

167LP Pneumatic Buoyancy Transmitter with Torque Tube for Liquid Level, Interface and Density

For table of contents see last page.

1 GENERAL

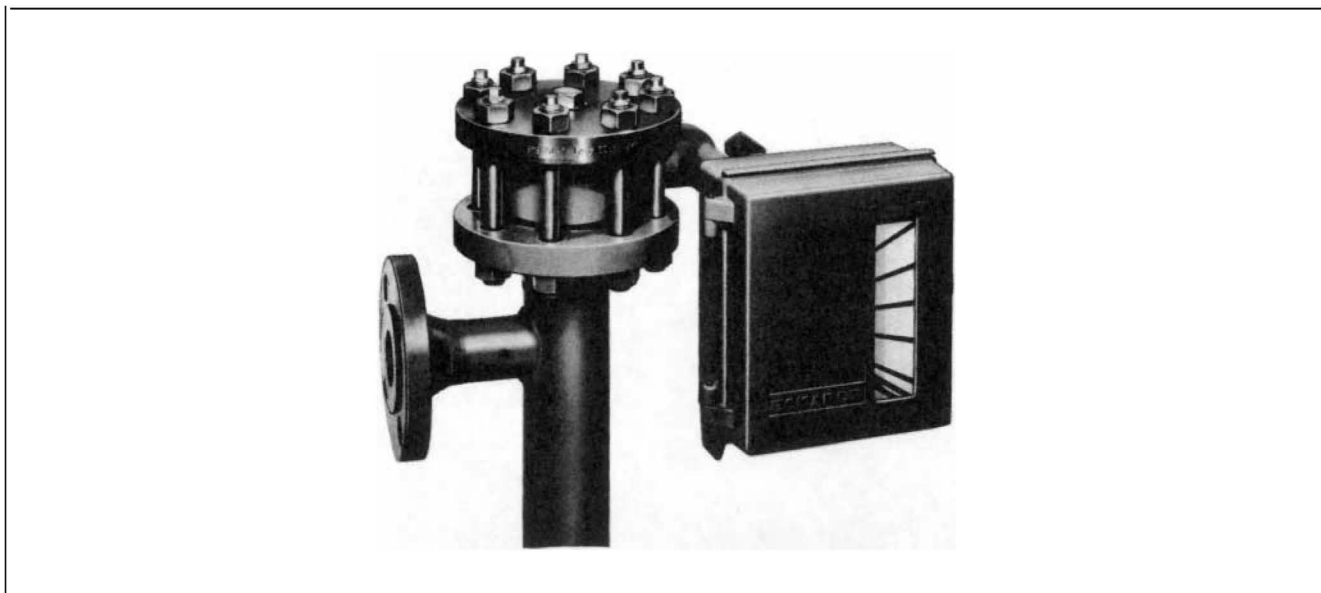
The pneumatic transmitter 167LP is used for measuring the level, interface or density of liquids. Measurement is carried out in accordance with Archimed's buoyancy principle.

The transmitter converts the lifting force of a displacer body to an analog, linearly arranged, pneumatic output signal in the unit range 0.2 to 1 bar, or 3 to 15 psi.

2 INSTALLATION

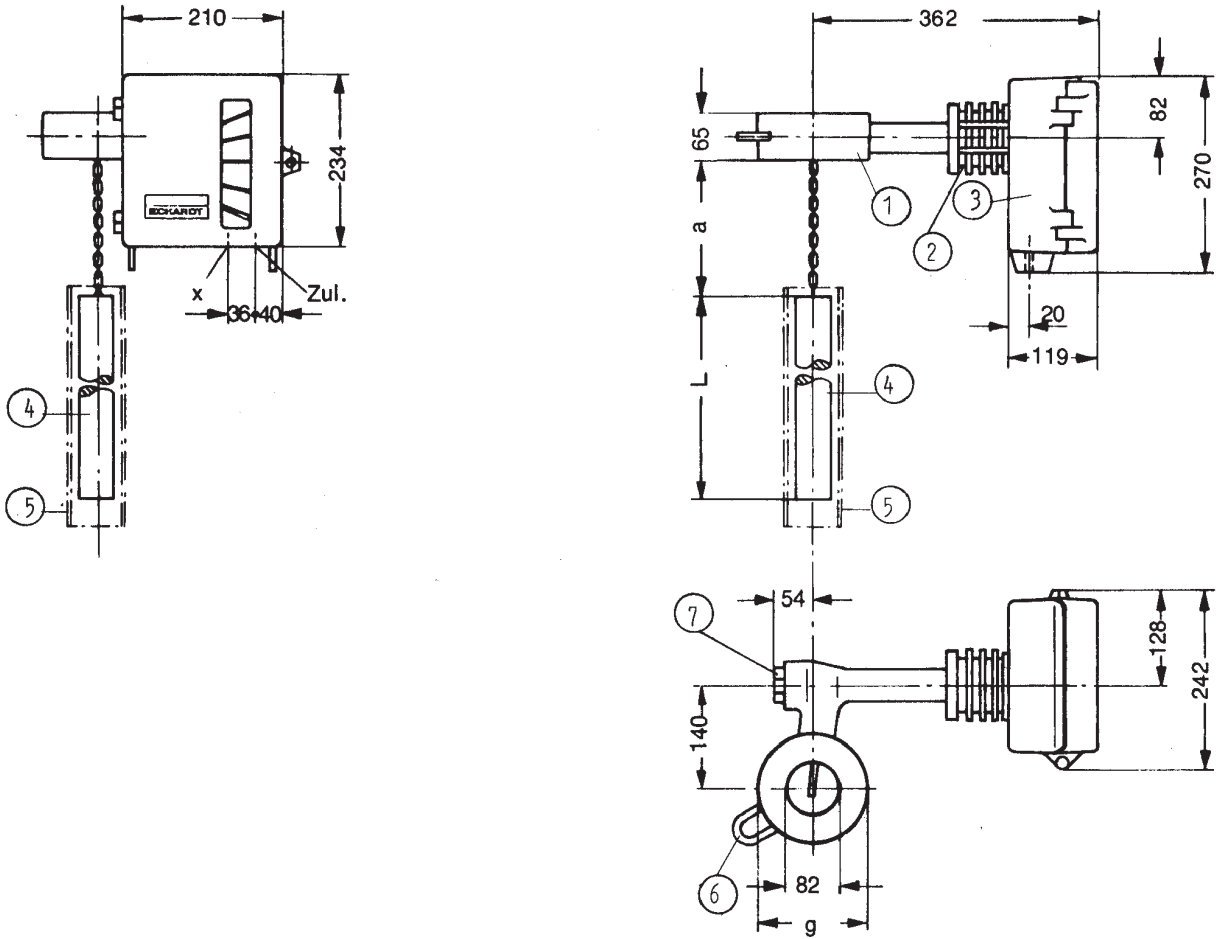
The pneumatic transmitter 167LP in sandwich construction, is built onto the vessel or the displacer chamber. The transmitter can be used for ambient temperatures ranging from -40 to $+90$ °C and, depending on the material, for temperatures of the measured medium ranging from -196 to $+400$ °C.

Heat insulation ensures that no heat radiation reaches the housing of the transmitter at high temperatures of the measured medium.



2.1 Dimensions

2.1.1 Transmitter without heating jacket



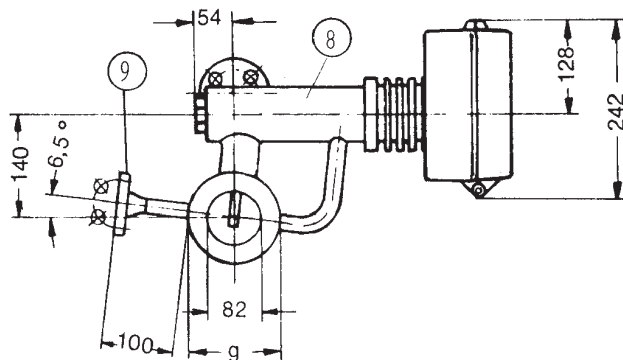
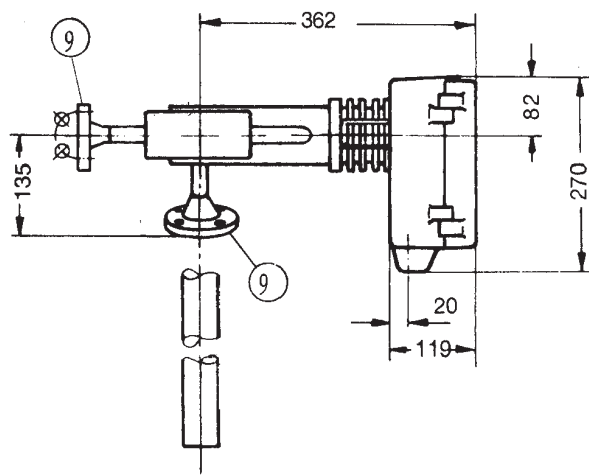
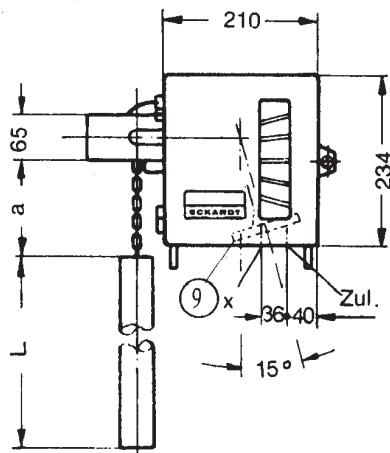
Pneumatic connections: Internal thread DIN 45141 – Q1/4-18-NPT	
x	signal output
Zul.	supply air

- ① Headpiece
- ② Cooling body
- ③ Transmitter housing
- ④ Displacer body
- ⑤ When installing the tank or during turbulent liquid, the customer must provide the protection cage or protection pipe for the displacer body.
- ⑥ Mounting brackets
- ⑦ Plug screw

Version	Contact faces		Dimensions in mm		
	DN	PN	a*	g	L
DIN	80	40	Form E	132	138
			DIN 2526	146	
				148	
		160	Form L	189	
			DIN 2696	215	
ANSI	3 in	150	Raised Face (RF)	144	138
			ANSI B16.5	154	
				163	
		900	Ring Joint Face (RJF)	210	
			ANSI B16.5	236	

* Suited to the dimensioning of our displacer bodies. Other lengths on request.

2.1.2 Transmitter with heating jacket (PN 25)



Pneumatic connections: Internal thread DIN 45141 – Q 1/4 - 18-NPT	
x	signal output
Zul.	supply air

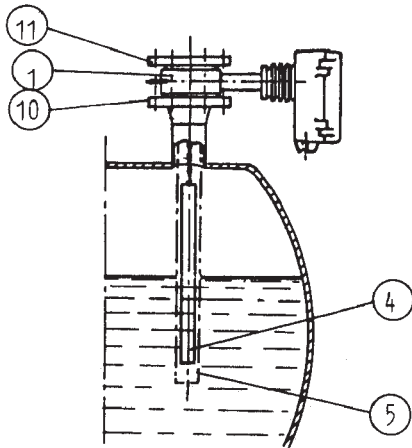
- ⑧ Heating jacket PN 25
- ⑨ Connecting flange for heating jacket DN 15, PN 25

Version	Pneumatic connections:		Contact faces	Dimensions in mm		
	DN	PN		a*	g	L
DIN	80	40	Form E DIN 2526	132	138	Length of displacer body
		64		146		
		100		148		
		160	Form L DIN 2696	189		
ANSI	3 in	150	Raised Face (RF) ANSI B 16.5	144	138	
		300		154		
		600		163		
		900		210		

* Suited to the dimensioning of our displacer bodies.
Other lengths on request.

2.2 Installation on the top of the tank (top mounting)

The headpiece (1) of the pneumatic transmitter in sandwich construction is installed between the (10) connecting flange and (11) the blind flange (see Section 2.5).
If the connecting flange (10) does not have a nominal diameter 80 (DIN), respectively three inches (ANSI), an adapter DN 80 is to be used.

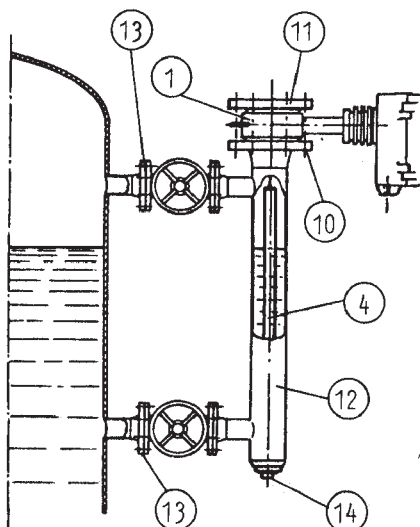


In the presence of turbulent liquid, a protection cage (5) or a pipe, which has a venting hole over the maximum liquid level, is to be installed in the tank. The distance between the protection cage or pipe and the displacer body (4) must, in the case of clean measuring mediums, be at least 5 mm all the way round, otherwise 10 mm distance is recommended.
The installation of the headpiece (1) is described in Section 2.5.

2.3 Installation on the side of the tank (side mounting)

Bolt the (12) displacer chamber onto the (13) two side connecting flanges of the tank in such a way that the displacer chamber is precisely vertical. Stop cocks can be fitted between the displacer chamber and the tank.
Depending on the design, a (14) bleeder screw, or a drain sleeve with flanges is fitted to the underneath of the displacer chamber (12).

The fitting of the headpiece (1) is described in Section 2.5.



2.4 Matching of the displacer body

Care must be taken during installation to ensure that the transmitter and the displacer body are correctly matched, since at the place of manufacture, each transmitter is adjusted to the relevant displacer body, in accordance with the order data. For this reason, each displacer body is marked with the service designation, or should this not be known, with the last three figures of the series number of the relevant transmitter. Should this identification marking be no longer recognizable, data concerning the displacer body can be determined through measurements and be compared with the information given on the data label on the inside of the transmitter.

Example of a data label on the inside of the transmitter:

VERDRÄNGERKÖRPER IMMERS. BODY PLONGEUR		MESSUMFORMER EINGESTELLT AUF ADJUSTED TO ADJUSTEE A	
LÄNGE LENGTH LONGUEUR	L - 1000 mm	DICHTE OBEN DENSITY ABOVE DENSITE HAUT	p 2 - <input type="text"/> kg/m ³
VOLUMEN VOLUME VOLUME	V - 707 cm ³	DICHTE UNTEN DENSITY BELOW DENSITE BAS	p 1 - 1000 kg/m ³
GEWICHTSKRAFT WEIGHT POIDS	G _K - 14,77 N	MESSANFANG MIN. INPUT VALUE DEBUT DE MESURE	G _{W0} - 14,77 N ≤20N
AUSGANG OUTPUT SORTIE	0.2-1 bar 4-20 mA 0-15 psr 0-20 mA	MESSSENDE MAX. INP VALUE FIN DE MESURE	G _{W100} - 7,78 N ≥2N
CDS 5/8 724			

Explanations:

Length L = length of the displacer body
(≅ length of measurement) in mm

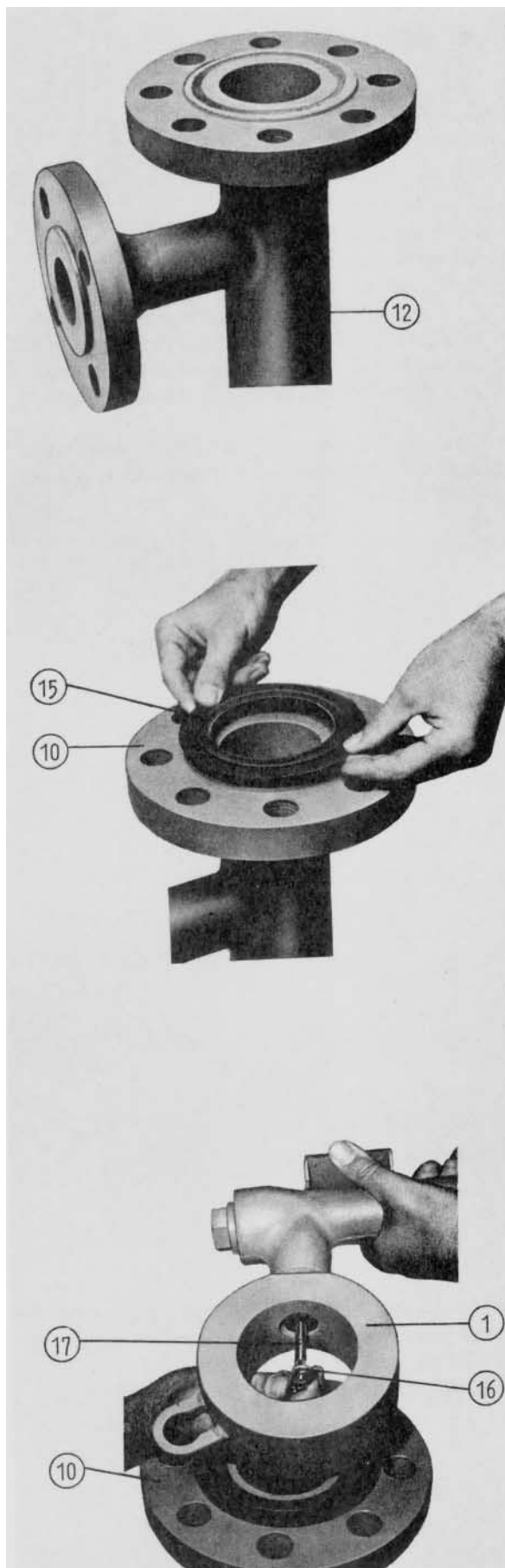
$$\text{Volume } V = \frac{L \cdot d^2 \cdot \pi}{4} \quad (L \text{ and } d \text{ in cm!})$$

L = length of the displacer body
(≅ length of measurement)

d = diameter of the displacer body

Weight force G_K: to be determined by weighing

2.5 Installation of the headpiece



Attach the displacer chamber (12) vertically onto the tank.

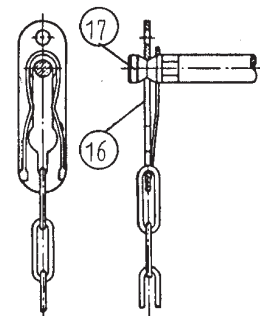
⑮ Place the seal onto the connecting flange (10).

Insert the displacer body in the displacer chamber (12) or tank.*

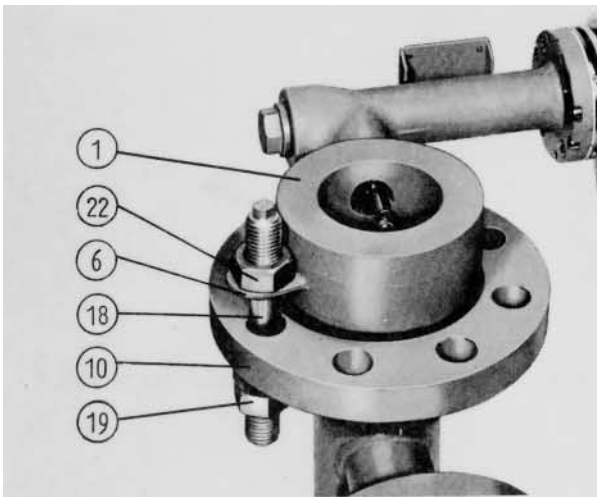
Hold the headpiece (1) above the connecting flange. Engage the

⑯ eyelet of the displacer body chain in the ⑰ transmission lever and place the headpiece (1) on the connecting flange (10).

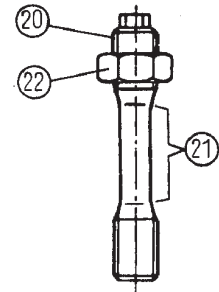
Caution:
In the case of transmitter of type BF 628 approved for Zone 0, Section 3.1 should be referred to before engaging the eyelet (16)!



* See also "Note for displacer bodies with a diameter less than 30 mm", Page 8.



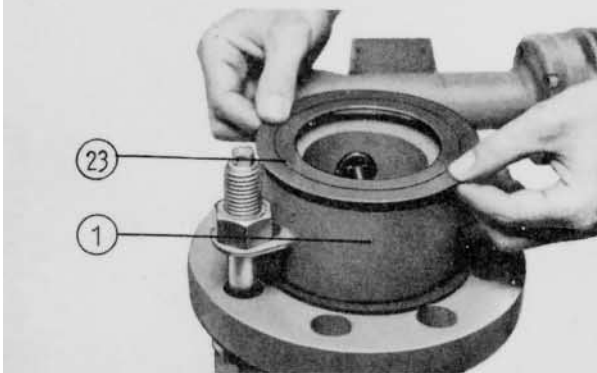
- ⑱ Screw bolt
- ⑲ Nuts
- ⑳ Thread
- ㉑ Reduced shaft of screw bolt
- ㉒ Nut



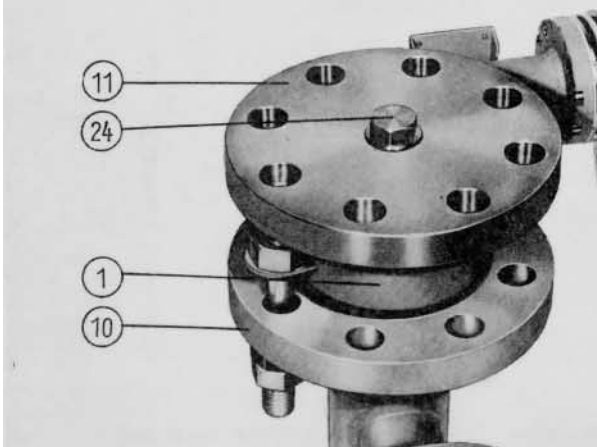
In order to make installation easier, the mounting bracket (6) of the headpiece is secured with a screw bolt (18) on the connecting flange (10).

The screw bolt should be pre assembled by screwing one nut (22) onto the thread (20) (see above sketch). Insert this screw bolt through the top of the mounting bracket (6) and the connecting flange (10).

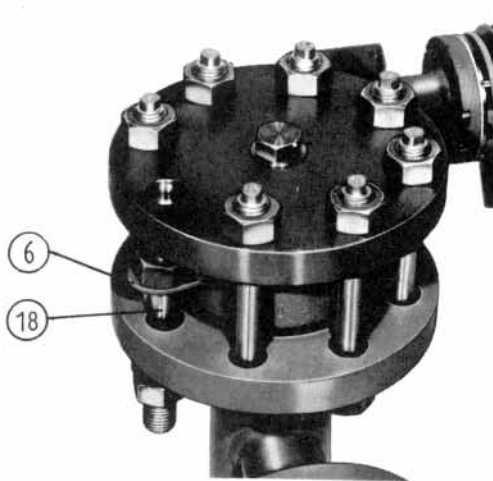
Assemble so many nuts (19) from underneath the connecting flange (10) onto the thread and the reduced shaft, until the headpiece (1) does not move.



- ㉓ Place the seal on the headpiece (1).



Place the blind flange (11) on the headpiece (1) in such a way, that the holes on the blind flange (11) and the connecting flange (10) are aligned. The blind flange (11) can be equipped with a ㉔ breather plug.

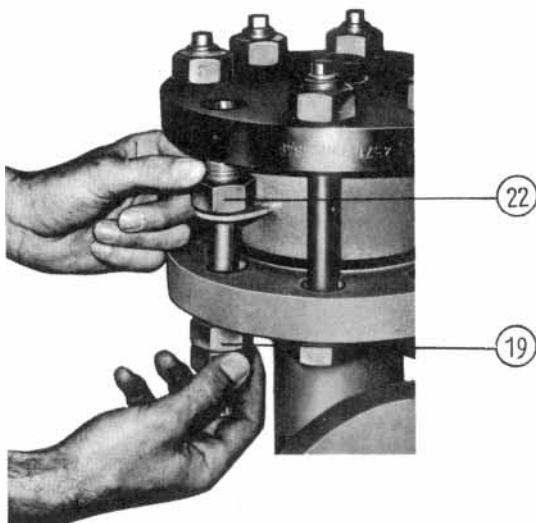


Place the screw bolt (18) in the mounting bracket (6) and insert the remaining seven screw bolts. Screw on the nuts and tighten gently.

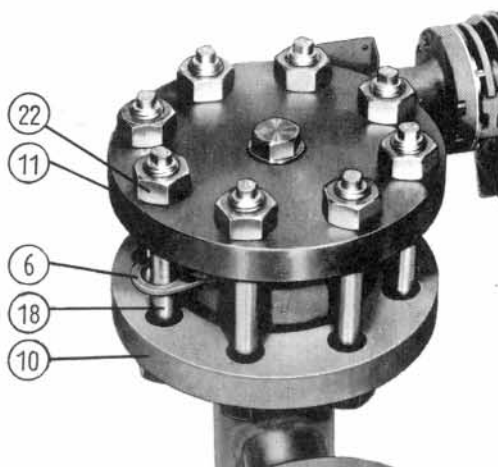
Caution!

The material from which the screw bolts and nuts are produced, is dependent on the material from which the headpiece is produced and the temperature of the measurement medium. **FOXBORO ECKARDT** will deliver (if nothing else has been ordered) on the basis of the following table:

Headpiece material	Temperature of measuring medium	Sign	
		Screw bolts	Nuts
Steel C 22.8/ W.Nr. 1.4571	- 60 to - 10°C	A2 - 70	A2 - 70
	- 10 to +400°C	GA	G
Special materials	- 10 to +400°C	GA	G
W.Nr. 1.4541	- 196 to +400°C	A2 - 70	A2 - 70



Unscrew the nut (22) and pull the screw bolt downwards. Unscrew all nuts (19), except one.



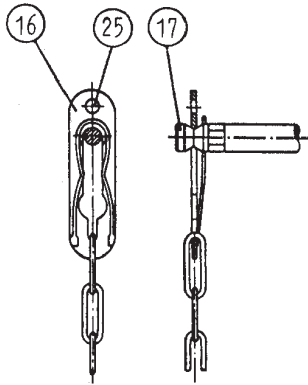
Push the screw bolt (18) upwards through the connecting flange (10), the mounting bracket (6) and the blind flange (11). Replace nut (22) and screw it down gently on the screw bolt.

Tighten the nuts of all eight screw bolts, doing this in a crosswise manner in order to prevent any tilting.

Note for displacer bodies with a diameter less than 30 mm:

Deviating from the previously described installation sequence displacer bodies with a diameter less than 30 mm, can also be installed when the headpiece is already fitted (Page 6, upper sketch).

As an aid to installation, a wire is pulled through the ②⑤ hole in the eyelet (16). With this wire, the displacer body is lowered through the headpiece, past the transmission lever, into the displacer chamber or tank. The eyelet (16) is then hooked onto the transmission lever (17). Finally remove the wire.



Caution!

When using transmitters of type BF 628 approved for Zone 0, pay particular attention to the Section 3.1 before insertion of the eyelet (16).

2.6 Pneumatic connections

The pneumatic connections, are designed as an internal thread 1/4 -18 NPT with a sintered metal filter attached to the underneath. Refer to the Sections 2.1.1 resp. 2.1.2 for the arrangement of pneumatic connections.

2.7 Air supply

The air supply must be free of water, oil and dust.
Supply-air pressure: 1.4 ± 0.1 bar.

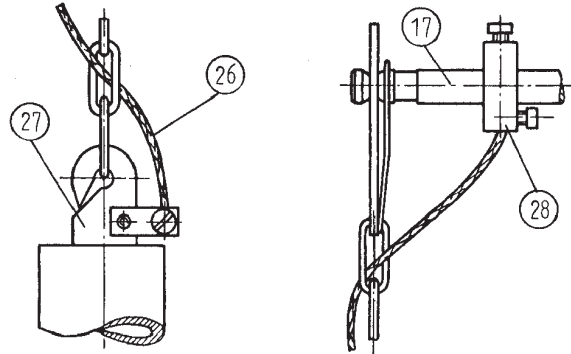
3 EXPLOSION PROTECTION (Zone 0)

Transmitters of type BF 628 with approval number 01/PTB/III B/S 1506 F, may be used in Zone 0 by tanks for flammable liquids of groups and danger categories A I, A II and B with the exception of carbon disulphide. (Type approval according to VbF, test certificate PTB-No. III B/S 1506 F).

The following points should also be noted.

3.1 Potential equalization for the displacer body

In order to avoid dangers due to electrically conducted electrostatic charges, the displacer body must be connected with the transmitter. Therefore, during installation, ②⑥ the wire cable which is connected onto the ②⑦ displacer body hooks, and pulled through the chain, can be secured to the ②⑧ clamp on the transmission lever (17).



3.2 Screwed plugs

In order to avoid danger due to loose or missing plug screws, it should be ensured that the plug screws are always firmly secured. This also applies to the plug screw of the headpiece (Page 2, Item 7) as well as, if fitted, the bleeder screw of the displacer chamber (Page 4, Item 14) and the breather plug of the cover flange (Page 6, Item 24).

3.3 Additional measuring connection

Should there be an additional measuring connection present on the displacer chamber near the normal connecting flanges, only those measuring devices can be connected onto the displacer chamber which are approved by § 5 of the ExVO (§ 8 Elex V) or by § 11 a of the VbF (§ 12 VbF) for Zone 0.

3.4 Guidance of the displacer body

Should the displacer body be longer than 3 m, it must be guided in a protective cage (Page 2, Item 5). The protective cage must be secured every 3 m with supports.

3.5 Pressure testing

The pneumatic transmitter is to be included in the pressure tests of the tank conducted by authorized personnel in accordance with § 17, Paragraph 1 of the VbF.

3.6 Corrosion

The explosion protection of the transmitter depends to a great extent on the sealing properties of the torsion tube (non-corrosive metal, wall thickness 0.5 mm and 0.8 mm). The transmitter may therefore only be used for such flammable liquids, for which the torsion tube is adequately resistant to chemicals and corrosion.

4 PUTTING INTO OPERATION AND TAKING OUT OF OPERATION

4.1 Putting into operation

It is recommended to check the correct connections and functions, as well as the possibility of leaks in the lines of all the devices in a control circuit, before actually putting into operation.

The transmitter has been set at the place of manufacture in accordance with the ordering specifications. In the case of danger Zone 0, pay particular attention to Section 3!

In the case of transmitters with a heating jacket, the heating must be started before the measuring medium reaches the transmitter.

To put into operation, switch on the air supply, and open any present stopcocks on the displacer chamber (12).

For zero point check, a testing pressure gauge is additionally connected at the exit of the transmitter (connection x).

The zero point can be

adjusted at the
 (29) zero point screw, when
 the following conditions
 are observed:

Level measuring:

The tank is empty or filled to its minimal level with the measuring medium. In the case of pressurized tanks establish normal working order.

Interface and density measuring:

The displacer body is completely immersed in the liquid with the lower density.

Should it be seen, that the density of the measuring medium does not correspond with the estimated values, the transmitter should be matched with the new conditions at the measuring test shop (see WA 6167).

4.2 Taking out of operation

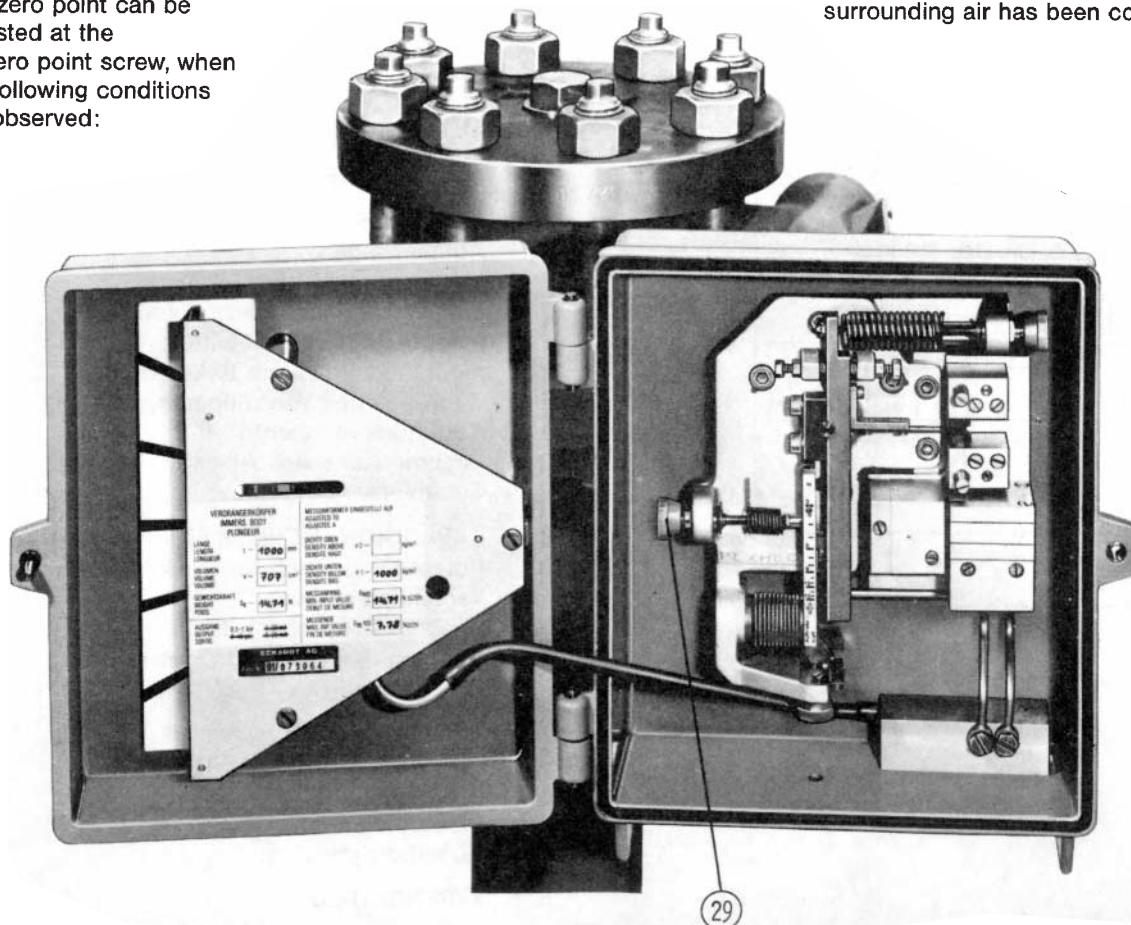
In the case of transmitters with a heating jacket, the heating must only be switched off, after the measuring medium has been drained off.

In the case of installation on the side of the tank, the stopcocks on the displacer chamber (when present), must be shut, and the measuring medium must be drained off by opening the screw plugs on the underside.

Caution!

In dealing with the measuring medium, the relevant rules are to be observed!

During short periods of non-operation, the transmitter should be continually supplied with air, especially when the surrounding air has been contaminated.



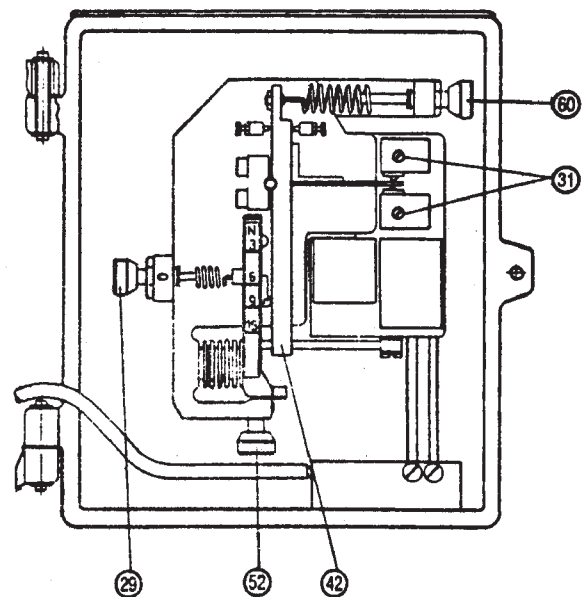
5 TESTING NEW EQUIPMENT

The setting data of the transmitter and the data of the associated displacer body is given on the yellow data label inside the transmitter.

The test should be performed in the sequence specified here.

- a) Clamp the headpiece horizontally in a vise, connect the output to a pressure test gauge for 0 to 1.6 bar and specify supply air of 1.4 ± 0.1 bar.
- b) Hook the weighing scale onto the kerf of the transmission lever (17) (see MB, Page 8), and add weights (including weighing scale) until the value corresponds to that specified on the yellow data label as the minimum input value (G_{w0}) (1 N=0.102 kp). The output pressure should be 200 mbar. Deviations greater than 8 mbar should be corrected by means of the adjusting screw (60).
- c) Remove weights from the weighing scale until the value corresponds to that specified on the yellow data label for the maximum input value (G_{w100}). The weights removed corresponds to the buoyancy ($G_{w0}-G_{w100}$). The output pressure should be 1.0 bar. Deviations greater than 8 mbar should be corrected by means of the span adjuster (52).
- d) Replace the weights previously removed. The output pressure should be 200 mbar. Deviations greater than 8 mbar should be corrected by means of the zero adjustment screw (29).
- e) Remove half of the buoyancy weights ($\frac{G_{w0} - G_{w100}}{2}$) from the weighing scale. The output pressure should be 600 ± 8 mbar.*
- f) Unscrew the screw plugs (31) from the hose connections, and connect the two hose connections together by means of a hose 4x1 mm. The output pressure should be 600 ± 200 mbar.* (= Operating point of the differential pressure amplifier)

- g) Connect the upper hose connection to the pressure test gauge, then seal the lower hose connection. The pressure test gauge should display a cascade pressure of 30 ± 10 mbar.* Press against the force beam (42) to test build-up of the cascade pressure when the flapper is applied fully to the upper nozzle. Check the lower cascade pressure in the same way as the upper cascade pressure. Compare the measured values for the build-up of cascade pressure with one another. The lower value should be at least 2/3 of the higher value, but not less than 0.2 bar.*
- h) Screw in the screw plugs (31) again.



* If the specified value cannot be obtained, the transmitter is misadjusted.

To adjust the transmitter see SA/WA 6167

Testing the installed transmitter

a) Test conditions:

For level measurements

The tank (displacer chamber) should be empty or filled to a minimum level with process medium.

Tanks under pressure should be set to their normal operating state.

For interface and density measurements

The displacer body should be fully submerged in the liquid with the lower density.

- b) Lift off the feed-back lever (50), and lock into position with the pin $\varnothing 5$; this pin should be inserted into the upper bore (94) (if necessary a hinge bolt from the equipment door may be used instead of the pin $\varnothing 5$).
- c) Set the output pressure to 0.6 bar by means of the adjusting screw (60) (the built-in large pointer should display $50\% \pm$ pointer width).
- d) unscrew the screw plugs (31) from the hose connections, and connect the hose connections together (hose 4x1 mm).
The output pressure (= operating point of the differential pressure amplifier) should be 0.6 ± 0.2 bar (built-in large pointer = 50% display ± 1 scale division). If not, this value should be set at the counterscrew on the underside of the differential pressure amplifier (46).
- e) Connect the upper hose connection to the pressure test gauge, then seal the lower hose connection. The pressure test gauge should display a cascade pressure of 30 ± 10 mbar.*
Press against the force beam (42) to check build-up of the cascade pressure when the flapper is applied fully to the upper nozzle.
Check the lower cascade pressure in the same way. Compare the measured values for build-up of cascade pressure with each other.
The lower value should always be at least $2/3$ of the higher value, but not less than 0.2 bar.*

- f) Screw on the screw plugs (31) again, and remove the locking pin from the bore (94).
- g) Connect the pressure test gauge to the output, and set an output pressure of 160 mbar with the zero adjustment screw (29). Then set an output pressure of 200 mbar by means of the adjusting screw (60).
- h) The span may also be adjusted with the aid of the setting unit (32), Type VRXG 418 738 017, as follows: Pull off the sliding weight (33) and screw the setting unit (32) flush with the lower end of the force beam (42).

Important: In order to ensure that the setting unit is correctly aligned, press the clamping piece (35) hard against the force beam (42) when tightening the hexagon socket screw (34).

Replace the sliding weight (33), and set to the scale value which corresponds to the buoyancy of the displacer body in N (see yellow data label:

$$\text{buoyancy} = G_{w0} - G_w 100).$$

Set an output pressure of 1.0 bar by means of the span adjuster (52).

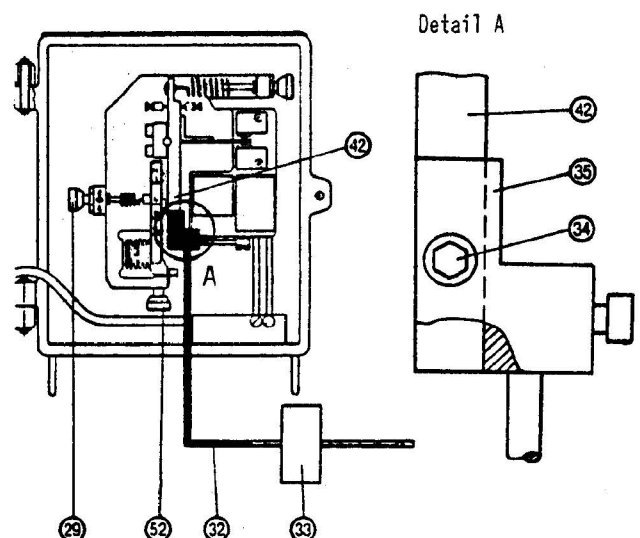
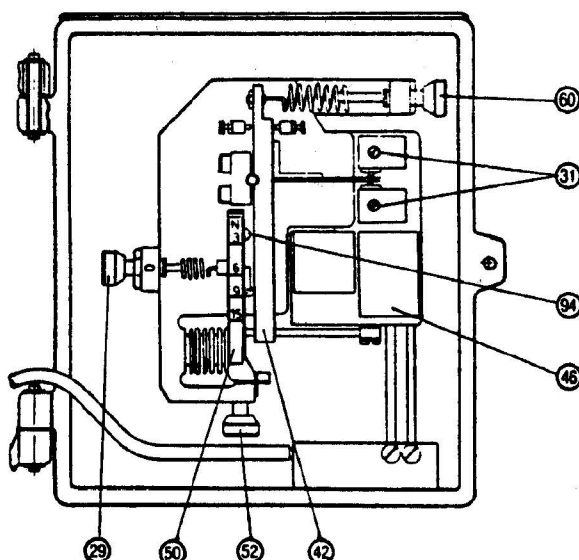
Unscrew the setting unit again.

The output pressure should be 200 mbar.

Correct any deviations by means of the zero adjustment screw (29).

* If the specified value cannot be obtained, the transmitter is misadjusted.


To adjust the transmitter see SA/w: 6167



Transmitter with connected setting unit for span,
Type SK/VRXG 81/1

6 DATA LABEL


Example:

MU FÜR FLÜSSIGKEITSSTAND LEVEL TRANSMITTER TRANSMETTEUR DE NIVEAU	
BAUART	BF 628
01/PTB/III B/S 1506	
FABR. NR. / SER. No / REF. N°	
91/073064	
BEST. NR. / TYPE / TYPE	
167LP- ...	
AUFTRIEBSKRAFT BOUYANCE FORCE FORCE ASCENSIONELLE	3 N ... 15 N
LIC 3200	
 CDS 521 110	

③① Designation and approvals symbol for explosion protection (Zone 0).

Notice Type Approval Certificate and Section 3 of this mounting and operation guide!

In the case of transmitters without explosion protection, nothing is entered in these boxes.

GEHÄUSE VON ARMATUREN BODY OF TRANSMITTER BOITIER TRANSMETTEUR																						
BAUJAHR / YEAR / ANNEE	19 83																					
INHALT / VOLUME / VOLUME	1 Liter Litre																					
FABRIK-NR. / SER. No / REF. N°	36/041064																					
WERKSTOFF / MATERIAL / MATIERE	C 22.8 / St 35.8 21 CrMo V57 (A2, A4)																					
DIN	PN 100 / Class 600 ANSI																					
ZULASSIGE ÜBERDRÜCKE IN ABHÄNGIGKEIT DER TEMPERATUR PERMISSIBLE PRESSURE - TEMPERATURE RATINGS SURPRESSION ADMISSIBLE																						
	<table border="1"> <tr> <th>-60 -10</th> <th>°C</th> <th>-10 +120</th> <th>+200</th> <th>+250</th> <th>+300</th> <th>+350</th> </tr> <tr> <td>73</td> <td>DIN</td> <td>98</td> <td>80</td> <td>70</td> <td>60</td> <td>48</td> </tr> <tr> <td>76</td> <td>bar</td> <td>ANSI</td> <td>92</td> <td>87</td> <td>83</td> <td>77</td> </tr> </table>	-60 -10	°C	-10 +120	+200	+250	+300	+350	73	DIN	98	80	70	60	48	76	bar	ANSI	92	87	83	77
-60 -10	°C	-10 +120	+200	+250	+300	+350																
73	DIN	98	80	70	60	48																
76	bar	ANSI	92	87	83	77																
UNTER -10°C NUR SCHRAUBEN AUS A2 (A4) VERWENDEN USE SCREWS MADE FROM A2 (A4) WHEN OPERATING TEMPERATURE IS UNDER -10°C UTILISER DES VIS EN A2 (A4) SI LA TEMPERATURE EST INFÉRIEURE A -10°C																						
 CDS 524 187 03																						

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