC 2 A	0.05 A to 2 A 0.05 A to 2 A
Contact voltage capacity	AC 1000V	-
Insulation voltage capacity	AC 2000V	Contact against casing
Ambient temperature	-45 °C to +55 °C	Others on request
Insulation liquid - Type - Temperature - Viscosity	Transformer oil -25 °C to +115 °C 1 mm <sup>2</sup> /s to 1100 mm <sup>2</sup> /s	- - -
Response of switching system in case of - Gas accumulation - Flow of insulation liquid	200 cm <sup>3</sup> to 300 cm <sup>3</sup> 0.65 m/s ± 15 % 1.00 m/s ± 15 % 1.50 m/s ± 15 % 2.00 m/s ± 15 % 2.50 m/s ± 15 % 3.00 m/s ± 15 %	- Others on request
Response time of damper	< 0.1 s	-
Shock resistance - Earthquake / Vibration - Impact	2 g (peak value) / frequency range 2 Hz to 200 Hz 25 g / shock duration 11 ms	- -
Nominal installation position	1° ascending towards expansion vessel	0° to 5°
Degree of protection	IP 54	Others on request

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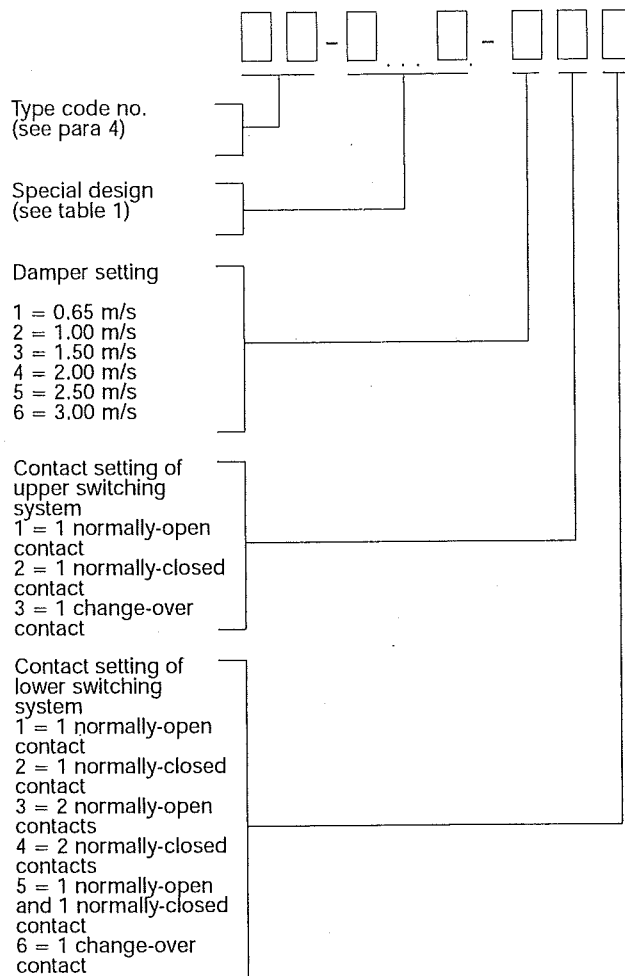
## 7. Ordering data

For placing orders, please, use the following key.

### Single-float Buchholz relays



### Double-float Buchholz relays



### Ordering example:

Buchholz relay 09-22.25.26.28.-313

### Explanation:

- 09 = Designation of a double-float Buchholz relay type 09
- 22 = Climate version
- 25 = switching system equipped with two magnet contact tubes
- 26 = Eight-hole flange
- 28 = Oil drain plug
- 3 = Damper setting of 1.50 m/s
- 1 = Contact setting of upper switching system  
„1 normally-open contact“
- 3 = Contact setting of lower switching system  
„2 normally-open contacts“

### Remark:

When using change-over contacts (for one or both switching systems) in the double-float Buchholz relay it is not possible to equip one of the switching systems of the relay with two magnet tubes due to the only available 6 possibilities for connecting.



Elektromotoren und Gerätebau Barleben GmbH may supply further products for protection and supervision of liquid-insulated transformers and connected equipment.  
These devices are described in separate catalogues.

ZG	Extra items for use together with Buchholz
ZG 1.1.	Unit for loss-free gas tapping at man's level
ZG 3.1.	Gas testing device
ZG 4.1.	Reflux lock
ZG 5.1.	Test pump
ZG 5.2.	Test pump, foot-actuated
ZG 6.1.	Oil Sampling Device
Gas Sampling Cartridges	Manual cartridge, Automatic cartridge, different sets
ÜRF 25/10	Supervisory relay as annunciator for oil-insulated high-capacity step switches
SG 25 SF 25/10	Flow indicator as protective relay for supervision of oil circulation lubrication or oil circulation cooling in machines and equipment

## 1. Installation

### 1.1 Pipe-mounting (Figure 1)

The Buchholz relay (2) has to be installed in the pipe (4) that is connecting the tank (1) of the device to be protected (transformer, reactance coil) with the expansion tank (5).

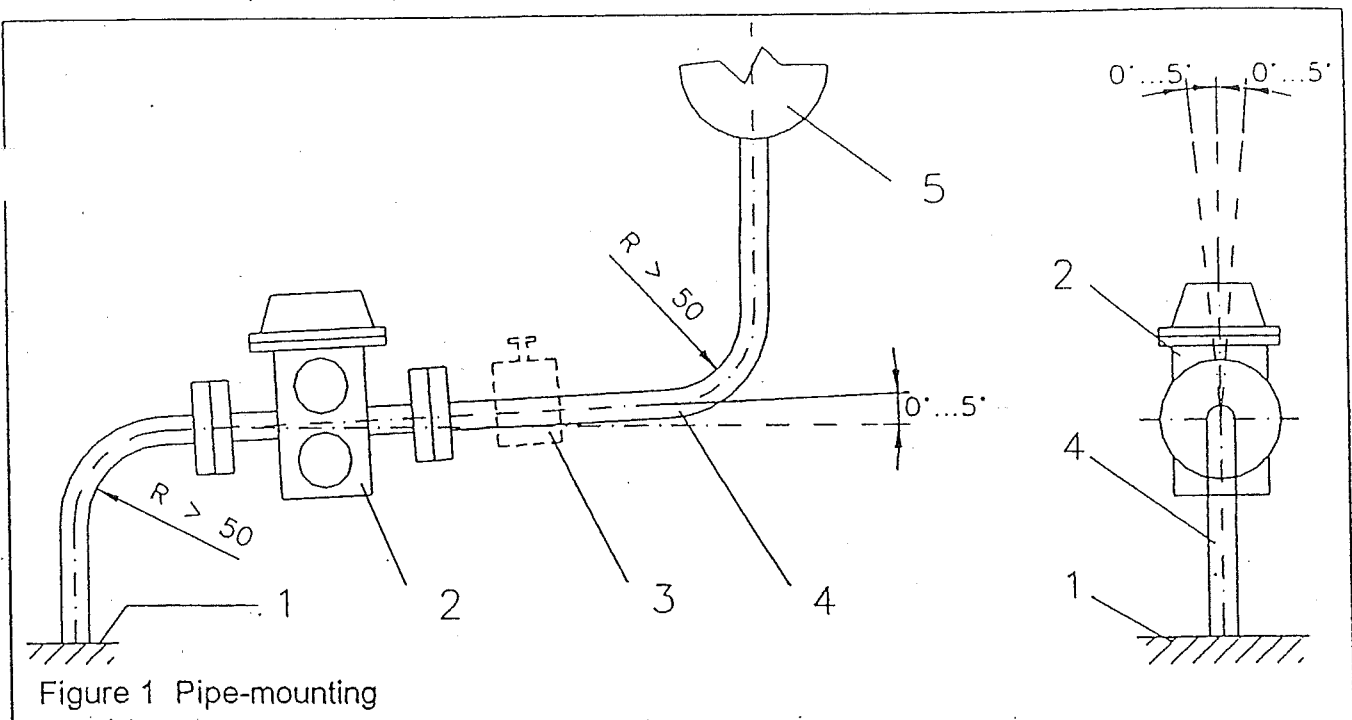


Figure 1 Pipe-mounting

When installing, note the following:

- The red arrow on the casing cover must point to the expansion tank.
- The upward slope of the pipe leading to the expansion tank must not fall below 0°, but should not exceed 5°.
- The sloping position of the Buchholz relay across the flow direction is such that the deviation from the perpendicular does not exceed 5°.
- The pipe should not contain any elbows. The radii of bends (R) must be greater than 50.
- The following limits apply to free pipe lengths between the Buchholz relay and the nearest reference point:

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

In case of longer distances than indicated, a supporting element should be provided next to the Buchholz relay.



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# Installation, operating maintenance instructions for Buchholz relays

Sheet: 2 of 8

Date: September 1993

## 1.2 Filling of the Buchholz relay (Figure 2)

- \* Screw off low cap nut (1) from test valve (2).
- \* Open test valve and let the air escape from the Buchholz relay.
- \* Close test valve when insulating liquid starts to flow out.
- \* Tighten low cap nut on test valve

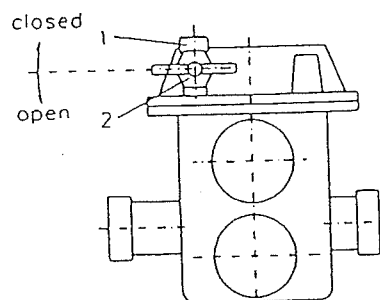


Figure 2 Filling of the Buchholz relay

## 1.3 Draining of the Buchholz relay (Figure 1)

- \* Close shutoff valve (3) on expansion tank side (5).

Open the Buchholz relay

- \* Lower insulating liquid level down to the upper mark of the glass front.

Dismantle the Buchholz relay

- \* Lower insulating liquid level down to the level of the lower interior wall of the piping.

## 1.4 Changing the contact setting (Figure 3)

Unless otherwise agreed, the switching systems of the devices are supplied as make contacts. The "make" setting can be changed, however, into the "break" setting, and vice versa. The manufacturer's setting of switching systems provided with changeover magnetic switches cannot be changed.

To change the setting, proceed as follows:

- \* Drain the Buchholz relay.
- \* Unscrew the M8 hexagon head cap screws of the cover.
- \* Remove cover together with switch mechanism from housing.
- \* Unscrew M3 fillister head screw (1).
- \* Turn magnetic mount (2) into the position marked "O" (break contact element) or "S" (make contact element).
- \* Tighten M3 fillister head screw.
- \* Put cover together with switch mechanism in the housing.

Ensure that

- the red arrow on the cover points to the expansion tank, and that
- the seal and the sealing faces are free from insulating liquid.

- \* Tighten the M8 hexagon head cap screws uniformly.

- \* Fill the Buchholz relay. Carry out a functional test.

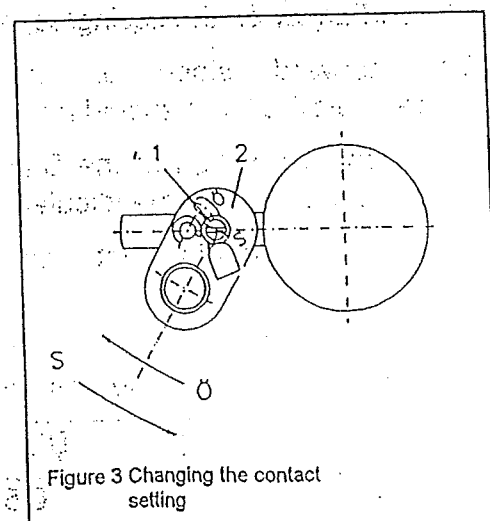


Figure 3 Changing the contact setting

## 1.5 Changing the baffle plate setting (Figure 4, Figure 5)

Unless otherwise agreed, the supplied baffle plate is adjusted to a flow rate of the insulating liquid of 1.0 m/s. The manufacturer's setting can be changed to 0.65 m/s or 1.5 m/s, and vice versa.

On request, the flow rate can be set to 2.0 m/s by the manufacturer. This setting cannot be changed by the customer, however.

To change the setting, proceed as follows:

- \* Drain the Buchholz relay.
- \* Unscrew the M8 hexagon head screws of the cover.
- Remove cover together with switch mechanism from housing.

### Single-float Buchholz relay (Figure 4)

- \* Loosen setting screw (2).
- \* Displace the upper part of baffle plate (3), until its cam snaps into the lower part of the baffle plate (1) at the desired operating value.
- \* Tighten setting screw.

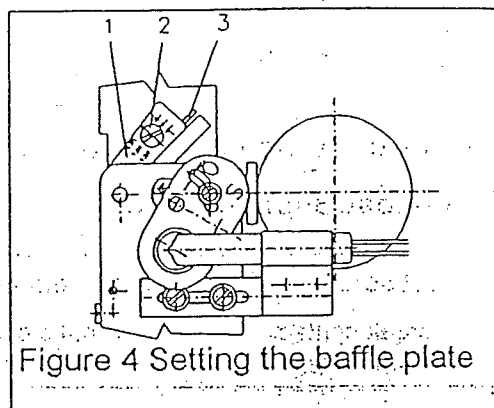


Figure 4 Setting the baffle plate

### Two-float Buchholz relay (Figure 5)

- \* Loosen the setting screw (2).
- \* Lift magnetic mount (1) out of snap in slots (3) of intermediate plate (4) and displace it, until the window (5) of the magnetic mount indicates the desired operating value.
- \* Snap magnetic hold into place.
- \* Tighten setting screw.

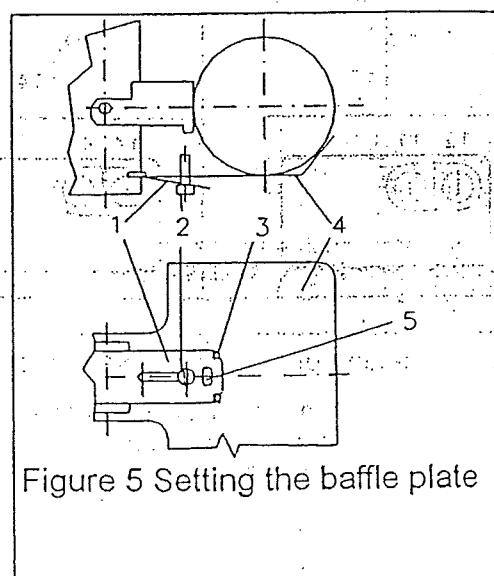


Figure 5 Setting the baffle plate

- \* Put cover together with switch mechanism in the housing.

Ensure that

- the red arrow on the cover points to the expansion tank, and that
- the seal and the sealing faces are free from insulating liquid.

- \* Tighten the M8 hexagon head cap screws uniformly.

## 1.6 Electrical connection (Figure 6)

The closure of the terminal box provides protection from contact and dust.

Connect the cables as follows:

- \* Loosen the fillister head screw (2).
- \* Fold up the spring flap cover (1).
- \* Insert cable through Pg 16 screwed conduit (3).
- \* Connect cable to the marked terminal bolt(4).(max. permissible cross-section:4mm<sup>2</sup>)
- \* Close spring flap cover.
- \* Tighten fillister head screw.

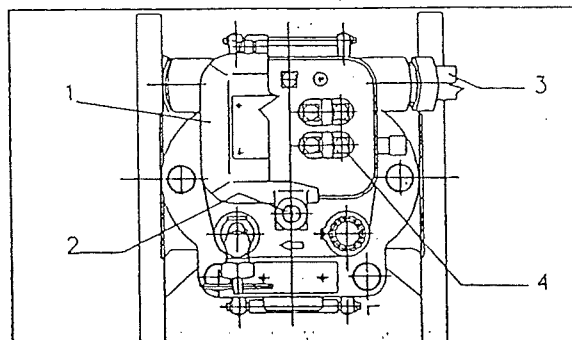
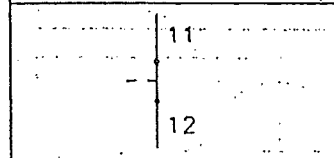
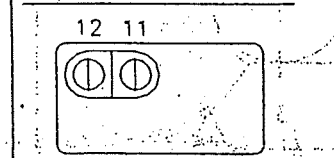
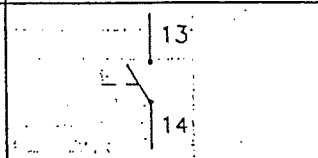
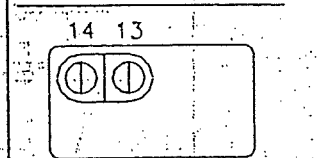
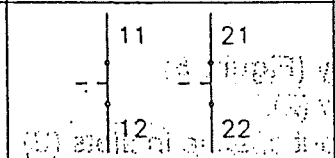
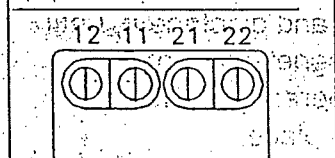
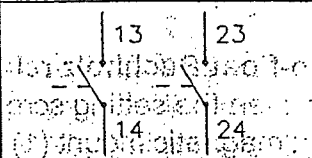
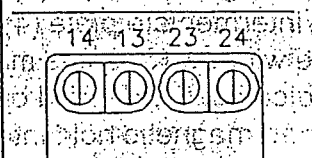
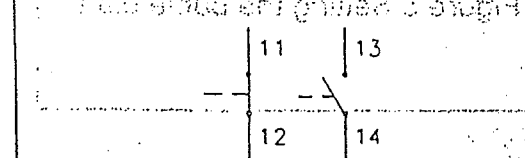
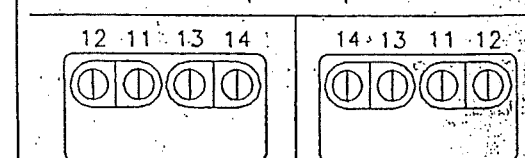
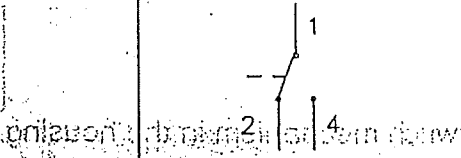
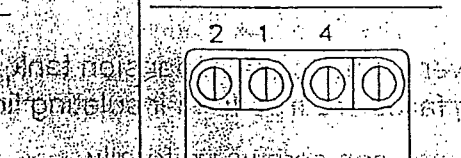


Figure 6 Electrical connection

Terminal box wiring is clear from the following diagrams:

### Single-float Buchholz relay

Contact setting of the switch system (disconnection):			
1 break contact element (NC)	1 make contact element (NO)	2 break contact elements (NC)	2 make contact elements (NO)
 	 	 	 

Contact setting of the switch system (disconnection):		
1 break contact element and 1 make contact element (NC/NO)	1 change-over contact element	
 	 	



Elektromotoren und  
Gerätebau Barleben GmbH

# Installation, operating maintenance instructions for Buchholz relays

Sheet: 5 of 8

Date: September 1993

## Two-float Buchholz relay

Contact setting of the upper switching system (warning):

1 break contact element (NC)	1 break contact element (NC)	1 make contact element (NO)	1 make contact element (NO)

Contact setting of the lower switching system (disconnection):

1 break contact element (NC)	1 make contact element (NO)	1 make contact element (NO)	1 break contact element (NC)

Contact setting of the upper switching system (warning):

1 break contact element (NC)	1 break contact element (NC)	1 break contact element (NC)

Contact setting of the lower switching system (disconnection):

2 break contact elements (NC/NC)	2 make contact elements (NO/NO)	1 break contact element and 1 make contact element (NC/NO)





# Installation, operating maintenance instructions for Buchholz relays

Sheet: 6 of 8

Elektromotoren und  
Gerätebau Barleben GmbH

Date: September 1993

## Two-float Buchholz relay

Contact setting of the upper switching system (warning):

1 make contact element (NO)	1 make contact element (NO)	1 make contact element (NO)

Contact setting of the lower switching system (disconnection):

2 make contact elements (NO/NO)	2 break contact elements (NC/NC)	1 break contact element and 1 make contact element (NC/NO)

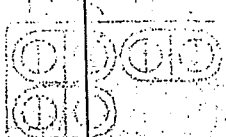
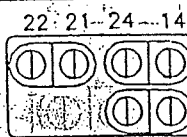
Contact setting of the upper  
switching system (warning):

1 change-over contact element

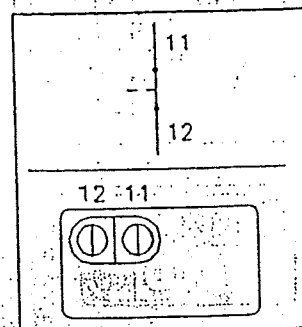


Contact setting of the lower  
switching system (disconnection):

1 change-over contact element



Explanation of symbols:  
Example: Single-float Buchholz relay



Graphical symbol with  
terminal marking and  
identification number

Terminal box wiring

Note: The illustration refers to switching systems in normal position. Normal position means the operating condition of the Buchholz relay completely filled with insulating liquid allowing troublefree operation of the equipment to be protected.  
A plate showing the connection diagram and wiring is provided inside the spring flap cover.

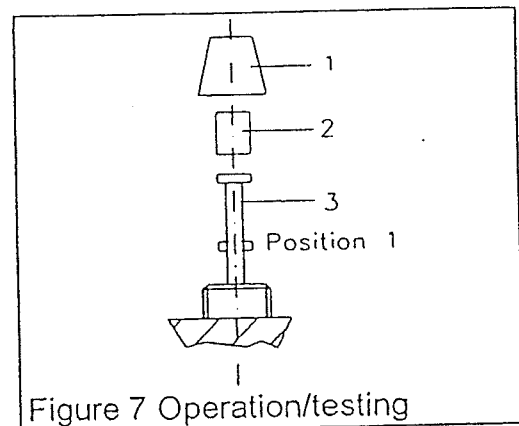
Connected loads: Voltage AC 12 V to 250 V  
DC 12 V to 250 V

Current AC 2Amps  $\cos\phi \geq 0.4$   
DC 2Amps  $\tau = L/R \leq 75\text{ms}$

## 2. Operation

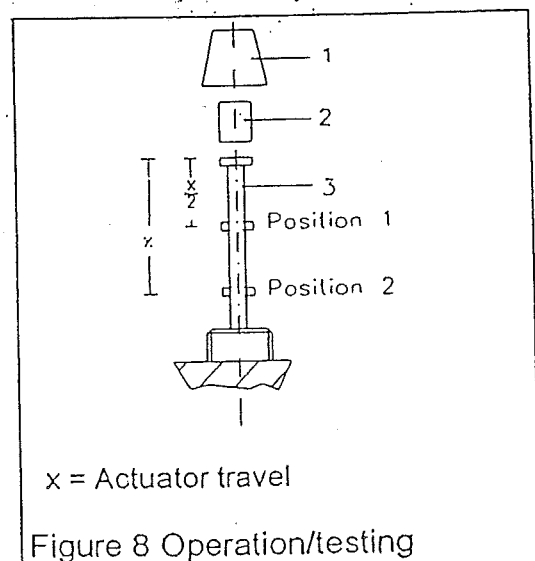
### 2.1 Single-float Buchholz relay (Figure 7)

- \* Screw off doned cap nut (1).
- \* Remove locking arrangement (2) from doned cap nut.
- \* Press test button (3) down to position 1 (stop position) and hold.
- \* Obtain verification of correct functioning from control room.
- \* Release test button.
- \* Screw on doned cap nut without locking arrangement.



### 2.2 Two-float Buchholz relay (Figure 8)

- \* Screw off doned cap nut (1).
- \* Remove locking arrangement (2) from doned cap nut.
- \* Press test button (3) down to position 1 and hold. (checking the upper switching system)
- \* Obtain verification of correct functioning from control room.
- \* Press test button (3) down to position 2 (stop position) and hold. (checking the lower switching system)
- \* Obtain verification of correct functioning from control room.
- \* Release test button.
- \* Screw on doned cap nut without locking arrangement



## 2.3 Testing by test pump (Figure 9)

- \* Screw off low cap nut (1) from the test valve (2).
- \* Connect adapter (4) of the connecting hose (3) of the air pump to valve sleeve (5).
- \* Open test valve.
- \* Pump air into the Buchholz relay until dropping of the (upper) float causes the magnetic dry-reed switch tube to make contact.
- \* Obtain verification of correct functioning from control room.
- \* Close test valve.
- \* Remove adapter from valve sleeve.
- \* Open test valve and let the air escape.
- \* Close test valve when insulating liquid begins to drain.
- \* Tighten low cap nut on test valve.

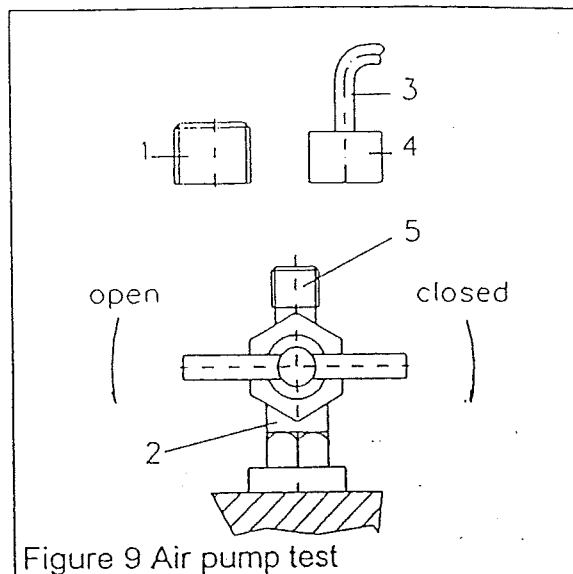


Figure 9 Air pump test

## 3. Maintenance

Buchholz relays are almost insensitive to ambient conditions. Therefore, continuous maintenance is not required in operation.

When repainting the Buchholz relay, keep condensate drain and vent hole free from paint coating. The condensate drain is arranged at the right side below the flanged connection of casing and cover. The vent hole is provided at the rear of the spring flap cover.

Buchholz relays should be visually inspected and checked according to the users' maintenance instructions. In that connection the functional tests indicated have to be carried out.

Check for accumulation of gas by means of a gas analyzer. An accessory facilitates the removal of gas at head height.

Elektromotoren und Gerätebau Barleben GmbH  
Bahnhofstraße 27/28  
D-39179 Barleben/FRG

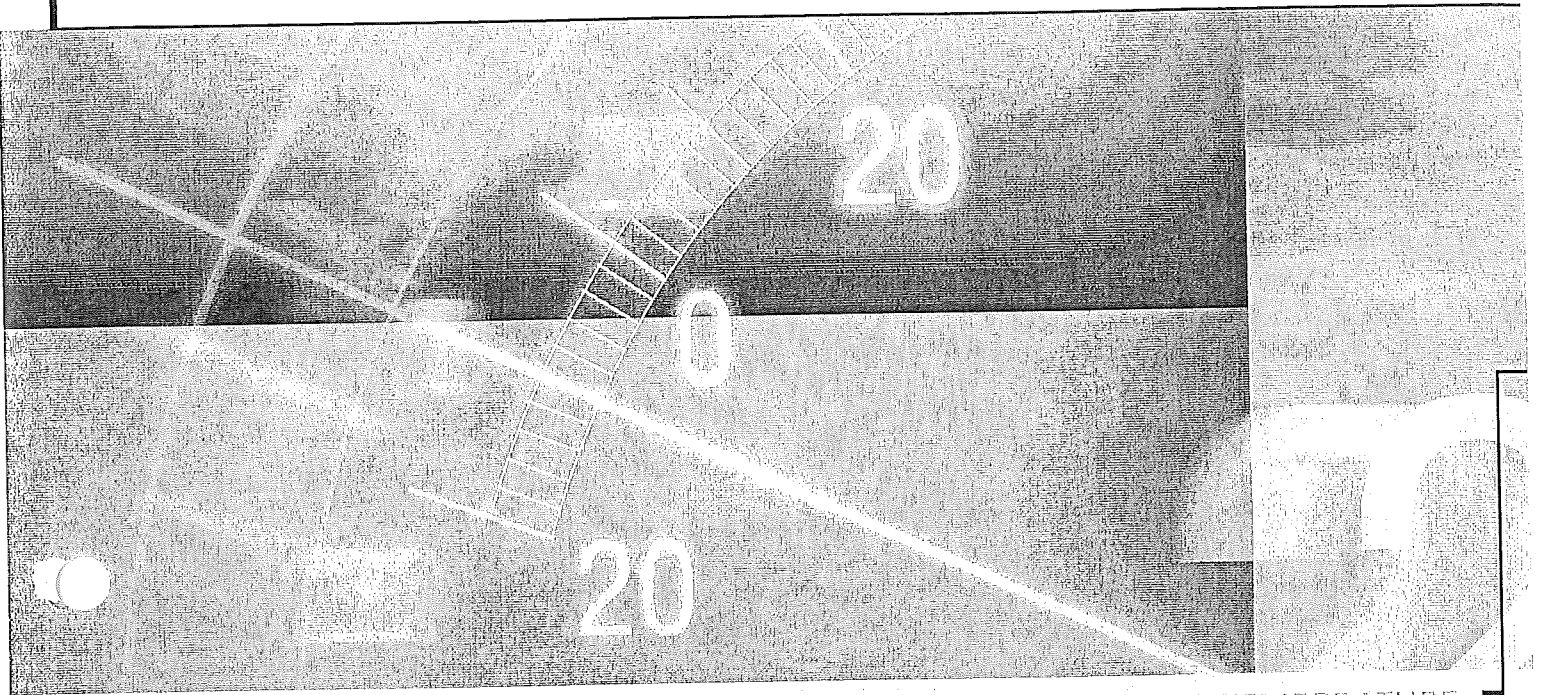
Phone:  
(039203) 79 - 0

Telefax:  
(039203) 5330, 5450

From abroad:  
xx49 39203 79 - 0.

from abroad:  
xx49 39203 5330, 5450

FOR TRANSFORMERS



OIL TEMPERATURE AND WINDING TEMPERATURE  
**[COMPACT] SERIES**

The [compact] series consists of two types of temperature measuring instruments which are compact and complete in themselves, providing:

- temperature measurement
- display of the measured values
- alarm messages
- remote indication of the measured values

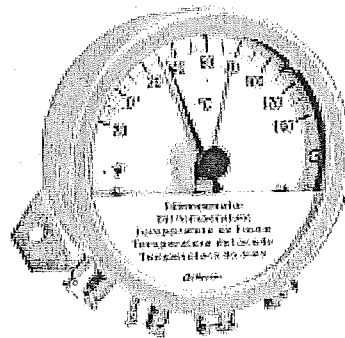
An extra advantage is that the temperature sensors are quite small and fit in all standard transformer thermometer pockets and wells.

#### 1. Oil temperature measurement

##### Dial indicating thermometers with adjustable microswitches

The mechanical measuring system is autonomous, energy independent and remains serviceable and stable long-term. The dial indicating thermometer is installed in the thermometer pocket in the transformer tank and provides a direct indication of the measured value.

Type MT-ST160SK

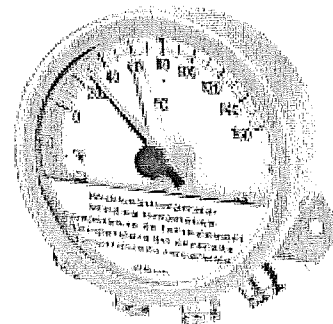


#### 2. Winding temperature measurement

The temperature of the winding is measured and determined indirectly.

The temperature difference between the winding and the coolant is a function of the actual current in the winding. The transformer secondary current is proportional to the current in the transformer winding. The secondary current of the transformer feeds a heating resistor in the thermometer and so produces a display reading of the transformer load, corresponding to the actual measured oil temperature (temperature gradient). This indirect method provides a display of the average or maximum winding temperature (i. e. a thermal image). The heater current is set to a characteristic curve using a potentiometer located in the dial indicating thermometer. It can be set in the factory or by the customer.

Type MT-ST160W



## MESSKO dial indicating thermometer

The measuring system of the dial indicating thermometer consists of a number of elements which measuring form a closed tube system which is filled with a liquid high pressure. When it is heated the liquid expands and transfers the pressure change to the Bourdon tube spring and the pressure cell. When the temperature changes, the Bourdon tube spring turns the pointer spindle, to which it is directly connected.

The MESSKO dial indicating thermometer features an extremely small bore capillary tube. This not only means it is very flexible and easy to lay (minimum bending radius only 10 mm) but because of

the relatively small capacity of the capillary, the ambient temperature has hardly any effect on the measured temperature so no line compensation is required. The measuring system is factory adjusted and calibrated to DIN 16203. **A readjustment after installation is not necessary.**

The capillary is protected from mechanical damage by a UV resistant 8 mm diameter PVC protection tube.

On request a stainless steel tube  $\varnothing$  4 mm can be used instead of a PVC protection tube.

### The detecting element

The detecting element is normally angled at 60°, with an installation length of 150 mm and doubled threaded union (see Fig. 2).

Other dimensions and materials are available on request.

The detecting element and the thread are made out of brass.

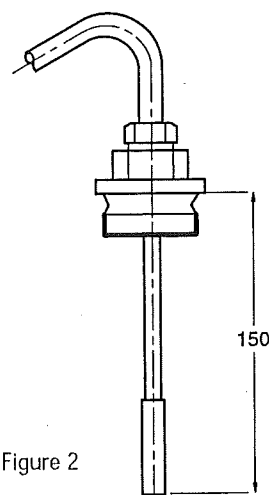


Figure 2

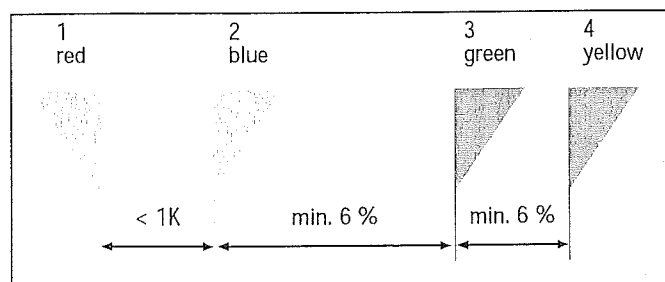
### The microswitches

The microswitches are spring changeover microswitches, specially designed for use in dial indicating thermometers. They are fully adjustable throughout the whole dial range. Usually either 2 or 4 microswitches are used. It is possible however for up to 6 microswitches to be incorporated, wired as Normally Open or Normally Closed.

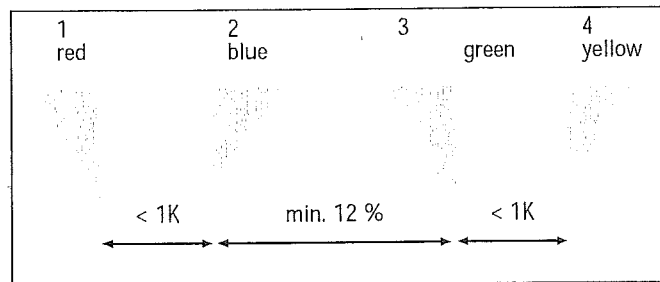
From a design point of view the minimum separation between the switches cannot be changed, but there are a number of options. Two or more switches can be set to the same temperature value (close switching). If it is required, it must be stated when ordering.

### Microswitches adjustable to one temperature (close switching)

#### 1 + 2 CLOSE SWITCHING, STANDARD



#### 1 + 2 / 3 + 4 CLOSE SWITCHING





## Technical specifications

For the remote indication of the measured value into a control room, the dial indicating thermometer (optional) can be equipped with an analog output signal (4–20 mA). The advantage is a simpler and therefore more reliable remote indication than the previously

used resistance thermometer with a PT100 (RTD) precision resistor. There is no compensation line (3-wire connection PT100) for larger transmission ways necessary and the current signal is insensitive against magnetical stray fields and temperature interferences.

## Technical specifications

Housing (Standard)	Sheet metal, galvanized
Ring and housing	acrylic coated paint RAL 7033
View glass	Laminated safety glass
Detecting element	Brass, bright, angled
Mounting plate	Stainless steel
Capillary tube	Copper capillary tube with PVC protection tube or stainless steel option: stainless steel capillary
Cable gland connection:	PG16, brass, galvanized

## Specifications

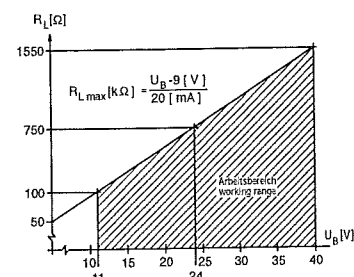
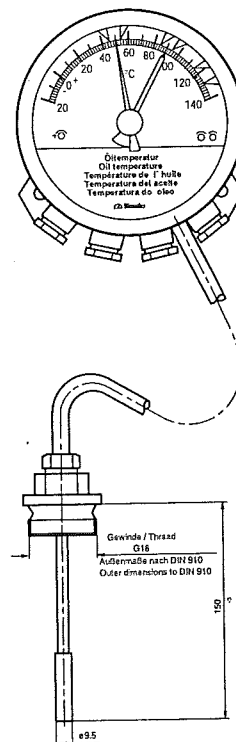
Measuring range	-20–140 °C or 0–160 °C
Tolerances	Class 1 to DIN 16203
Location	Indoors and out of doors, tropicalized
Temperature	-20–80 °C electronic (compensated) -40–100 °C storage
Protection mode	IP55 to DIN VDE 0470-1
Ventilation	The thermometer is ventilated and remains mist free up to 80 % RH
Maximum Pointer	Resettable maximum pointer, red

## Microswitches

Number	1 to 6 adjustable microswitches
Contact rating	AC: 250 V / 5 A / $\cos \varphi = 1$ DC: 250 V / 0,4 A (induction free) 110 V / 0,6 A, 60 V / 1 A, 24 V / 4 A (induction free)
Switching distance	6 % of measuring range. If required the switching interval values can be the same. (switching interval = 0 °C)
Contact material	Silver Cadmium Oxide (AgCdO10)
Rated insulation voltage	AC: 2500 V / 1 min

## Analog output (optional)

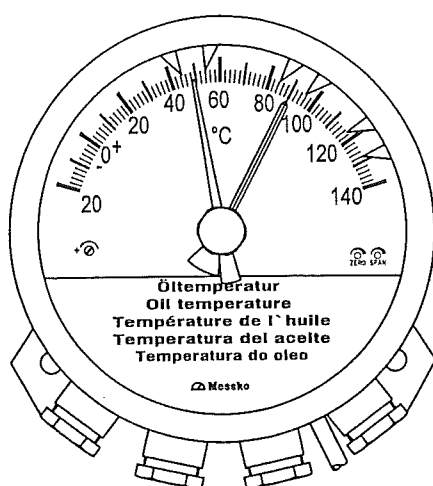
Sensor	Thin film load cell
Sensor housing	Stainless steel
Supply voltage	DC: 10–36 V unregulated maximum 10 % residual ripple,
Output signal	4–20 mA protected against reverse polarity
Maximum load	750 $\Omega$ at $U_b = 24$ V DC
Repeat accuracy	$\pm 0,1$ % at the maximum value



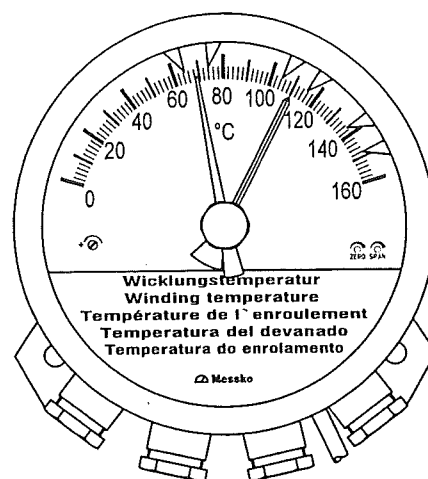
MT-ST160SK	63501-					Oil, Meas. range -20-140°C, PVC protection tube
MT-ST160SK/TT	63502-					Oil, Meas. range -20-140°C, PVC protection tube, 4-20 mA analog output
MT-ST160W	63507-					Winding, Meas. range 0-160°C, PVC protection tube
MT-ST160W/TT	63520-					Winding, Meas. range 0-160°C, PVC protection tube, 4-20 mA analog output
MT-ST160SK	63510-					Oil, Meas. range -20-140°C, st. st. protection tube
MT-ST160SK/TT	63518-					Oil, Meas. range -20-140°C, st. st. protection tube, 4-20 mA analog output
MT-ST160W	63511-					Winding, Meas. range 0-160°C, st. st. protection tube
MT-ST160W/TT	63519-					Winding, Meas. range 0-160°C, st. st. protection tube, 4-20 mA analog output
Microswitches						
			1			1 microswitch (changeover)
			2			Standard: 2 microswitches (changeover)
			3			3 microswitches (changeover)
			4			Standard: 4 microswitches (changeover)
			5			5 microswitches normally close NC or normally open NO (please indicate)
			6			6 microswitches normally close NC or normally open NO (please indicate)
Capillary tube						
				02		2 m capillary tube, material copper
				04		4 m capillary tube, material copper
				06		Standard: 6 m capillary tube, material copper
				08		8 m capillary tube, material copper
				10		10 m capillary tube, material copper
				12		12 m capillary tube, material copper
				xx		Other length on request
(Special:)						
Terminal cover						
				-00		Standard
				-01		Oil temperature (German, English, French, Spanish, Portuguese)
				-02		Oil temperature (English, Swedish, Norwegian, Finnish)
				-03		Winding temperature (German, English, French, Spanish, Portuguese)
				-04		Winding temperature (English, Swedish, Norwegian, Finnish)
				xx		Other languages on request
Thread joint						
					01	Standard (G1"B)
					07	G3/4"B
Microswitch adjustment						
					01	Standard (1 and 2 close switching)
					05	1+2/ 3+4 close switching
					xx	Other microswitches adjustments on request
MT-ST160SK/TT	63502-	4	08	-00	07 05	Example: (4 microswitches, 8 m capillary tube, G3/4"B, 3 and 4 close switching)



# BA 2038



**MT-ST160SK**  
**(MT-ST160SK/TT)**



**MT-ST160W**  
**(MT-ST160W/TT)**

Montage- und Betriebsanleitung  
MESSKO Zeigerthermometer Typ MT-ST160SK  
und MT-ST160W  
Option: Analogausgang 4..20mA  
Deutsch Seite 2-3, Abbildungen Seite 10-14

Installation- and Operating Instruction  
MESSKO Pointer Thermometer Type MT-ST160SK  
and MT-ST160W  
Option: Analog Output 4..20mA  
English page 4-5, figures page 10-14

Instructions de Montage et de Service  
MESSKO Thermomètre à Aiguille Modèle MT-ST160SK  
et MT-ST160W  
Option: sortie analogique 4...20 mA  
Français page 6-7, illustrations page 11-15

Instrucciones de Montaje y Servicio  
MESSKO Termómetro de Aguja Tipo MT-ST160SK  
y MT-ST160W  
Opción: salida análoga 4...20 mA  
Español páginas 8-9, ilustraciones páginas 11-15

## 1.1 Product Description MT-ST160SK

Oil temperature pointer-type thermometers with adjustable microswitches are used for measuring the temperature of the power transformers.

The closed liquid-filled patented measuring system is used for obtaining measured values. It consists of connected parts: 1. temperature bulb, 2. capillary tube, 3. Bourdon tube and type "/TT" 4. pressure element with electronics for evaluation. The elements comprise a single closed tube system which is filled with liquid at high pressure. As the temperature rises the liquid expands and transfers the change in pressure to the Bourdon tube. The Bourdon tube, connected to the pointer spindle, causes it to rotate so that temperature changes and temperature values are displayed on the scale.

The mechanical measuring system is an independent unit and requires no power input.

## 1.2 Product Description MT-ST160W

Winding temperature pointer-type thermometers with adjustable microswitches are used for measuring the temperature in the windings of power transformers. The mechanical measuring system is an independent unit and requires no power input.

Winding temperature is measured in an indirect way. The temperature gradient between windings and coolant depends on the current in the windings: the secondary transformer current is in proportion to the current in the windings of the transformer.

The secondary current is connected to a heating resistor in the pointer thermometer, and thus causes an increase of the indicated temperature in relation to the real temperature (=temperature gradient). In this indirect way one receives the indication of the medium or maximum winding temperature (=Thermal Image).

Adjustment of the heating current is done by a potentiometer which is located in the pointer thermometer. The values are taken from a curve. The adjustment can be done either by the customer or at our factory.

The patented measuring system consists of connected parts: 1. temperature bulb, 2. capillary tube, 3. auxiliary bulb (with heating resistors), 4. Bourdon tube and type "/TT" 5. pressure element with electronics for evaluation.

The function of the system is described under 1.1.



### ATTENTION !

Measuring instruments are sensitive. So all parts should be protected from being dropped and from knocks and vibration. The capillary tube and temperature bulb must not be modified in any way since the system is pressurised and it would be destroyed. The fluid used in the measuring system is hazardous to your health.



### IMPORTANT !

Ensure strict compliance with the instructions for installation and operation contained in this manual.

## 2. Mechanical Installation

### 2.1 Pointer-type thermometer

The pointer-type thermometer is fixed to the transformer with a mounting plate (Fig.1/item11). The 9mm holes are at 140mm centres. The pointer-type thermometer should be installed in a location where it will not be subject to vibration or mains voltage fluctuations.

The installation is vertical.

### 2.2 Capillary tube

Unroll the capillary tube without kinks or loops, and avoid

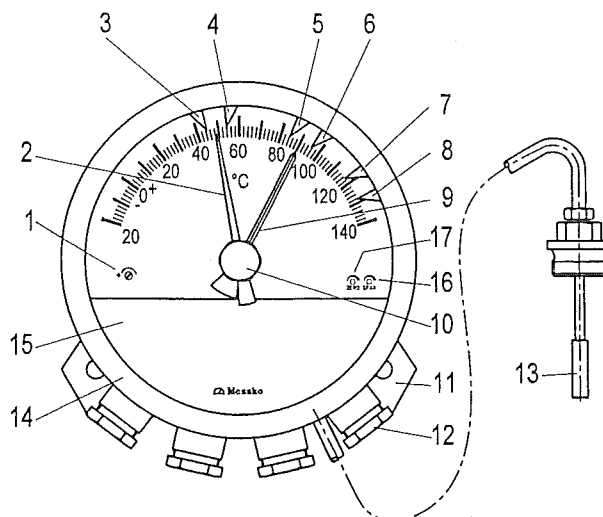


Fig.1

any jerking, snatching, crushing or buckling. Never carry the thermometer by the capillary tube. Decide the route of the capillary tube and mount it in position. Coil up excess capillary and locate it in position not subject to excessive temperatures. Minimum bending radius 10mm.

### 2.3 Temperature bulb (Fig.1/item13)

Fill the thermometer pocket (for example to DIN 42554 or similar) 2/3 with oil or heat conducting paste and screw in the temperature bulb.

### 2.4 Kick protection

If available fit the kick protection on the screw (Fig.2) of the temperature bulb and route the capillary tube inside the protection. Tighten the mounting screw of the kick

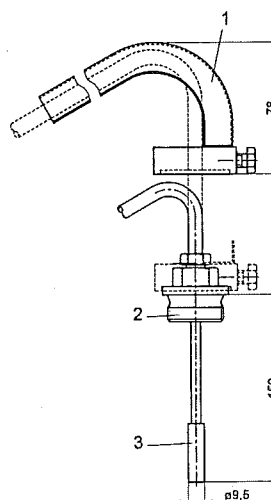


Fig.2

protection on the flat part of the hex nut.

### 2.5 Bayonet fixing ring (Fig.1/item14)

To make electrical connections and to set and test the microswitches it is necessary to remove the bayonet fixing ring. Turn it anti clockwise to the limit and then lift it off. While screwing the bayonet fixing ring make sure that the position of the maximum pointer (Fig.1/item9) is correct. This must be to the right of the pointer (Fig.1/item2). Replace the front ring and turn it clockwise to the limit.

### 2.6 Maximum pointer (Fig.1/item9)

The maximum pointer is operated by the pointer and records the maximum reading reached when measuring the temperature. The maximum pointer can be adjusted with a button (Fig.1/item10).

### 3. Electrical Installation



#### ATTENTION !

High voltage! Danger of Death!  
Before opening the terminal cover (Fig.1/item15),  
disconnect from the power supply.

#### 3.1 Electrical connection

Remove the bayonet fixing ring. To make an electrical connection lift the terminal cover (Fig.3). Cut back the cover on the leads approx. 160mm and insert the leads through the Pg screw connections (Fig.1/item12). The nut of the cable gland is tightened until the cable seal is waterproof. The individual leads are then connected in accordance with the connection diagram on the inside of the terminal cover. Depending on the number and type of microswitches the terminals are allocated in accordance with figures 7 or 8 on page 12. Close the terminal cover and replace the bayonet fixing ring.

#### 3.2 Inspection of the microswitches

Remove the bayonet fixing ring. Turn the pointer gently by hand clockwise (Fig.4), past the microswitch. A return spring pulls the indicator back to the original position. During this procedure, do not release the indicator, but lead it slowly back to its original position.

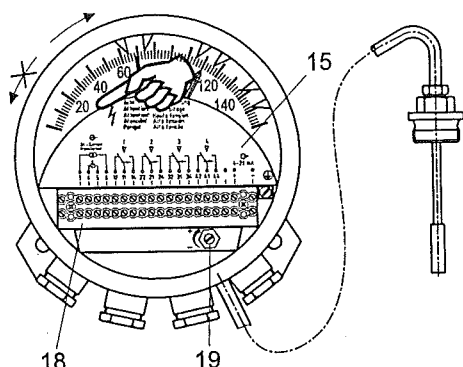


Fig.3



#### WARNING !

The display indicator should never be turned  
counter clockwise towards lower temperatures.  
This will damage the measuring system.

#### 3.3 Adjusting the microswitches

Manually bring the microswitches (Fig.1/item3-8) to the desired position: move the microswitch at the casing and not at the tip (Fig.4).

#### 3.4 Option: Analog output 4..20mA

Zero is set using the "ZERO" Potentiometer (Fig.1/item 17) such that the output current is 4mA when the pointer is at the start of the scale. The potentiometer marked "SPAN" (Fig.1/item16) is used for setting the maximum output current 20mA at the maximum value on the scale. Both settings are factory set and must not be changed. For this reason the potentiometers are paint sealed to prevent them from being turned.

### 4. Indication Control and Readjustment

Operate indication control and comparison measurements only in moving water baths, which maintain a constant temperature for a period of several minutes. Readjustments are possible, however, the maximum temperature is 2° Celsius. The adjustment screw (Fig.1/item1) is on the inside of the cover plate.

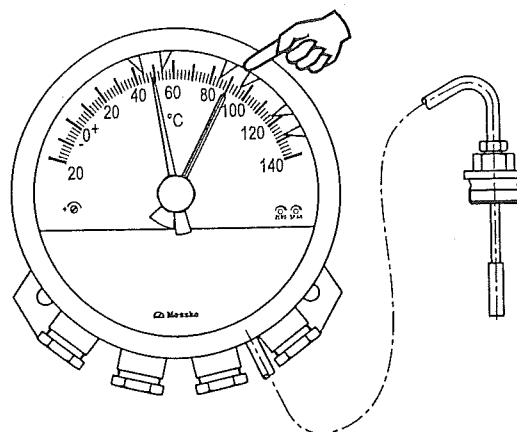


Fig.4

### 5. Adjustment of the temperature gradient (Type MT-ST160W)

The heating current is measured across 1  $\Omega$  (see figure 9, page 12). The numerical value of the heating current in "A" therefore corresponds to the measured voltage in "V". Consequently, a high-resistance voltmeter (rather than an ammeter), set to "V" is used to set the heating current  $I_H$ . Lift up the terminal cover (figure 1, item 15). Attach the voltmeter to terminals 4 and 5. Read the heating current  $I_H$  for the desired temperature jump "K" from the setting curve (figure 10, page 14) and use the set screw (figure 3, item 19) to set the current for the matching resistor. Turn the setscrew to the right to increase the heating current and turn it to the left to reduce the current. Once the setting is complete, remove the voltmeter and close the cover plate.



#### IMPORTANT!

For secondary transformer currents >2A up to 5A an additional current transformer must be used.  
(See type V5a, manual BA 2039)



#### IMPORTANT!

Max permissible heating current is 2.3A W 2.3V on the Voltmeter. When secondary current is 1.5A, then heating current is 0.75..1.45A.

### 6. Service

In case this procedure does not solve the problem, contact our factory.

### 7. Maintenance

The pointer thermometer is maintenance free.



## Technische Daten

## Materialien

Frontring und Gehäuse	Stahlblech, verzinkt,
Sichtscheibe	Verbundsicherheitsglas
Temperaturfühler	Messing, blank
Befestigungsplatte	Edelstahl
Kapillarleitung	Kupfer-Kapillare mit Schutzmantel
Kabelverschraubung	Pg16, Messing, verzinkt

## Kenndaten

Meßbereich -20.. 140°C Typ MT-ST160SK

Fehlergrenzen Klasse 1 nach DIN 16203

Aufstellung Innenraum und Freiluft,

Umgebungstemperatur -20.. 80°C Elektronik (kompensiert)

Schutzart IP55 nach DIN VDE 0470-1

Belüftung Belüftungseinrichtung,

Schleppzeiger Rückstellbarer Schleppzeiger

## Mikroschalter

Anzahl 1 bis 6 Mikroschalter

Belastbarkeit AC: 250V / 5A /  $\cos\varphi = 1$   
DC: 250V/0,4A, 250V/0,1A(ind.),

Schalterabstand 6% des Meßbereiches  
Option: Einstellung auf einen Temperaturwert

Kontaktmaterial Silber-Cadmium-Oxid  
Nennisolationsspannung AC: 2500V / 1min

## Stromausgang

Sensor Piezoresistive Druckmeßzelle

Versorgungsspannung DC: 10..36V unregelt,  
max 10% Restwelligkeit,

Ausgangssignal 4..20mA

Max. Bürde 750Ω z.B.  $U_b = 24V$  DC, (Bild5)

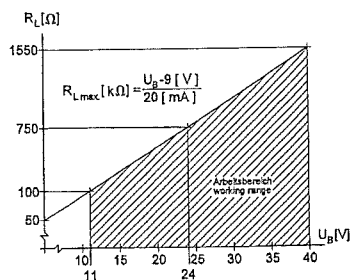


Bild5

Wiederholgenauigkeit  $\leq \pm 0,1\%$  vom Endwert

## Technical Specifications

## Materials

Ring and Casing	Sheet steel, galvanised, paint RAL 7033
Glass	Laminated safety glass
Temperature bulb	Brass, bright
Mounting plate	Stainless steel
Capillary	Copper capillary tube with sheath
Cable glands	Pg16, brass, galvanised

## Specifications

Measuring range -20.. 140°C Typ MT-ST160SK  
0.. 160°C Typ MT-ST160W

Tolerances Class 1 to DIN 16203

Location Indoor and out of doors, tropicalised

Ambient temperature -20.. 80°C electronic (compensated)  
-40.. 100°C storage

Protection IP55 to DIN VDE 0470-1

Ventilation The thermometer is ventilated and remains mist free up to 80% RH

Maximum pointer Resettable maximum pointer

## Microswitches

Number 1 to 6 microswitches

Rated current AC: 250V / 5A /  $\cos\varphi = 1$   
DC: 250V/0,4A, 250V/0,1A(ind.),  
110V / 0,6A, 60V / 1A, 24V / 4A

Switching distance 6% of measuring range  
If required the switching interval values can be the same.  
(switching interval = 0°C)

Contact materials Silver-Cadmium-Oxide

Rated insulation voltage AC: 2500V / 1min

## Current output

Sensor Piezo resistive load cell

Supply DC: 10..36V unregulated,  
maximum 10% residual ripple,  
protected against reverse polarity

Output signal 4..20mA

Maximum load 750Ω for  $U_b = 24V$  DC, (Fig.5)

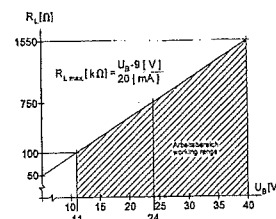


Fig.5

Repeat accuracy  $\leq \pm 0,1\%$  at the maximum value

# Abmessungen / Dimensions

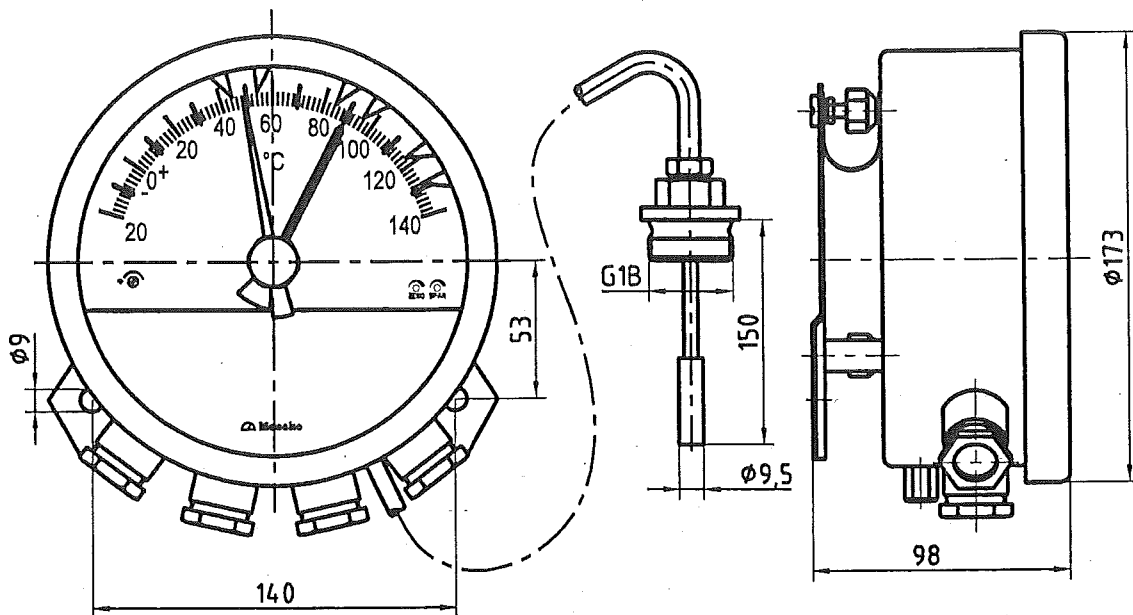


Bild 6 / Fig.6

## Anschlußplan / Schematics

### MT-ST160SK

Beispiel 4 Umschalter / Example 4 changeover switches

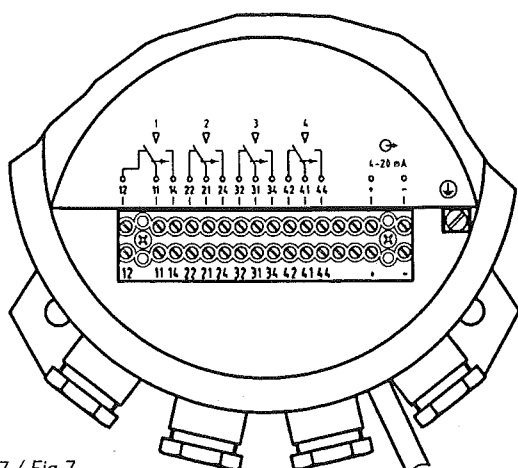


Bild 7 / Fig.7

### MT-ST160W

Beispiel 4 Umschalter / Example 4 changeover switches

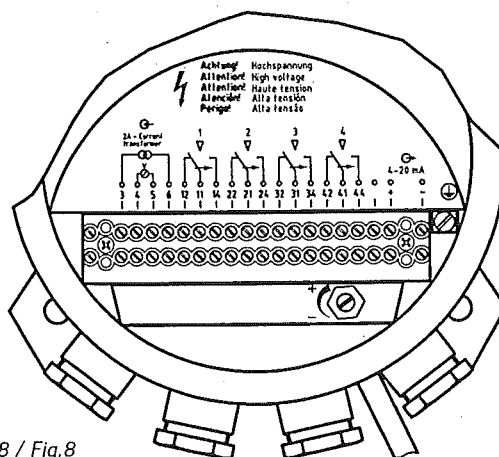


Bild 8 / Fig.8



#### WICHTIG !

Der Schaltplan ist auf der Innenseite der Abdeckblende aufgedruckt.

#### IMPORTANT !

The schematic is printed on the inside of the terminal cover.

## Messung der Spannung zur Ermittlung des Heizstromes bei Typ MT-ST160W

Measuring the voltage for indication the heating current type MT-ST160W

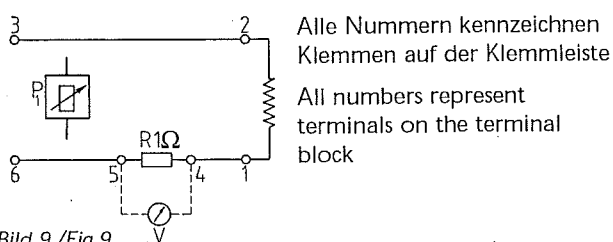
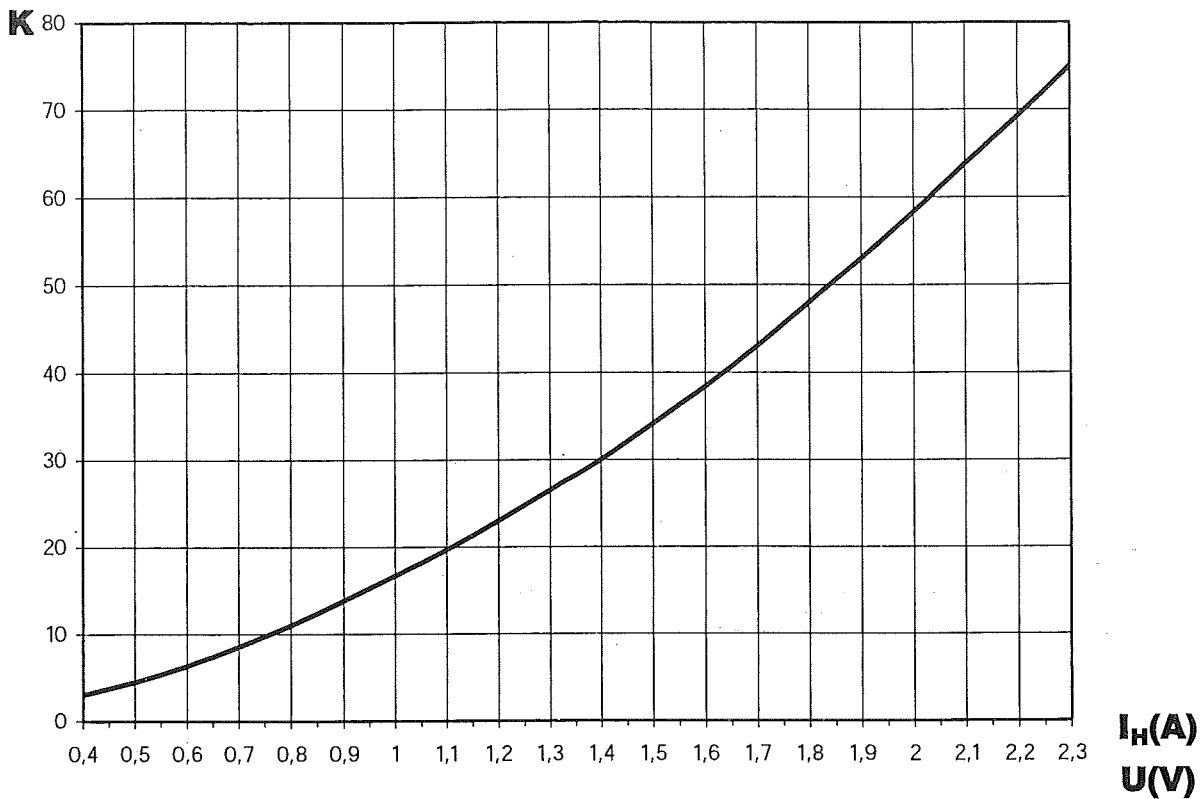


Bild 9 / Fig.9

MT-ST160W Einstellkurve / MT-ST160W Gradient Adjustment Curve



Heizstrom  $I_H$  W  
Heating current  $I_H$  W

gemessene Spannung  $U$  über  $1\Omega$  (siehe Seite 12, Bild 9)  
measured voltage  $U$  with  $1\Omega$  (see page 12, Fig. 9)

Bild 10 / Fig.10

**Beispiel:**

temperatursprung (in K) 30K  
Heizstrom  $I_H$  aus Einstellkurve  $I_H = 1,4A$  (siehe Pkt.5)

Max. Heizstrom: 2,3A

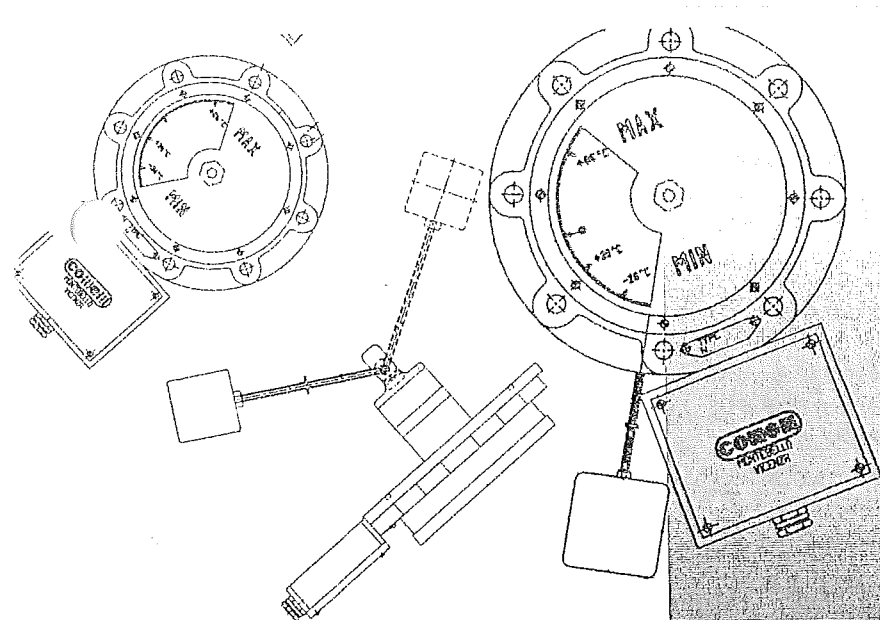
Bei 1,5A Wandlerstrom nur 0,75 bis 1,45A Heizstrom.

**Example :**

Temperature gradient (in K) 30K  
Heating current  $I_H$  from adjustment curve  $I_H = 1,4A$  (see point 5)

Max. heating current: 2,3A

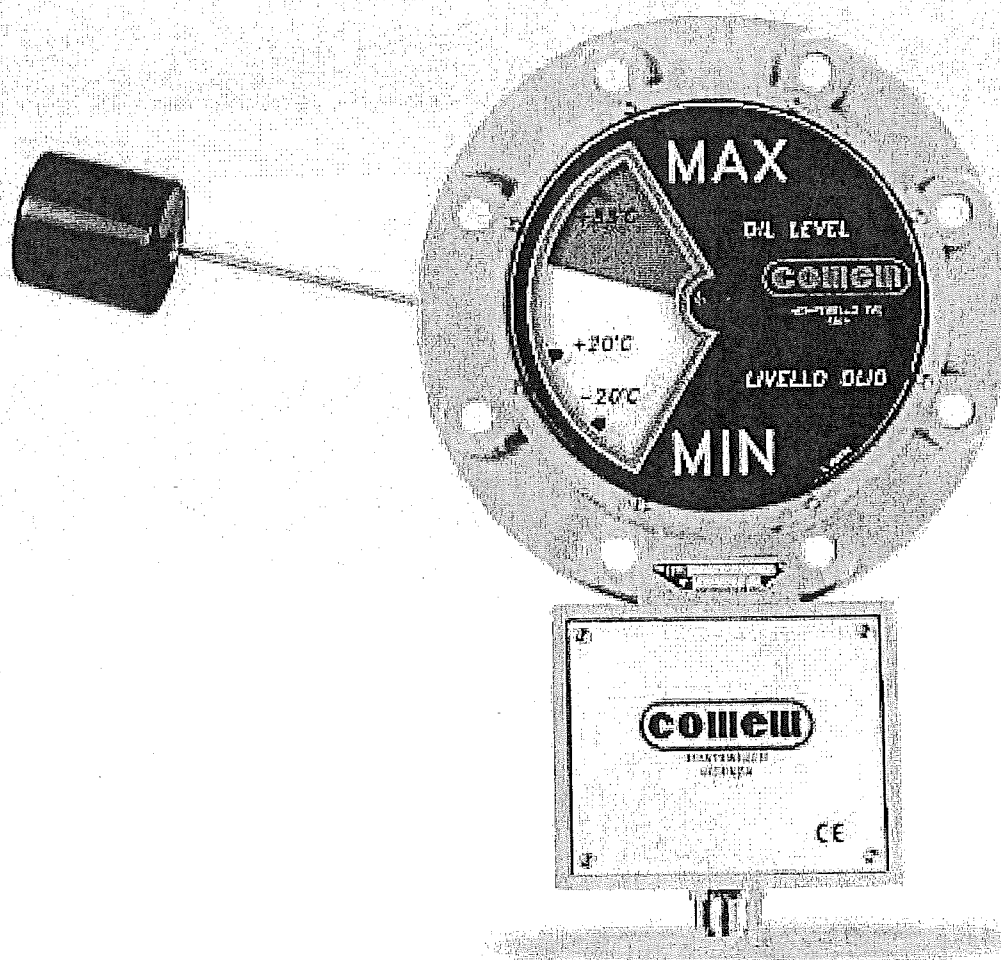
For 1,5A transformer current only 0,75 to 1.45A heating current.



LEVEL GAUGES WITH  
MAGNETIC JOINT  
**L 14 - L 22 - L 34**

**comem**®

**LEVEL GAUGES WITH MAGNETIC JOINT**  
**SIZE Ø 140/220/340**



## TYPE "LA"

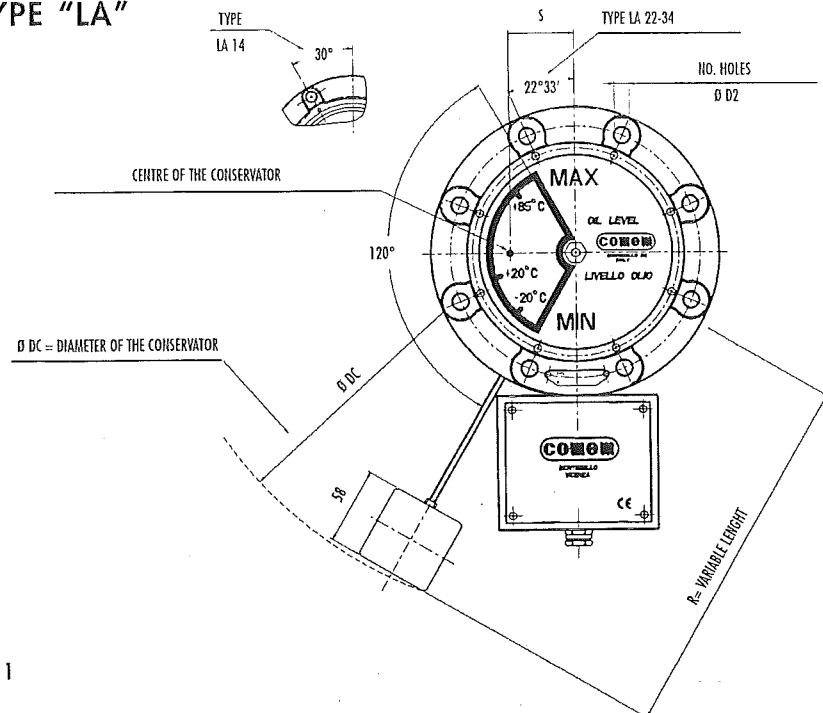
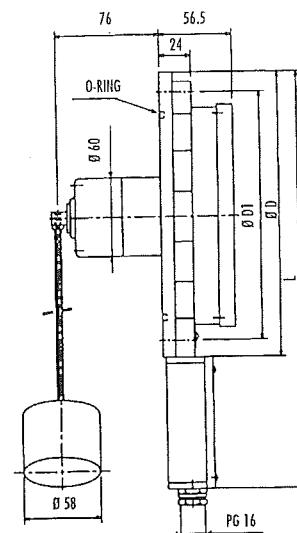


fig. 1



$$R = (DC/2 - 10) \times 1.15 \quad S = (DC/2 - 40) \times 0.577$$

## TYPE "LB"

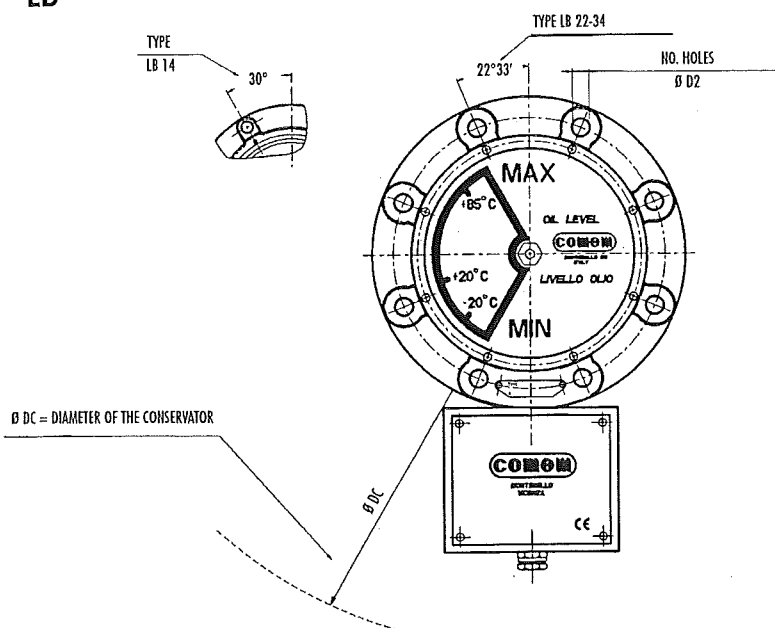
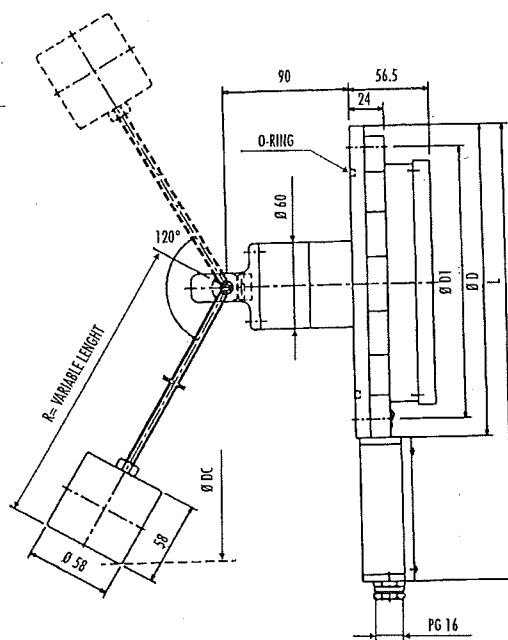


fig. 2



$$R = (DC/2 - 10) \times 1.15$$

TYPE OF GAUGE	Ø D	Ø D1	Ø D2	NO. HOLES	L	O-RING TYPE	WEIGHT kg	R STANDARD
LA14	140	125	7	6	245	O.R. 186 (6362)	1.40	max. 370
LA22	220	190	11.5	8	325	O.R. 221	2.30	max. 550
LA34	340	305	18	8	445	O.R. 248 (81000)	6.00	max. 710
LB14	140	125	7	6	245	O.R. 186 (6362)	1.70	max. 370
LB22	220	190	11.5	8	325	O.R. 221	3.60	max. 550
LB34	340	305	18	8	445	O.R. 248 (81000)	6.30	max. 710

DIMENSIONS IN MILLIMETERS



## LEVEL GAUGES WITH MAGNETIC JOINT

The level gauges with a magnetic joint are composed of a sturdy watertight body of aluminium alloy painted against corrosion. The movement of the float rod and the gauge disk takes place by means of magnetic coupling through an angle of  $120^\circ$ . In this way, for every variation in the level of the oil there is a corresponding rotation of the magnet with consequent variation of the indication on the dial of the gauge. The gauge disk is coloured white and red. The system is closed with a screen-printed polycarbonate disk with reference marks corresponding to the levels that the oil should reach at the following temperatures in degrees Centigrade:  $-20^\circ\text{C}$ ,  $+20^\circ\text{C}$ ,  $+85^\circ\text{C}$ . **Note:** special dials may be made on request.

### READING THE INDICATIONS OF THE VARIOUS LIQUID LEVELS

- **Minimum level:** when the dial shows all red.
- **Maximum level:** when the dial shows all white.
- **Intermediate indications between MAX and MIN:** the dial shows part white and part red. Remember that the amount of red shown indicates, in proportion, the part of the conservator left without liquid.

### FLOAT MOVEMENT

This may be in the radial direction of the conservator (type "LA") or in the axial direction (type "LB"), as shown in the drawing (Fig. 1 and 2).

### FLOAT ROD

This is completely threaded. If the length is not specified (distance R in the drawing, fig. 1 and 2), the standard size indicated on the table is supplied.

### ELECTRIC INDICATION

These level gauges are fitted with microswitches for indicating the minimum and maximum oil level.

### ELECTRIC CHARACTERISTICS

- Power supply: 24 to 220 V a.c. or d.c.
- Interruption power: 3 A 125/250 V ac (resistive)  
0.5 A 125 V dc for inductive load  $L/R = 40$  ms  
0.25 A 250 V dc for inductive load  $L/R = 40$  ms

### INDICATING INTERVENTION

The electric microswitches intervene with an advance angle of  $5^\circ$  with respect to the indications of the minimum or maximum oil level in the conservator. When there is a double contact on MIN and/or MAX, the second contact intervenes about  $5^\circ$  after the first contact. After installation of the gauges it is possible to check the correct operation of the microswitches and, in general, good operation of all the internal parts of the gauge by proceeding as follows:

- Remove the cap situated in the centre of the dial on the front of the level gauge, unscrewing it in an anticlockwise direction.
- Insert a screwdriver in the slot provided and turn the gauge disk until the electric circuit connected to it switches on or off.
- Close the cap again, being particularly careful to position the O-ring (O.R.) correctly under the cap and to screw the cap on quite firmly.

### RESISTANCE TO VIBRATIONS ON THE ELECTRIC CONTACTS

Tests have been carried out according to the procedures illustrated below in graph (10 cycles), with an amplitude of oscillation of 2 mm and in normal working conditions. No contacts gave any sign of closing or opening.

### NOTES

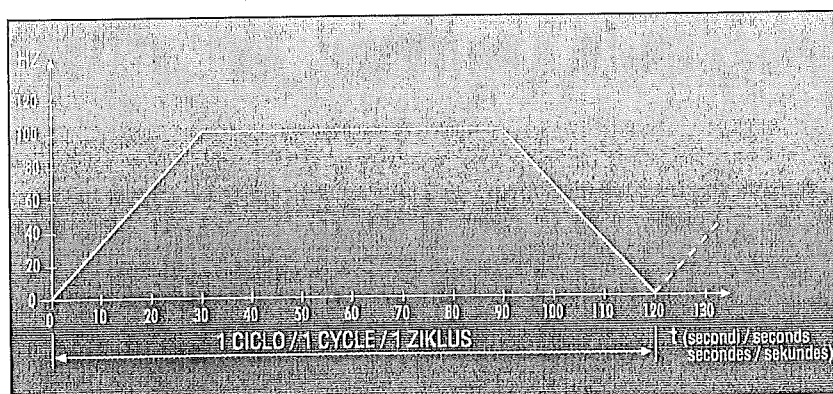
External nuts and bolts made of stainless steel.

External painting in grey RAL 7001.

Degree of protection: IP 54.

**Working temperature.** All the level gauges are suitable for working with:

- Oil temperature between:  $-25^\circ\text{C}$  and  $+120^\circ\text{C}$
- Environment temperature between:  $-25^\circ\text{C}$  and  $+60^\circ\text{C}$





## INDICATIONS FOR ASSEMBLY

The level gauges which have float movement in the radial direction of the container (type "LA") must be fitted offset with respect to the horizontal axis of the conservator (distance "S" fig. 1) so as to have an exact indication of the minimum and maximum oil level. with movement in the axial direction (type "LB") must be fitted in the centre of the conservator. The measurements of the movements (distance "S") and length of the rod (distance "R") are obtained from the formulae given under fig. 1 and 2. It is good practice to check operation of the gauge after having fitted it on the conservator. For further and more detailed information, see the technical information card supplied.

## TESTS AND INSPECTIONS

The level gauges are subjected to insulation test towards earth as follows: 2.5 kV AC 50/60 Hz for 72 seconds. The bodies of the level gauges, after having passed the dimensional inspection and without their internal parts, are tested for watertightness so as to eliminate those that have leaks. Final testing is carried out when the level gauge is completely assembled. The sensitivity of all the signalling movements and the accuracy of their assembly are scrupulously checked.

## IDENTIFICATION MARKS

The mark that completely identifies the type of level gauge is composed of a series of letters and numbers according to the following pattern:

1 (letter)	L	Level gauge
2 (letter)	A	Movement of the radial float (fig. 1) (letter)
	B	Movement of the axial float (fig. 2)
3 & 4 (cifra)	14	Size of the level gauge = Ø 140 mm
	22	Size of the level gauge = Ø 220 mm
	34	Size of the level gauge = Ø 340 mm
5 (letter)	K	Wiring diagram with 1 contact on min.
	Y	Wiring diagram with 2 contacts on min.
	X	Wiring diagram with 1 contact on min. + 1 contact on max.
	W	Wiring diagram with 2 contacts on min + 2 contacts on max.
6 (letter)	O	Ordinary paint
	S	Paint for corrosive environments
7 (letter)	N	COMEM standard level gauge
	S	Specific level gauge for customer

### Example : LA14XON

Level gauge with radial movement, diameter 140 mm, wiring diagram with 1 contact on minimum and 1 contact on maximum, painted for normal environments and with standard COMEM dial and rod length.

## WIRING DIAGRAMS

DIAGRAM TYPE "K"

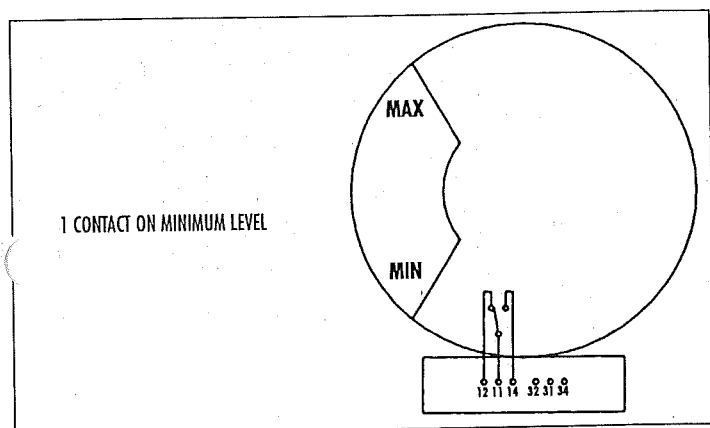


DIAGRAM TYPE "Y"

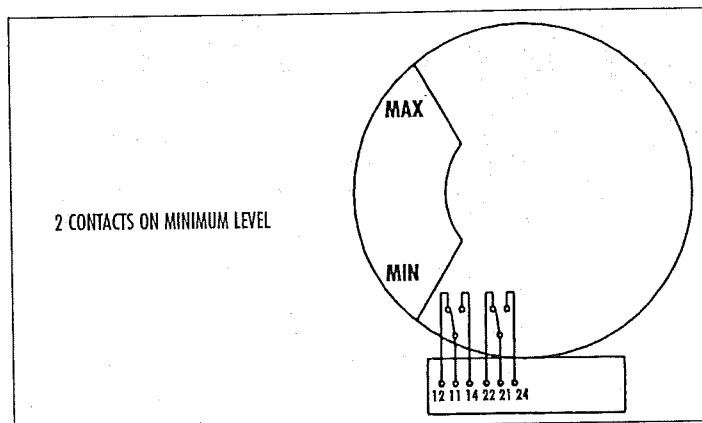


DIAGRAM TYPE "X"

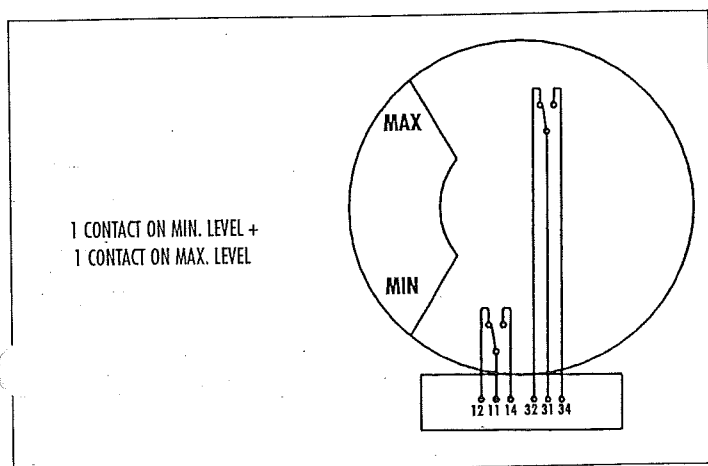
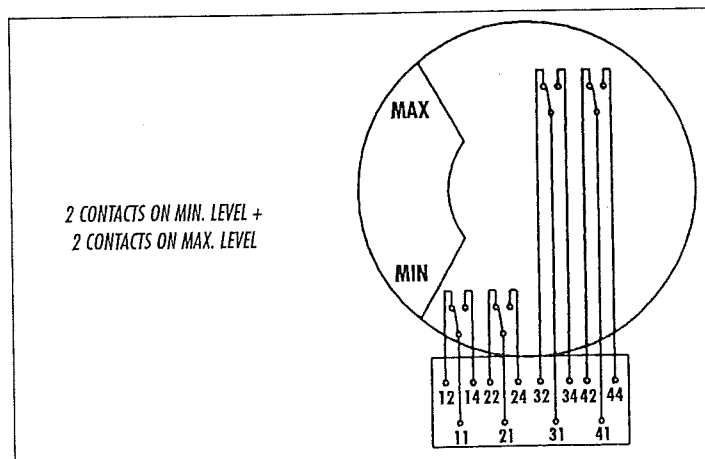
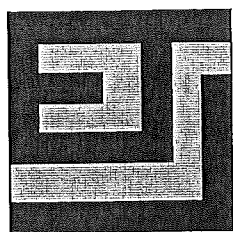


DIAGRAM TYPE "W"







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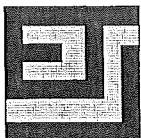
# Pressure Relief Valves Series VS

Catalogue N°:

10VSCATR02-E

Revision:

02 of 29.10.2001



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Specification N° SPR/

**10VSGENR02-E**

Accessory:

**Pressure relief valve Series VS**

Page N°:

**1 of 5**

Title:

**Function, features, operation and assembly**

Revision:

**02 – 29/10/01**

## **1.0 Function, features, operation and assembly**

This specification concerns the function, the main features and the operation of the accessory concerned, as well as the admitted environmental and operating condition for the different executions. Operating conditions depend generally from the compatibility of the materials, components, surface finish, and, for the electric contacts and circuits, their degree of protection, with the operating conditions of the transformer.

## **2.0 Function**

The pressure relief valve opens when the pressure inside the tank increases over the set operating value, following for example a failure or a short circuit, and by releasing oil reduces the pressure in the tank. By means of the electric contact, if present, and the optical indication the pressure relief valve indicates that a fault has taken place.

## **3.0 Construction features**

### **3.1.0 Materials and components**

- Flange, obturator, cover and electric contact's casing are of cast aluminium;
- Fittings are of stainless steel or nickel coated brass;
- Gasket materials as specified for the different executions;
- Splash diverter is made of stainless steel;
- Springs are of spring steel, sandblasted and painted with epoxy powders;
- External screws are of stainless steel.

### **3.2.0 Reference drawings**

Overall dimensions:

Pressure relief valves with contact type K

- |  |               |
|--|---------------|
| • Type VSQI 050 NKP - nominal diameter 50 mm | N° 10.050.710 |
| • Type VS 080 NKP - nominal diameter 80 mm   | N° 10.080.90  |
| • Type VS 100 NKP - nominal diameter 100 mm  | N° 10.100.90  |
| • Type VS 150 NKP - nominal diameter 150 mm  | N° 10.150.90  |

Pressure relief valves with contact type C

- |   |              |
|---|--------------|
| • Type VS 080 NCP - nominal diameter 80 mm  | N° 10.080.10 |
| • Type VS 100 NCP - nominal diameter 100 mm | N° 10.100.10 |
| • Type VS 150 NCP - nominal diameter 150 mm | N° 10.150.10 |

Pressure relief valves without contact

- |  |               |
|--|---------------|
| • Type VSQI 050 N - nominal diameter 50 mm | N° 10.050.705 |
|--|---------------|

The drawings show the valves complete with splash diverter.

### **3.3.0 Construction**

The pressure relief valves Series VS are spring operated safety valves, consisting of a mounting flange with the central opening closed by a spring loaded obturator; the springs are compressed between obturator and cover, which is assembled to the flange by columns.

No part of the pressure relief valve reaches inside the transformer tank. A specially designed gasket assures the oil-tightness between flange and obturator when the valve is closed.



Specification N° **SPR/**

**10VSGENR02-E**

Accessory:

**Pressure relief valve Series VS**

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### **3.4.0 Pressure setting and springs**

The setting of the pressure relief valves Series VS is effected by choosing a different spring - for Type VS 150 a double spring set – for every operating pressure value; therefore the setting of the pressure relief valve can be changed only at the factory, thus eliminating possible misuses. The springs are of the compression type, designed so as to have a limited force gain with the stroke.

Specification N° **SPR/10VSTARRxx** indicates the tolerance of the setting and the minimum operating pressure for the different pressure settings as well as the minimum pressure at which the valve closes after operation.

### **3.5.0 Operation indication**

#### **3.5.1.0 Optical indication**

The pressure relief valves Series VS have as a standard feature an optical indication that the valve has operated; this optical indication consists of a red pin showing about 30 mm over the top of the valve cover when the valve has operated because of an internal overpressure. For valves Type VS 080, VS 100 and VS 150 the pin is spring loaded so that even in case of partial openings of the valve due to small or short-duration overpressures the pin is nevertheless expelled completely. For Type VSQI 050 the optical indication operates also the electric contact, if present.

#### **3.5.2.0 Electric contact**

The operation of the pressure relief valve can be indicated also by an electric contact, which can be of the "C" type, according to specification N° **SPR/10VSSCHCRxx** or of the "K" type according to specification N° **SPR/10VSSCHKRxx**.

### **3.6.0 Splash diverter**

To avoid that during the operation of the valve hot oil is shot in all directions, thus increasing the danger to man and machine, the valves Series VS can be fitted with a splash diverter, which diverts the out-flowing oil in a determined direction.

### **3.7.0 Oil-tightness and resistance to pressure**

The pressure relief valves Series VS:

- are oil tight to oil at 100°C up to pressure  $P_t$ , which depends on the setting pressure;
- are mechanically and electrically resistant to vacuum (10 torr);
- have a mechanical resistance to pressures up to 4 bars.

### **3.8.0 Resistance to dynamical stress**

The pressure relief valves Series VS can operate without undue operation in following conditions:

- Sinus vibrations with frequency  $\leq 120$  Hz and amplitude  $\leq 250 \mu$ ;
- Dynamical conditions causing following accelerations:
  - ◊ Max 3g in all directions, sinus vibration, amplitude  $\leq 20$  mm;
  - ◊ Shock condition with max 10 g in all directions.

### **3.9.0 Surface protection**

Flange, obturator, cover and contact's casing are painted internally and externally with one primer coat of epoxyd paint and externally with a finishing coat of polyurethane paint colour RAL 7031. The primer coat on the internal surfaces in contact is compatible with transformer mineral oil up to temperatures of 120°C.

The painting procedure is accepted by the Italian electricity authority ENEL.



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Specification N° SPR/

**10VSGENR02-E**

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**Pressure relief valve Series VS**

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The specification N° SPR/00VERRxx describes in details all the features of the painting procedure relevant to the protection against corrosion.

## **4.0 Operation and installation**

### **4.1.0 Operation**

Should an overpressure inside the transformer tank build up due to short circuit or else, higher than the set operation pressure of the pressure relief valve Series VS, the obturator lifts from the flange propelled by the pressure, thus opening the discharge opening. The oil can flow out thus reducing the overpressure; at the same time the optical indication and if installed the electric contact show that the valve has operated.

When the overpressure has been discharged the valve shuts again automatically to complete oil-tightness.

Thanks to the design of the pressure relief valves Series VS and their springs, the full opening is reached even for small overpressures in a matter of milliseconds, so as to reduce the resistance to the oil flow.

### **4.2.0 Importance of the electric contact**

Real life tests have shown, that failures of the transformer followed by sudden pressure increases, such as for instance short circuits, induce the operation of the pressure relief valve in time spans which are considerably shorter than that of other safety devices, such as the Buchholz Relay. **To exploit this rapid operation for the safety of the transformer we strongly advice to fit out the pressure relief valve Series VS with electric contacts, which should be connected to the trip circuit of the transformer.**

### **4.3.0 Installation**

The pressure relief valve should be installed, either in horizontal or vertical position, on the transformer tank, as near as possible to possible failure sources or in a central position to such sources. The size of the pressure relief valve should be chosen considering the available space and the oil quantity to be vented in case of failure.

For a higher safety standard and to increase the rapidity of operation it can be preferable to install more than one pressure relief valve eventually of a smaller size.

### **4.4.0 Choice of nominal pressure**

To avoid oil leakage or undue operation of the valve, the operating pressure should be chosen so that in normal operation the corresponding maximum operating pressure is never reached. Furthermore, to reduce oil loss after operation, the minimum pressure at which the valve closes after operation should be always higher than the oil head insisting on the valve.

## **5.0 Compatibility**

The installation compatibility of the pressure relief valves Series VS depend mainly on the material used for the gaskets; therefore the executions differ because of the used gaskets.

### **5.1.0 Standard execution – nitrile rubber gaskets (N)**

Admitted operating conditions are:

**Environmental conditions:**

Ambient temperature

Relative humidity

-20°C to +50°C

95% to 20°C - 80% to 40°C - 50% to 50°C



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Specification N° SPR/

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**Insulating liquid:** transformer mineral or silicon oil  
Temperature

- 20°C to + 110°C

#### **5.2.0 Execution Nf - nitrile rubber gaskets for low temperatures (Nf)**

Admitted operating conditions are:

**Environmental conditions:**

Ambient temperature

-40°C to +50°C

Relative humidity

95% to 20°C - 80% to 40°C - 50% to 50°C

**Insulating liquid:** transformer mineral or silicon oil  
Temperature

- 40°C to + 120°C

#### **5.3.0 Execution V – fluor rubber gaskets (Viton V)**

Admitted operating conditions are:

**Environmental conditions:**

Ambient temperature

-15°C to +50°C

Relative humidity

95% to 20°C - 80% to 40°C - 50% to 50°C

**Insulating liquid:** transformer mineral or silicon oil  
Temperature

- 15°C to + 150°C

#### **5.4.0 Special executions**

For other environmental and/or operating conditions to be examined individually.



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Specification N° SPR/

**10VSGENR02-E**

Accessory:

**Pressure relief valve Series VS**

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## 6.0 Identification of types

Taking for example type **VS 080 NCP 0,5**, which indicates:

- pressure relief valve series VS
- nominal diameter 80 mm
- with nitrile rubber gaskets N
- with one contact type C
- with splash diverter P
- with operating pressure 0,5 bars,

the pressure relief valves Series VS are identified as follows:

<b>VS</b>	<b>080</b>	<b>N</b>	<b>C</b>	<b>P</b>	<b>0,5</b>
<b>Series identification:</b>					
<b>VS</b>	Pressure relief valve Series VS, types VS 080, VS 100, VS 150				
<b>VSC</b>	Only for pressure relief valves Series VSC, type VSC 050				
<b>VSQ</b>	Only for pressure relief valves Series VSQ, type VSQ 050				
<b>Identification of nominal diameter:</b>					
<b>050</b>	Nominal diameter 50 mm				
<b>080</b>	Nominal diameter 80 mm				
<b>100</b>	Nominal diameter 100 mm				
<b>150</b>	Nominal diameter 150 mm				
<b>Identification of gasket type:</b>					
<b>N</b>	Nitrile rubber gaskets				
<b>Nf</b>	Nitrile rubber gaskets for low temperatures				
<b>V</b>	Fluor rubber gaskets (Viton)				
<b>Identification of contact – see contacts specifications</b>					
...	Contact type ...				
<b>Optional splash diverter:</b>					
-	Without splash diverter				
<b>P</b>	With splash diverter				
<b>Operating pressure:</b>					
<b>0,5</b>	Operating pressure 0,5 bars				

## 7.0 Reference specifications

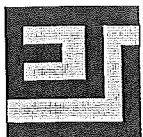
- Setting tolerance
- Wiring diagrams and contacts
  - Contacts type C
  - Contacts type K
- Painting

N° SPR/10VSTARRxx

N° SPR/10VSSCHCRxx

N° SPR/10VSSCHKRxx

N° SPR/00VERRxx



Specification N° SPR/

**10VSSCHCR00-E**

Accessory:

**Pressure relief valve Series VS**

Page N°:

**1 of 1**

Title:

**Features contact type C**

Revision:

**00 - 10/10/99**

## 1.0 Features contact type C

The specification indicates the electrical and mechanical features as well as the admitted environmental conditions for the contact type C and it's wiring.

## 2.0 Resetting of the contact

In standard execution the contact resets automatically when the valve closes after the overpressure is discharged. On request the contact can be supplied with manual reset and in this case the resetting of the contact after operation is obtained by acting on the spring that hooks the lever in the operating position.

## 3.0 Features

The contact type C is a mechanically operated sudden operation changeover microswitch with double interruption bedded in a protecting casing; it can have one or two contacts and the construction is usually Telemecanique.

- Telemecanique – one contact type ZCK-J1
- Telemecanique – two contacts type ZCK-J2
- Degree of protection IP 66
- Standard cable gland PG 13,5
- Cable gland on request M20
- Resistance to vibrations (IEC 68-2-6) 25g from 10 to 500 Hz
- Resistance to shock 50g
- Protection against electric shocks Class I according to IEC 536
- Contact resistance  $\leq 25$  mOhms
- Standard interruption power ( $1 \times 10^5$  operations) AC 250V-3,5A - 24V-10A
- DC 24V-10W - 120V-4W
- Short life interruption power (100 operations) DC 120V-150W
- Insulation to earth at 20°C 2.500V
- Insulation of open contact at 20°C 1.500V

## 4.0 Table of function and operation of contact

Wiring diagram N°	Terminal N°	Contact's position in NE	Description of wiring diagram
10-131C	13-14	Open	1 changeover contact, trips with overpressure; name of wiring diagram on type label = <b>C</b>
	21-22	Closed	
10-291C	14-13/23-24	Open	2 changeover contacts, trip with overpressure; name of wiring diagram on type label = <b>2C</b>
	11-12/21-22	Closed	

**Two contacts having the same function may not operate simultaneously.**

If manual reset of the contact is present, the letter **m** is added to the contact's name on the type label.

**Notes:**

**NE** = Normal operation; the pressure in the tank is lower than the setting pressure of the valve:

**Wiring diagram N°** = Identification number of the wiring diagram

**Terminal N°** = Identification of the terminals by numbers

**Contact's position in NE** = State of the contact in normal operation.



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Specification N° SPR/

Accessory:

Page N°:

**10VSSCHKR00-E**

**Pressure relief valve Series VS**

**1 of 2**

Title:

Revision:

**Features contact type K**

**00 - 10/10/99**

## 1.0 Features contact type K

The specification indicates the electrical and mechanical features as well as the admitted environmental conditions for the contact type K and its wiring.

## 2.0 Resetting of the contact

In standard execution the contact must be reset manually after operation, when the valve closes after the overpressure is discharged, by acting on the hook that holds the lever in the operating position. By dismantling the hook, the contact resets automatically.

## 3.0 Features

The contact type K is a mechanically operated sudden operation changeover microswitch with one interruption; the microswitch is mounted inside an aluminium protecting case and the terminals are connected to a terminal board.

### 3.1.0 Standard contact (ST) - Crouzet type 83 169 4 or Matsushita

- Degree of protection IP 67
- Lever and pushbutton Stainless steel
- Contact material Nickel coated silver
- Mechanical endurance of contact  $1 \times 10^7$  cycles
- Temperature range  $-40^\circ\text{C} - +125^\circ\text{C}$
- Standard interruption power AC 250V-5A - DC 125V-1A
- Short endurance interruption power DC 125V-1,5A
- Insulation to earth at  $20^\circ\text{C}$  2.500V
- Insulation of open contact at  $20^\circ\text{C}$  1.500V
- Minimum and maximum current 1,0 - 10A

### 3.2.0 Low current contact (BC) - Crouzet type 83 169 8

Contacts type BC are used only on request; features are identical to standard contact except for:

- Contact material Gold alloy
- Minimum and maximum current 1 to 100mA - 4 to 30V

### 3.3.0 Electric circuit

- Degree of protection of protective casing IP 65
- Material of casing Aluminium
- Insulation to earth at  $20^\circ\text{C}$  2.500V
- Material of terminals tin coated brass





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Specification N° SPR/

**10VSSCHKR00-E**

Accessory:

**Pressure relief valve Series VS**

Page N°:

**2 of 2**

Title:

**Features contact type K**

Revision:

**00 - 10/10/99**

#### 4.0 Table of function and operation of contact

Wiring diagram N°	Terminal N°	Contact's position in NE	Description of wiring diagram
10-131K	1-2	Open	1 changeover contact, trips with overpressure; name of wiring diagram on type label = K
	1-3	Closed	
10-291K	1-2 / 4-5	Open	2 changeover contacts, trip with overpressure; name of wiring diagram on type label = 2K
	1-3 / 4-6	Closed	

**Two contacts having the same function may not operate simultaneously.**

If manual reset of the contact is present, the letter **m** is added to the contact's name on the type label.

**Notes:**

**NE** = Normal operation; the pressure in the tank is lower than the setting pressure of the valve:

**Wiring diagram N°** = Identification number of the wiring diagram

**Terminal N°** = Identification of terminals by numbers

**Contact's position in NE** = State of the contact in normal operation.



## 1.0 Setting tolerance, operating pressure

The specification defines the terminology and indicates the setting pressure tolerance and all the other pressure values relevant for the test and operation of the pressure relief valves Series VS.

The performance of the pressure relief valves depends from the test fluid and the layout of the transformer tank. The pressure values listed below are obtained by operating the valves with compressed air on a test bed having a compressed air volume of 150 dm<sup>3</sup>.

## 2.0 Definitions

### 2.1.0 Nominal pressure – P<sub>n</sub>

The nominal pressure is the setting pressure of the pressure relief valve, on which the tolerance must be applied in order to determinate the minimum and maximum operating pressure.

### 2.2.0 Minimum and maximum operating pressure - P<sub>min</sub>, P<sub>max</sub>

Minimum and maximum operating pressure are the limits of the pressure range inside which the pressure relief valve must operate. The table indicates the %age on the nominal pressure as well as the actual pressure.

### 2.3.0 Service pressure – P<sub>e</sub>

The service pressure is the maximum pressure the pressure relief valve can withstand without showing oil leakage or oil loss.

### 2.4.0 Closing pressure - P<sub>c</sub>

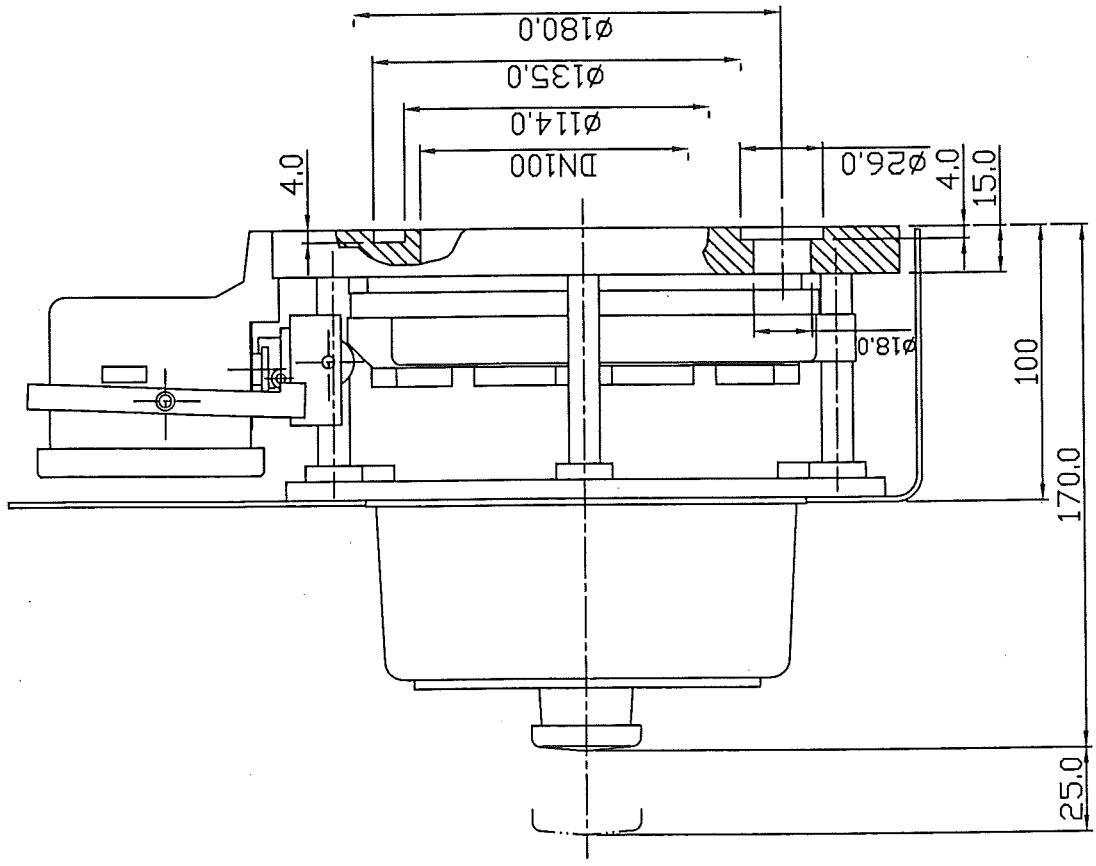
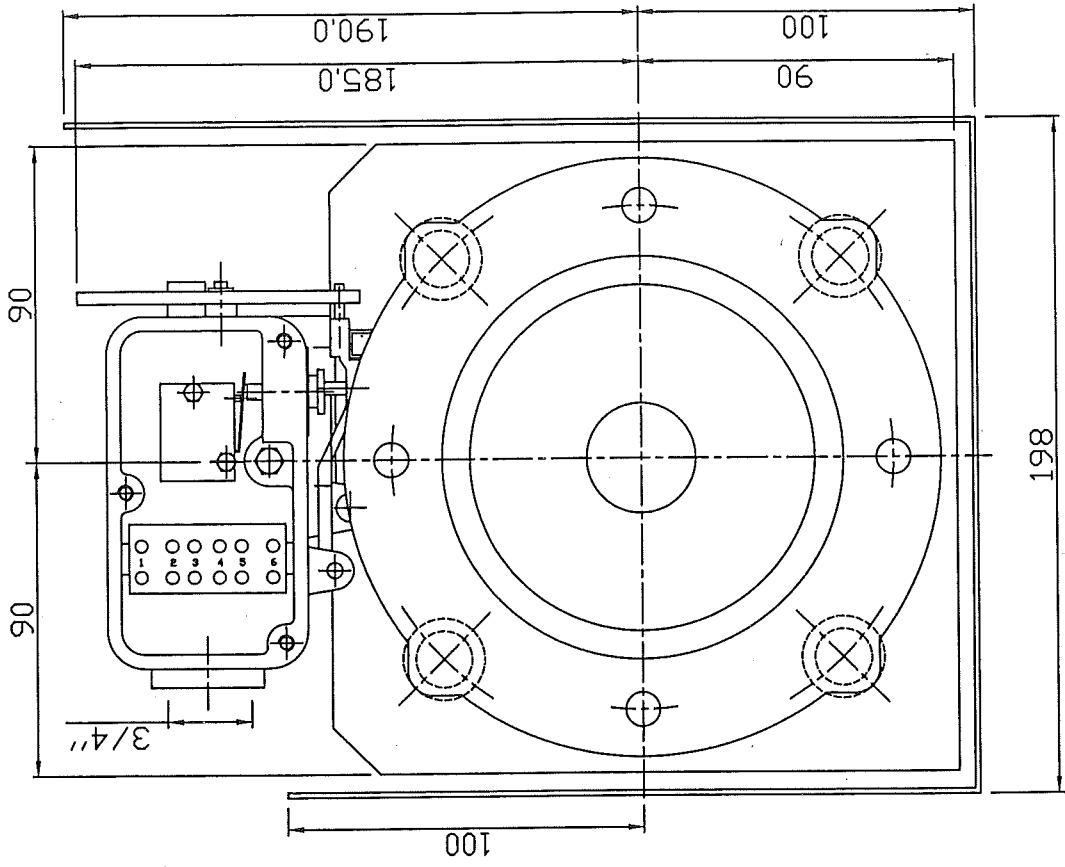
The closing pressure is the minimum pressure at which the valve closes after operation.

### 2.5.0 Tightness test pressure - P<sub>t</sub>

The tightness test pressure is the minimum pressure that must be applied to the valve at the beginning of the leakage test. During the test the pressure may drop significantly provided it remains higher than the service pressure P<sub>e</sub>.

## 3.0 Table of pressures

P <sub>n</sub> [bars]	P <sub>min</sub>		P <sub>max</sub>		P <sub>e</sub> [bars]	P <sub>c</sub> [bars]	P <sub>t</sub> [bars]
	- %	[bars]	+ %	[bars]			
0,3	0	0,300	30	0,390	0,19	0,18	P <sub>min</sub> - 0,40 bars
0,4	5	0,380	20	0,480	0,31	0,26	
0,5	5	0,475	15	0,575	0,35	0,30	
0,6	5	0,570	10	0,660	0,46	0,35	
0,7	3	0,680	10	0,770	0,53	0,44	
0,8	3	0,775	8	0,865	0,62	0,50	
0,9	3	0,875	8	0,975	0,74	0,60	
1,1	0	1,100	8	1,190	0,88	0,75	
1,3	0	1,300	8	1,400	1,00	0,95	
1,5	0	1,500	7	1,600	1,20	1,10	



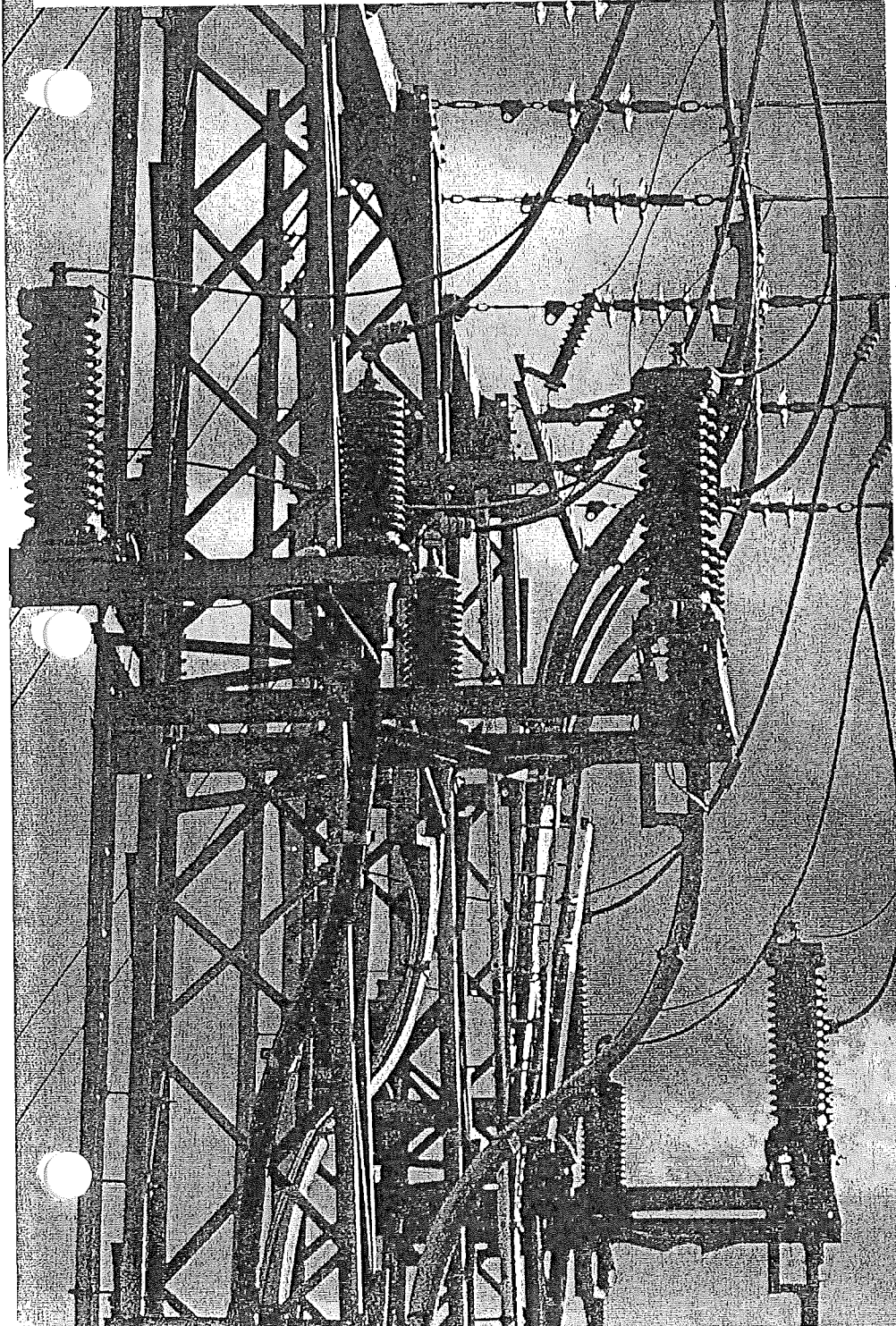
Rif.	Quantità	Titolo/Nota	Designazione, materiale, dimensioni, etc.	N. articolo/Riferimento	Disegnato	1:1.5
Proprietà di	Confezione di	Approvato da - data	Nome file	Data	30-10-98	
<b>ETI ELETTRINDUSTRIA S.p.A.</b> <b>20032 CORMANO ITALY</b>				<b>VALVOLA DI SICUREZZA - SURETY DE SECURITE - SAFETY VALVE</b> <b>TIPO-TYPE VS100NK</b>		
Numero disegno				10.100.90	Revisione	A
Riproduzione vietata				Non misurare le quote dal disegno		

A	Aggiornato dimensioni flangia e protezione secondo ultima versione	22/10/01	GL	
N.rev	Nota sulla revisione	Data	Signature	Controllo



# DEHYDRATING BREATHERS

*For Oil Insulated Electrical Equipment*



Dehydrating breathers are used to prevent moisture in the air from coming into contact with the transformer oil and reducing its insulation capability. Air entering the transformer when the load or temperature drops passes through a Plexiglas container which is filled with an absorbing agent, Silicagel.

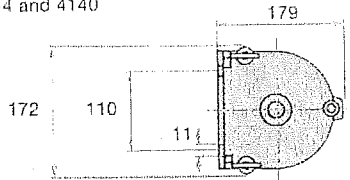
The dehydrating breathers have an oil trap which prevents continuous contact between the moist air and the Silicagel.

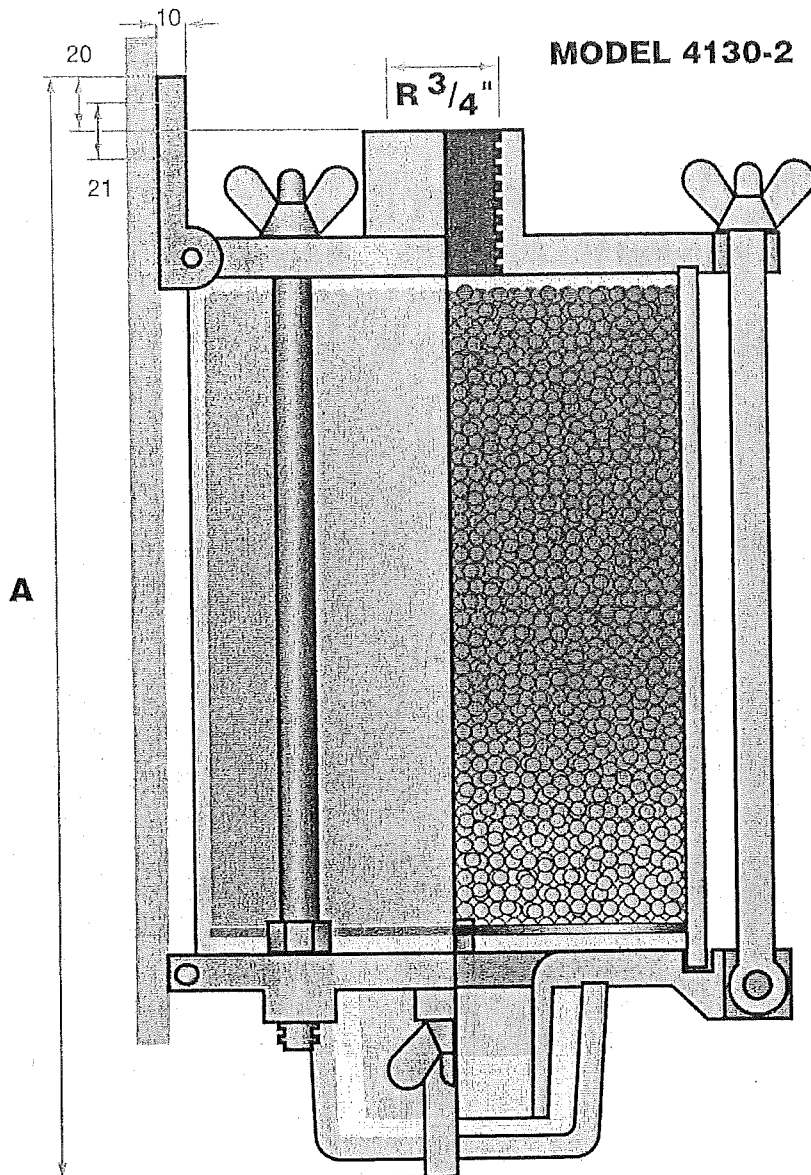
All models of our dehydrating breathers are dimensioned for a one-year interval between changing or regenerating the Silicagel. This period, however, depends on operating conditions and air humidity.

Silicagel can absorb over 20% of its own weight in moisture. When dry it is blue in color but turns pale pink as it becomes saturated with moisture.

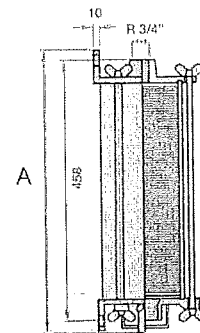
Silicagel that is saturated with moisture can be dried and used again. Drying should take place at a temperature of max. 130 °C.

**RUNE HAMP** 

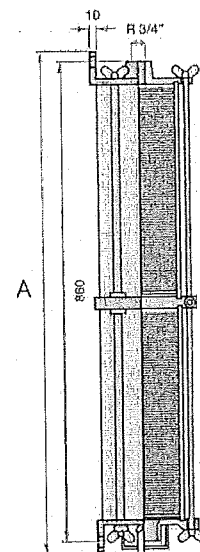
Model	For transformer with max oil weight (kg)	Weight kg		A mm	4130-2, 4130-4 and 4140
		Breather	Silicagel		
4130-2	8000	2.7	2	319	
4130-4	16 000	3.5	4	515	
4140	32 000	5.7	8	916	



**MODEL 4130-4**



**MODEL 4140**



### Assembly and maintenance Models 4130-2, 4130-4 and 4140

1. Screw the dehydrating breather onto the pipe underneath the expansion tank. The top cover has a mounting flange. Models 4130-4 and 4140 also have a mounting flange on the bottom.
2. Loosen the three top wing nuts by a few turns and then release the front support bolt forward and down. Pull the Plexiglas container forward and fill it with Silicagel.
3. Check that both gaskets are positioned correctly and put the container back on. Tighten the wing nuts carefully so that there is a good seal.
4. Remove the oil trap by releasing the wing nut on the bottom and then turn the bracket forward 90°. Fill with transformer oil up to the level indicated on the oil trap.
5. Make sure that the oil does not touch the Silicagel to avoid contamination.

# Schormann

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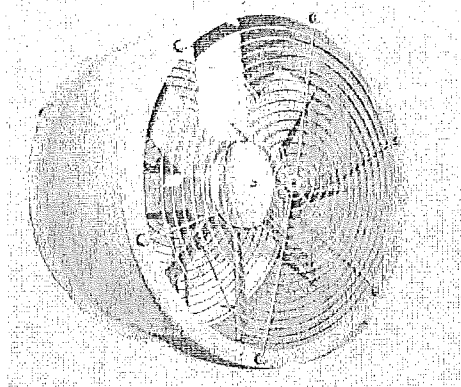
Betriebsstätte HALTERN  
HALTERN PLANT

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45721 Haltern  
Telefon +49(0)2364 9385-0  
Tele fax +49(0)2364 9385-50

Ausgabe : 01/12/02  
Edition : 01/12/02

Internet : <http://www.schormann.de>  
E-Mail: [info@schormann.de](mailto:info@schormann.de)

## Trafo-Ventilatoren - Transformer Fans - Type SK



### Verwendung - Application

Zur Kühlung von Transformatoren.

In der Regel Anbau unter den Radiatoren, der Kühlstrom wird dabei über die Radiatoren geblasen.

Einbau in jeder Achslage möglich.

They are used for the cooling of transformers.

Normally they are fixed underneath the radiators of the transformer, whereby the cooling air flow is blown via these radiators.

The mounting in any shaft position is possible.

### Ausführung - Design

Für Freiluft-Aufstellung, korrosionsgeschützt.

Laufblad aus glasfaserverstärktem Polyamid oder Silumin.

Gehäuse mit angedrückter Einströmdüse ist mit beidseitigem Schutzgitter ausgestattet.

Gehäuse aus Aluminium mit Deckanstrich in Pulverbeschichtung.

Motor mit Klemmenkasten in Schutzart IP 55, Iso-Klasse F.

Für 50 Hz und 60 Hz Betrieb.

They are suitable for outdoor-installation and protected against corrosion.

The impeller is out of reinforced polyamid or cast-silumin.

The housing and the inlet-nozzle is equipped with in - and outlet protection screen.

The housing is out of aluminium with powder coating.

Motor and conduit box protection IP 55, insulation class F.

In 50 Hz and 60 Hz design.

# Schormann

Betriebsstätte BURSCHEID  
BURSCHEID PLANT

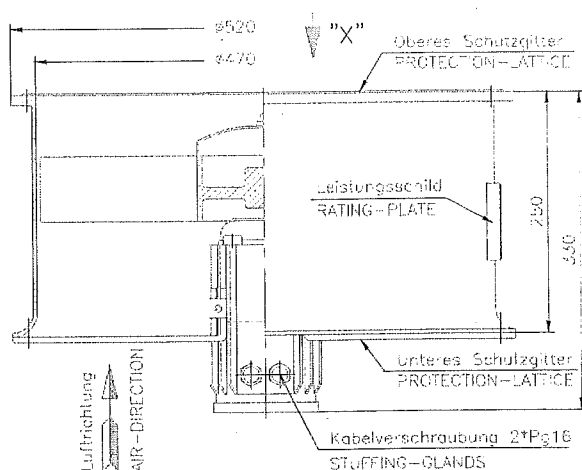
Griesberger Str. 43-45  
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Telefax +49(0)2174 63015  
Telefon +49(0)2174 60447

Betriebsstätte HALTERN  
HALTERN PLANT

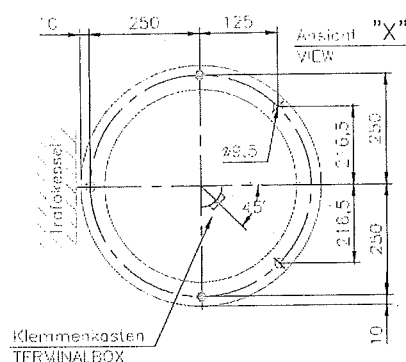
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45721 Haltern  
Telefax +49(0)2364 9385-50  
Telefon +49(0)2364 9385-0

Ausgabe : 01/12/02  
Edition : 01/12/02

## Trafo-Ventilator / Transformer-Fan : SK 470



- Zweipunktbefestigung DOUBLE-FIXING
- Dreipunktbefestigung TRIPLE-FIXING



Daten gelten für 220-240/380-415 Volt ( 50 Hz ), 208-265/360-460 Volt ( 60 Hz ), Gewicht: etwa 13 Kg  
Technical data are for 220-240/380-415 Volt ( 50 Hz ), 208-265/360-460 Volt ( 60 Hz )

Luftmenge freiblasend +/- 10 % Toleranz

Quantity of air free outlet blowing +/- 10 % Tolerance

Schalldruckpegel L<sub>pa</sub> : Meßentfernung 1 m seitlich im reflexionsarmen Raum  
Toleranz + 2 dB(A)

Sound pressure level L<sub>pa</sub> : Measuring distance 1 m sideways in anechoic room  
Tolerance + 2 dB(A)

Typ Type	F [ Hz ]	Drehzahl Speed [ 1/min ]	Nennstrom Rated current [ A ] Delta/Star	Leistungsaufnahme Power input [ Watt ]	Luftmenge Air quantity [ m <sup>3</sup> /s. ]	stat. Druck stat. pressure [ Pa ]	L <sub>pa</sub> L <sub>pa</sub> [ dB(A) ]
SK 470-4	50	1343	2,08/1,20	525	2,25	80	69,0
SK 470-4	60	1580	3,20/1,85	850	2,63	110	73,5
SK 470-6	50	963	1,21/0,70	260	1,61	45	62,0
SK 470-6	60	1118	1,09/0,63	350	1,87	55	65,5
SK 470-8	50	720	1,18/0,68	155	1,25	25	53,0
SK 470-8	60	830	1,04/0,60	180	1,41	33	58,0
SK 470-10	50	570	0,40/0,23	78	0,98	18	47,0
SK 470-10	60	630	0,35/0,20	87	1,00	20	47,5
SK 470-12	50	460	0,52/0,30	85	0,78	10	40,5
SK 470-12	60	525	0,47/0,27	90	0,97	15	44,5



## 7 EQUIPMENT- DRAWINGS

7.1	Current transformer CT- 4000 .....	353710
7.2	Current transformer CT- 225 .....	353711
7.3	Valve 80 mm.....	CZ8918
7.4	Valve 50 mm.....	CZ8743
7.5	Valve 25mm.....	CZ8742
7.6	Oil Sampling Valve 15mm.....	CZ8739
7.7	Core earthing .....	CD1644
7.8	Main earthing terminal .....	C65796
7.9	Thermometer pocket.....	C65801

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Datum Date	Izradio Designed	Odobrio Approved	Promijenio Revised
VIII 2005.	ing. Taslak <i>Taslak</i>	m. Biloš <i>Biloš</i>	

OB-0006  
2003-05



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**D&ST**



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Mokrovićeva 8, P.O.Box 6062, HR-10090 Zagreb, Croatia  
Phone (385 1) 37 83 732, Fax (385 1) 37 94 050, e-mail: info@koncar-dst.hr



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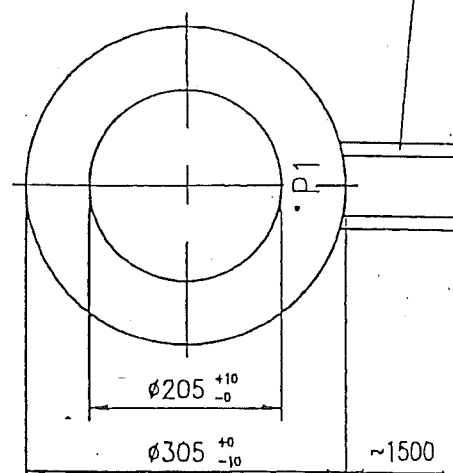
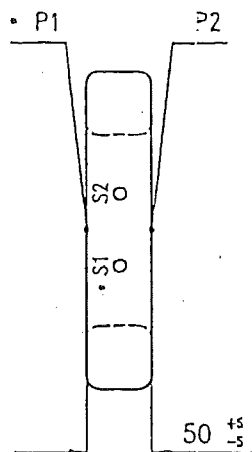
MJERNI

TRANSFORMATORI dd

CURRENT TRANSFORMER

PROUDOVÝ TRANSFORMÁTOR S KRUHOVÝM JÁDREM

M54705

Sekundarni izvodi - Fleksibilni kobl 2.5 mm<sup>2</sup>Volne izvodi vinuti 2.5 mm<sup>2</sup>**KONČAR**

Mjerni transformatori dd

PROUDOVÝ TRANSFORMÁTOR No. Typ   Hz Ext.  %S1-S2  A  VA Cl. Norma  Made in Croatia

M54705

90

40

Dimenzije u [mm]

Dimensions in [mm]

Mass:

6 kg

Váha:

Date:	Designed:	Approved:
31.03.2005	ing. Mlinar	ing. Mlinar

Datum Date	Izradio Designed	Odobrio Approved	Promjer Revision
VIII 2005	ing. Taslak	mr. Šiloš	

03-700/1

INSTRUMENT TRANSFORMERS

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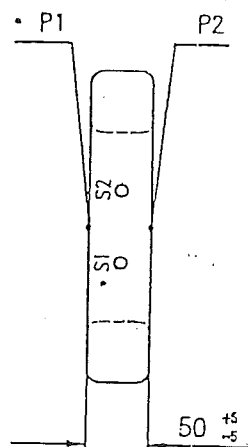
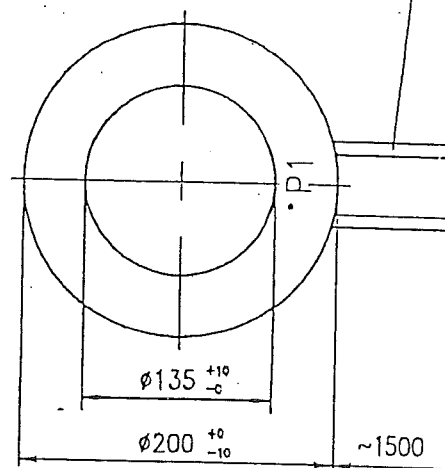
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TRANSFORMATORI dd

CURRENT TRANSFORMER

PROUDOVÝ TRANSFORMÁTOR S KRUHOVÝM JÁDREM

M54706

Sekundarni izvodi-Fleksibilni kabel 2.5 mm<sup>2</sup>Volne vyvody vinuti 2.5 mm<sup>2</sup>**KONČAR**

Mjerni transformatori dd

PROUDOVÝ TRANSFORMÁTOR No. 

Typ ST-225 50 Hz Ext. 150 %

S1-S2 225/2 A 10 VA Cl. JFS5

Norma IEC 60044-1

Made in Croatia

M54706

90

40

Date:	31.03.2005	Designed:	ing. Mlinar	Approved:	ing. Jurek
-------	------------	-----------	-------------	-----------	------------

Dimenzije u [mm]

Dimensions in [mm]

Mass:

2 kg

Váha:

DB-700/1

INSTRUMENT TRANSFORMERS

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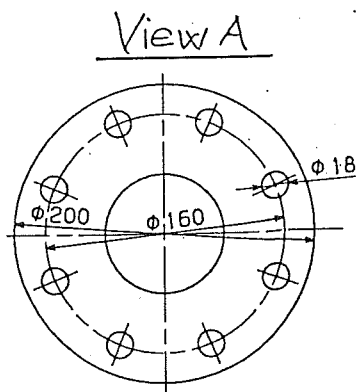
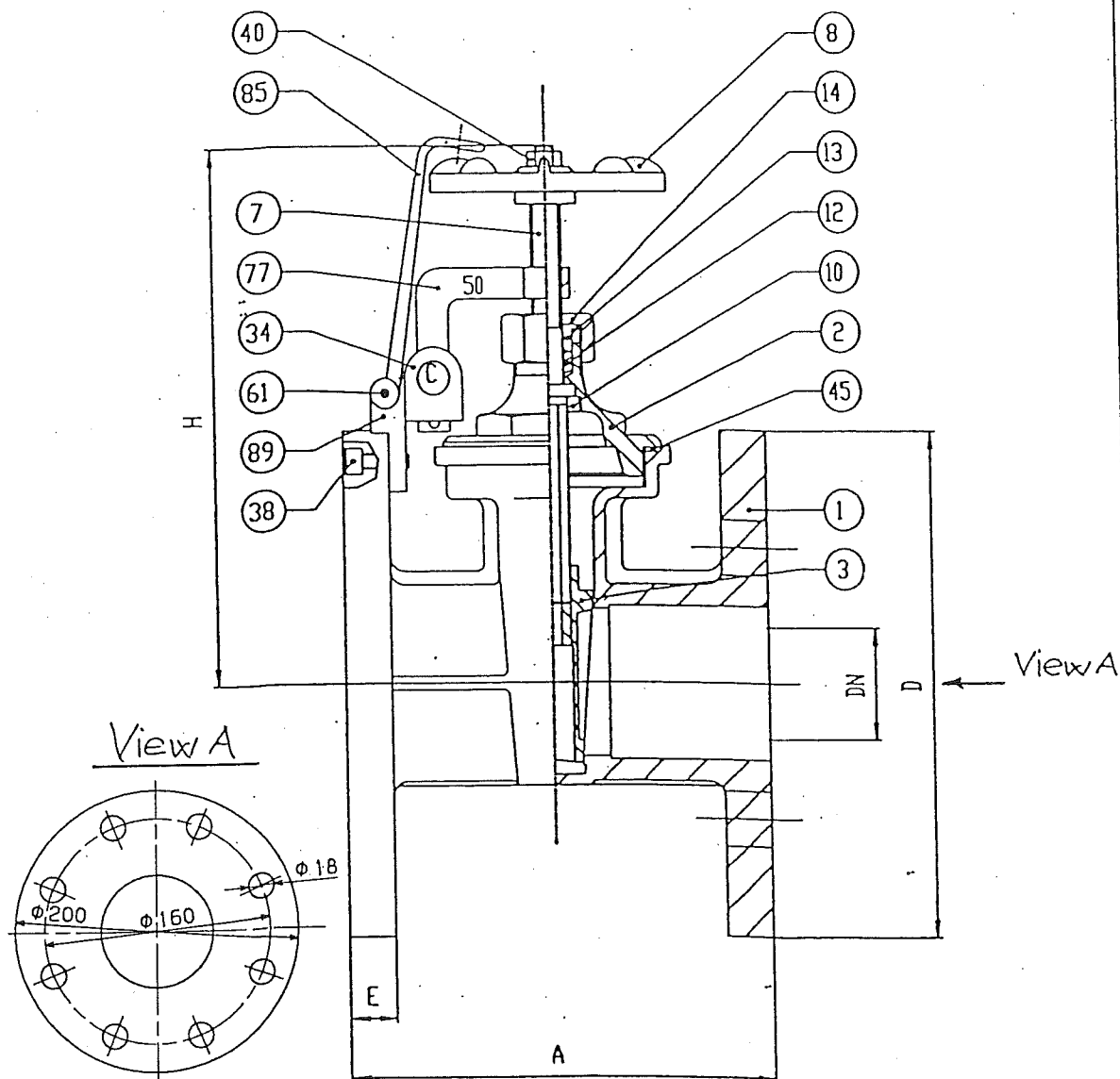
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AUTEXIER

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93115 ROSNY-SOUS-BOIS Cedex  
Tel:01 48 54 25 37 Fax:01 48 54 73 08

PL -



DN	A	D	E	H	Veight Kg	Broj dijela
25	100	115	10	121	2.186	
40	120	150	14	147	5.082	
50	135	165	11.5	175	6.80	
80	160	200	17	263	14.46	
100	172	220	19	316	21.57	

89	BRACKET	1	BRONZE
85	BOLT	1	BRONZE
77	TRAVEL INDICATOR	1	BRONZE
61	PN	1	STAINLESS STEEL A2
45	GASKET	1	P.T.F.E
40	NUT	1	BRASS
38	SCREW	1	STEEL
34	GUIDE	1	BRONZE
14	PACKING NUT	1	BRASS, BRONZE (80/100)
13	PACKING GLAND	1	BRASS

12	PACKING	1	GRAPHITE FIBER
10	STEM NUT	1	BRASS
8	HANDWHEEL	1	ALUMINUM ALLOY
7	STEM	1	BRASS
3	SINGLE VEDGE	1	BRONZE
2	BONNET	1	BRONZE
1	BODY	1	BRONZE

Ref.	DESIGNATION	Nbr.	Material
OBSERVATIONS			
MAX WORK CONDITIONS : 16 BAR / 200°C			
HYDRAULIC TEST 24 BAR			
CONNECTING - FLANGES ISO PN 16 STANDARDS/ASA ON DEMAND			
MODIFICATIONS : INDEX 0			
subject to modifications			

GATE VALVE SINGLE VEDGE  
BRONZE

Date 26/01/00 BMM

SERIE A1191C0

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Projekcija	Revizija
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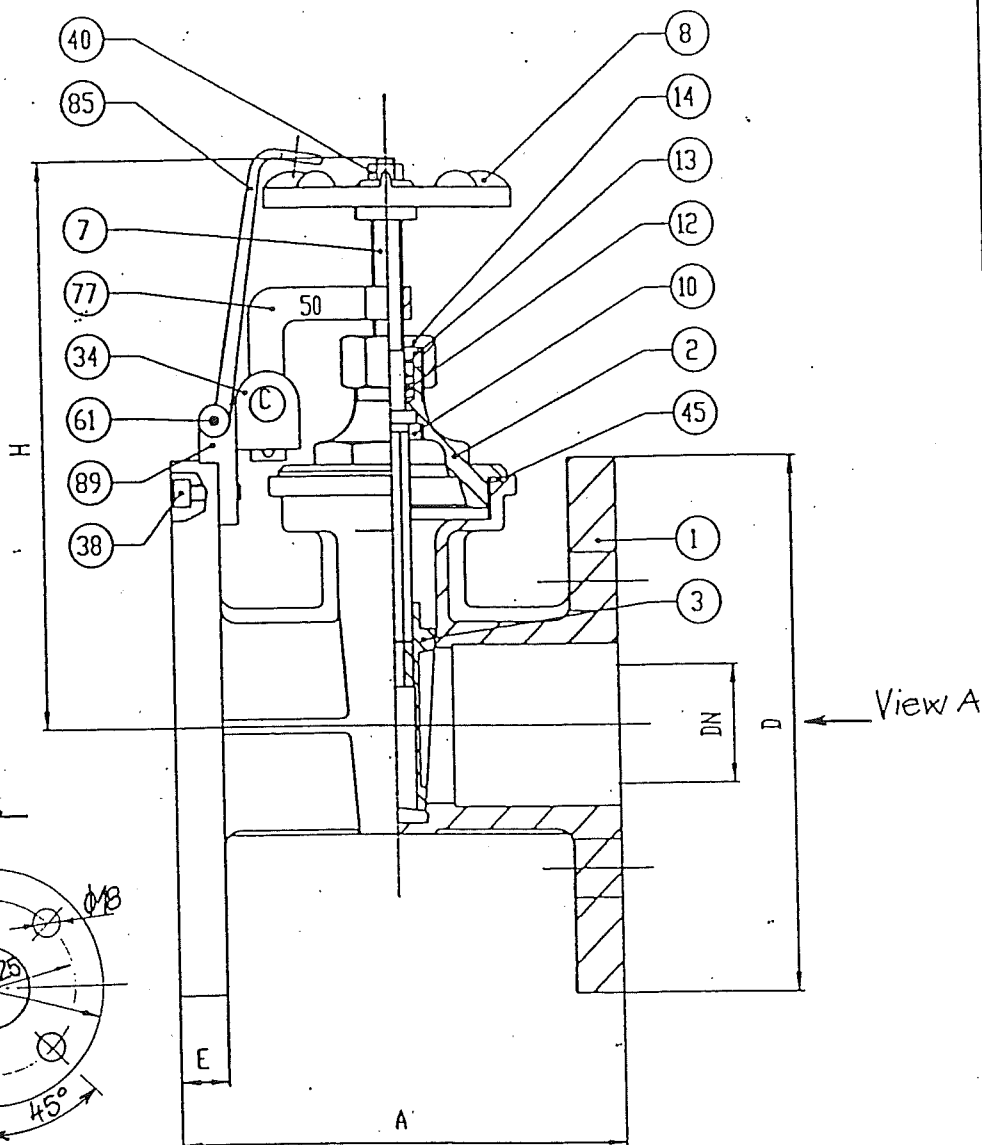
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2, rue Gustave EIFFEL  
93115 ROSNY-SOUS-BOIS Cedex  
Tel:01 48 54 25 37 Fax:01 48 54 73 08

PL -



DN	A	D	E	H	Weight Kg	Broj dijela
25	100	115	10	121	2486	
40	120	150	14	147	5082	
50	135	165	11.5	175	6.80	CZ8743
60	160	200	17	263	14.46	
100	172	220	19	316	21.57	

89	BRACKET	1	BRONZE
85	BOLT	1	BRONZE
77	TRAVEL INDICATOR	1	BRONZE
61	PIV	1	STAINLESS STEEL A2
45	GASKET	1	P.T.F.E
48	NUT	1	BRASS
38	SCREW	1	STEEL
34	GUIDE	1	BRONZE
14	PACKING NUT	1	BRASS, BRONZE (80;100)
13	PACKING GLAND	1	BRASS

12	PACKING	1	GRAPHITE FIBER
10	STEM NUT	1	BRASS
8	HANDWHEEL	1	ALUMINUM ALLOY
7	STEM	1	BRASS
3	SINGLE WEDGE	1	BRONZE
2	BONNET	1	BRONZE
1	BODY	1	BRONZE

Ref.	DESIGNATION	Mar.	Material
OBSERVATIONS			
MADE WORK CONDITIONS : 16 BAR / 200°C		HYDRAULIC TEST 24 BAR	
CONNECTING : FLANGES ISO PN 16 STANDARDS/ASA ON DEMAND			
MODIFICATIONS : INVOICE 8		subject to modifications	

GATE VALVE SINGLE WEDGE  
BRONZE

Date 26/01/00 RAHNO

SERIE A1191C0

Date Date	Issued Designed	Approved By	Revision
02. '00.	Ing. Dean <i>Dean</i>	Ing. J. J. J. <i>J. J. J.</i>	1. 66873 12.6. '00.

08 - 010,  
1999-03-23

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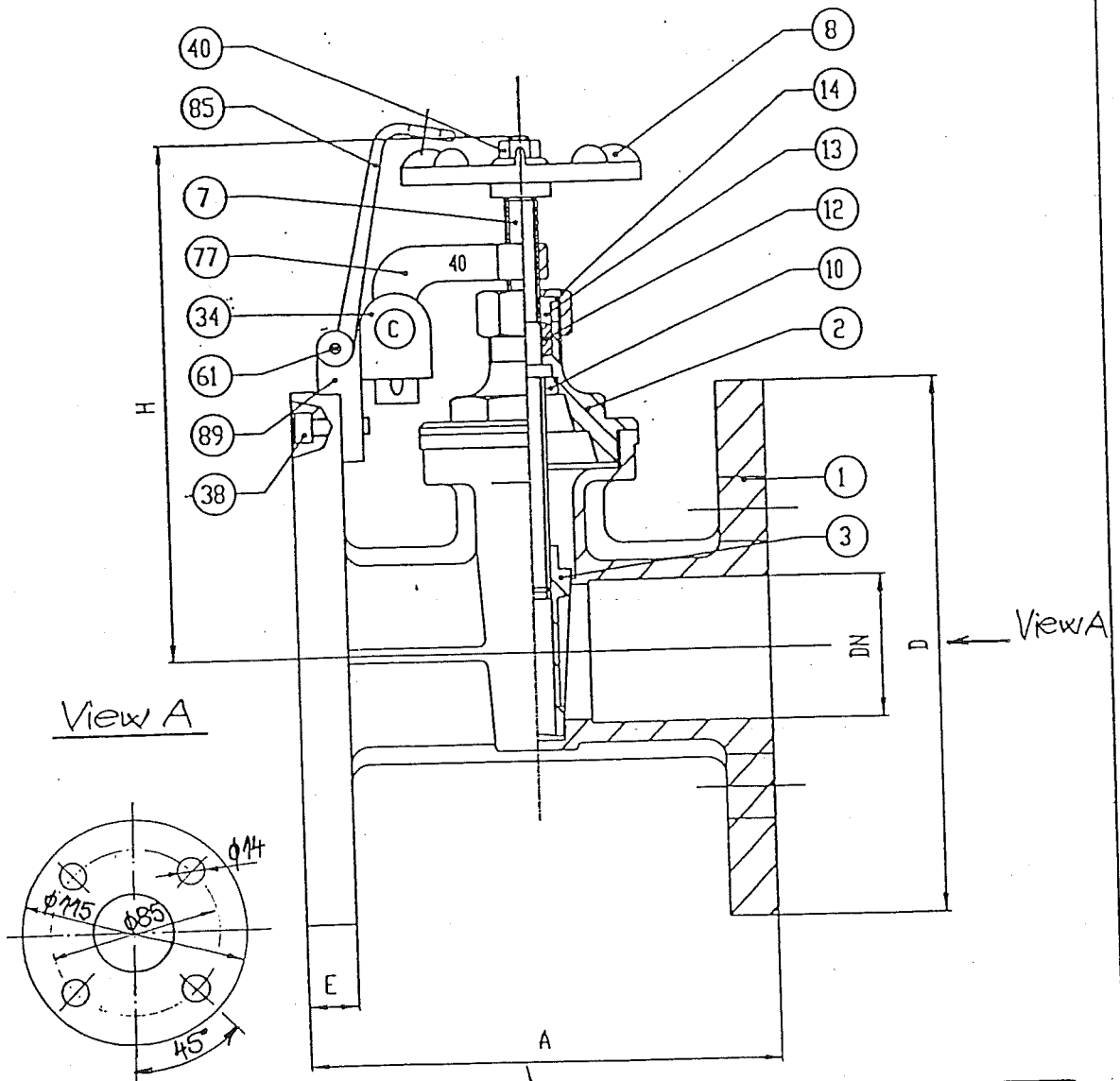
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PL -



DN	A	D	E	H	Weight Kg	Broj dijela
15	80	95	9	102	1.425	
25	100	115	10	120	2.375	CZ8742
40	136	150	14	146	5.18	
50	142	165	15	173	6.8	

89	BRACKET	1	BRONZE
85	BOLT	1	BRONZE
77	TRAVEL INDICATOR	1	BRONZE
61	PIN	1	STAINLESS STEEL A2
40	NUT	1	BRASS
38	SCREW	1	STEEL
34	GUIDE	1	BRONZE
14	PACKING NUT	1	BRASS
13	PACKING GLAND	1	BRASS
12	PACKING	1	GRAPHITE FIBER

10	STEM NUT	1	BRASS
8	HANDWHEEL	1	ALUMINUM ALLOY
7	STEM	1	BRASS
3	SINGLE WEDGE	1	BRONZE
2	BONNET	1	BRONZE
1	BODY	1	BRONZE
Ref.	DESIGNATION	Qty.	Material
OBSERVATIONS			
MAXI WORK CONDITIONS : 16 BAR / 207°C			
HYDRAULIC TEST 24 BAR			
CONNECTING : FLANGES ISO PN 16 STANDARDS/ASA ON DEMAND			
MODIFICATIONS : INDICE 0			
subject to modifications			

GATE VALVE SINGLE WEDGE  
BRONZE

Date 26/05/98 BAHIO

SERIE A191C0

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Datum Data	Izradio Designed	Odobrio Approved	Promjena Revision
02. '00.	Ing. Dean 7/2000	Ing. Jurec 12.6.00.	A.66873

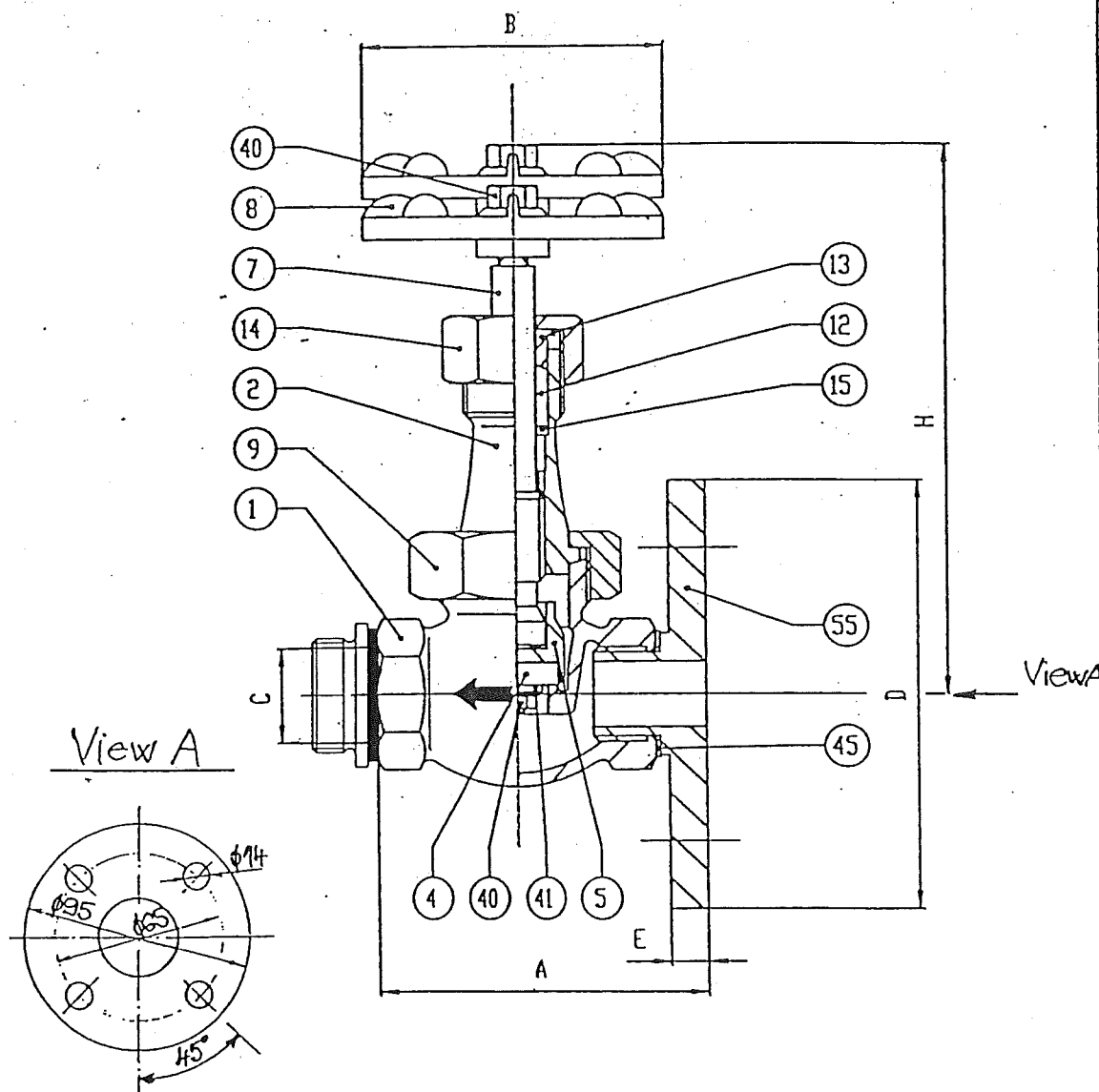
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PL -



DR	A	B	C	D	E	H	Weight Kg
15	76	70	1/2	95	8	122	1.18

55	FLANGE	1	BRASS
45	GASKET	1	ELASTOMER FIBER
41	WASHER	1	BRASS
40	NUT	2	BRASS
15	THRUST DISC	1	BRASS
14	PACKING NUT	1	BRONZE
13	PACKING GLAND	1	BRASS
12	PACKING	1	GRAPHITE FIBER
9	RONNET NUT	1	BRONZE

8	HANDWHEEL	1	ALUMINIUM ALLOY
7	STEM	1	BRASS
5	DISC HOLDER	1	BRASS
4	DISC	1	BRONZE
2	RONNET	1	BRONZE
1	BODY	1	BRONZE
Ref.	DESIGNATION	Nbr.	Material
OBSERVATIONS			
MAXI WORK CONDITIONS : 28 BAR / 25°C			
HYDRAULIC TEST 38 BAR			
CONNECTING : GAZ FEMALE THREADED ENDS / FLANGES ISO PN 16			
MODIFICATIONS : NOTICE 8			
subject to modifications			

GLOBE VALVE

Date 25/01/00 BAHN

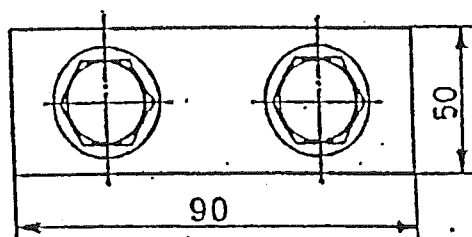
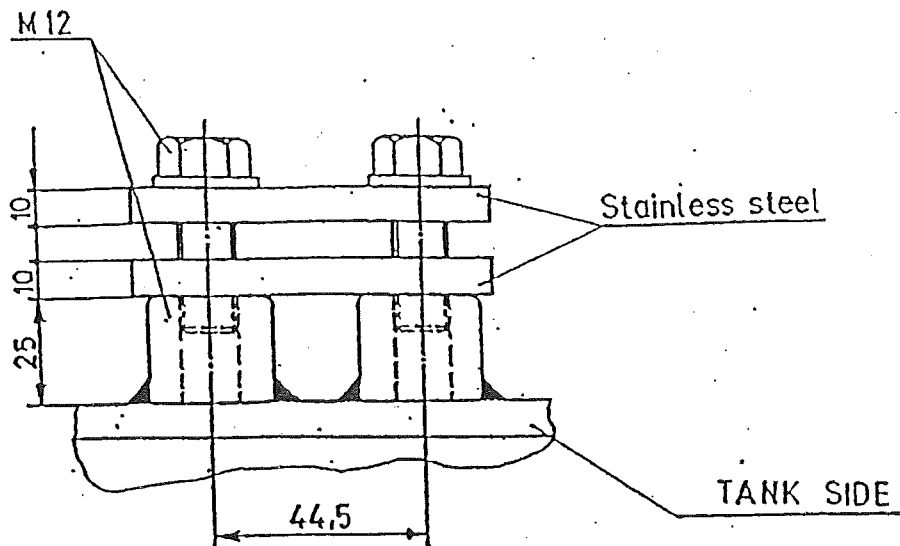
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Datum	Desig.	Appr.	Proj.	Revizija
02. '00.	150.000	150.000	150.000	150.000

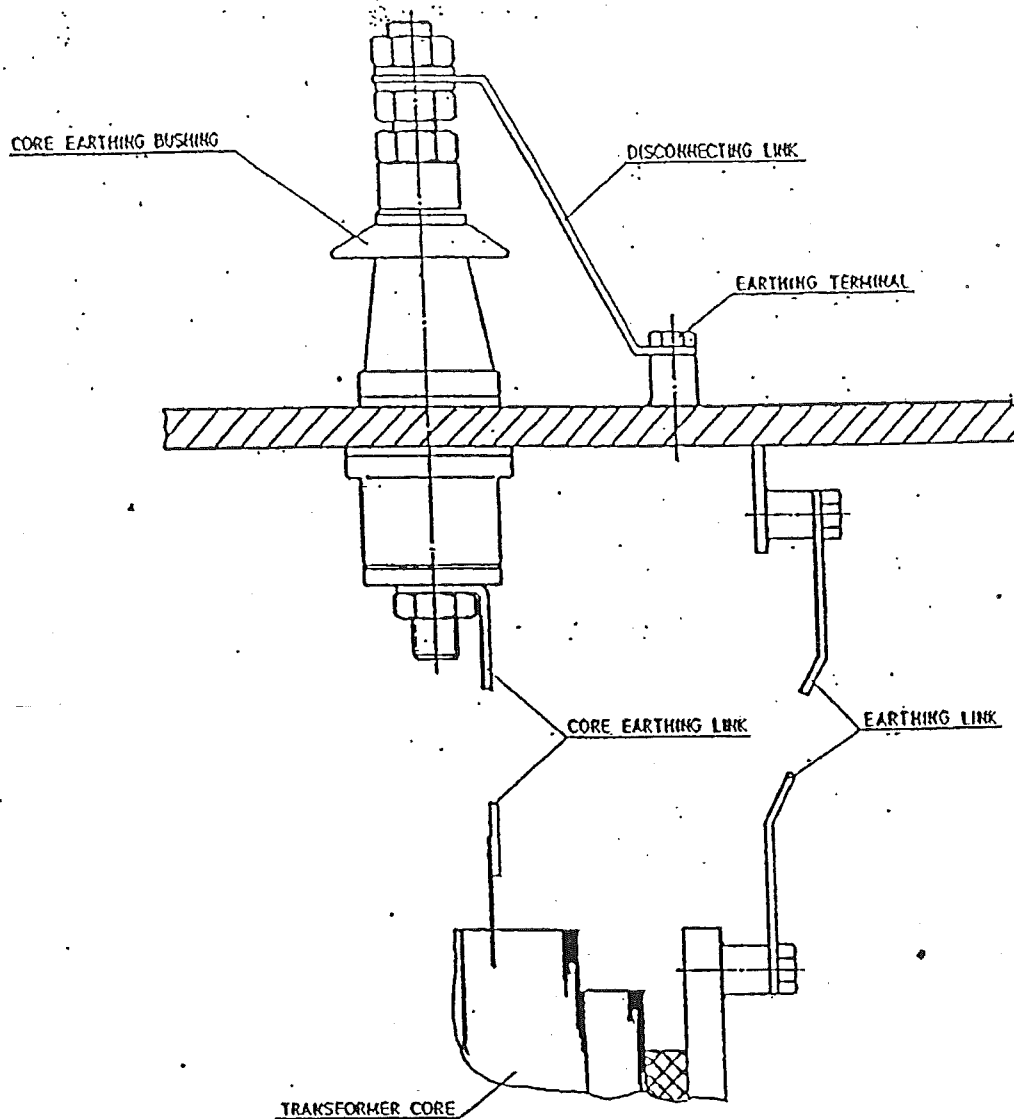
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

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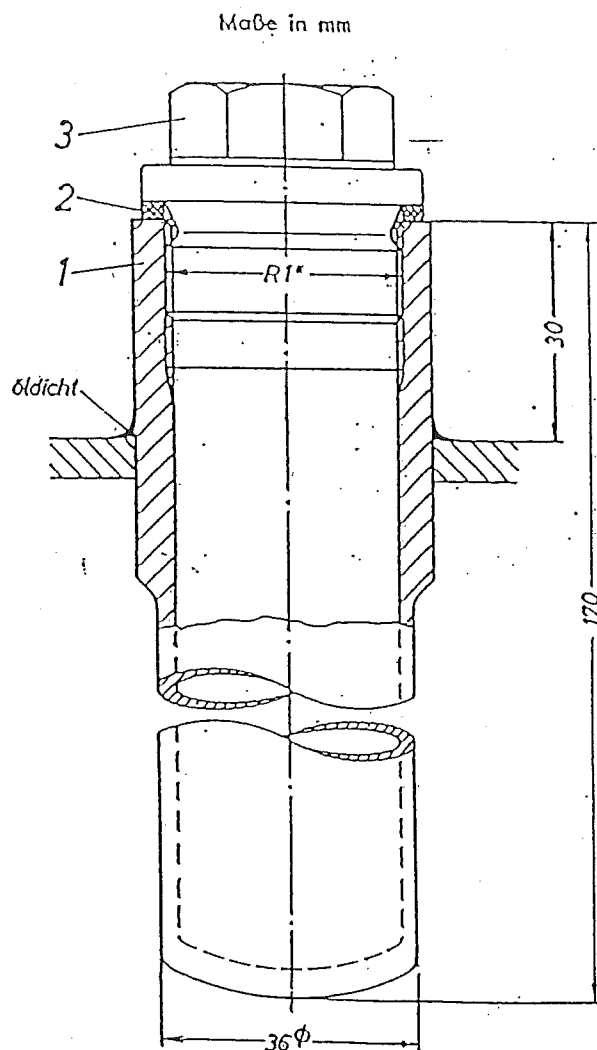
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Bezeichnung der vollständigen Thermometertasche (T) einschließlich Dichtring und Verschlußschraube:  
Thermometertasche T DIN 42 554

Lfd. Nr	Stückzahl	Bezeichnung	
		Benennung	Kurzzeichen
1	1	Tasche	T DIN 42 554
2	1	Dichtring	A 33x39 DIN 7603 — II
3	1	Verschlußschraube	R 1" DIN 910 — verzinkt und bidromatisiert

Datum Date	14.06.00.
Izradio Designed	Corale
Odobrio Approved	<i>[Signature]</i>
Promjena Revision	