

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

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.

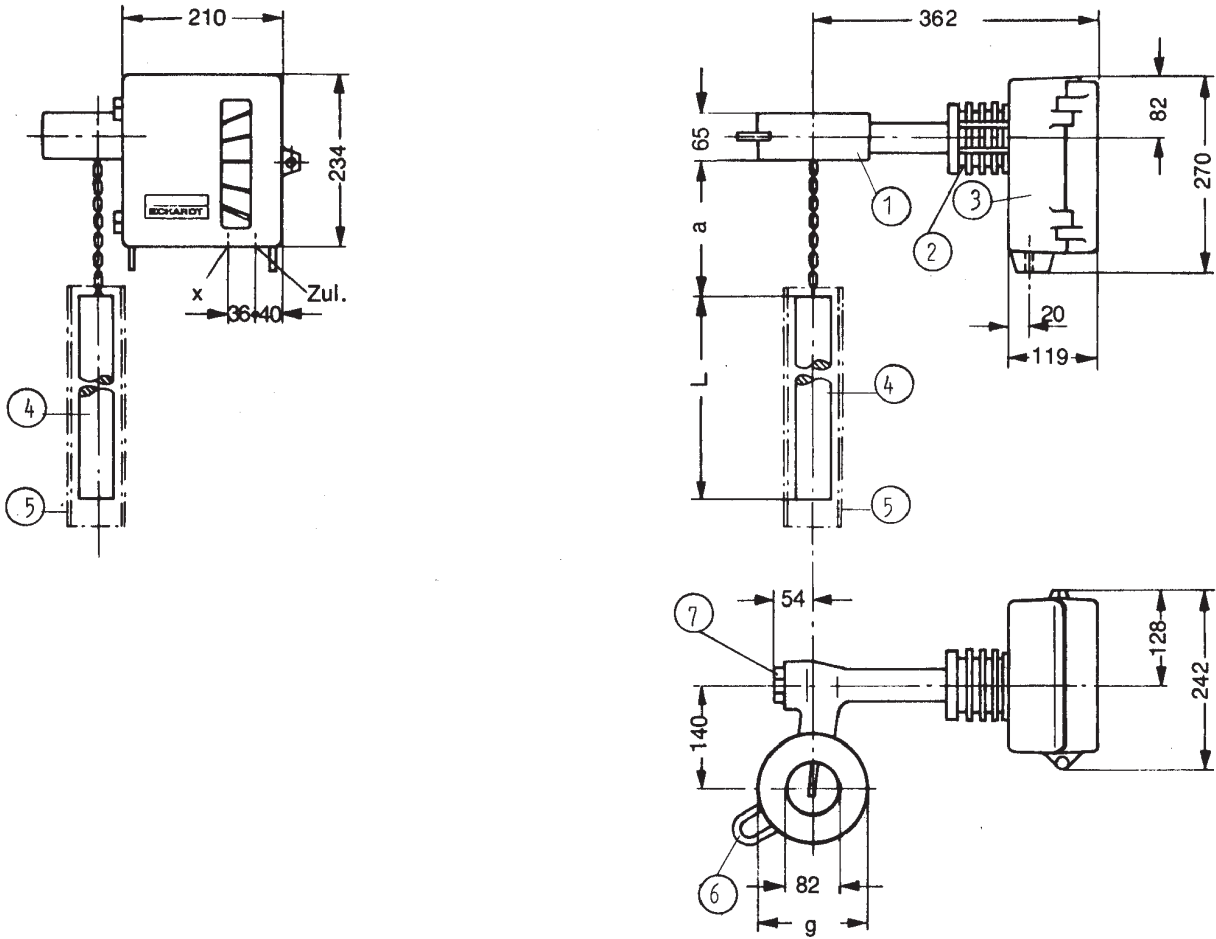


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by Schneider Electric

2.1 Dimensions

2.1.1 Transmitter without heating jacket



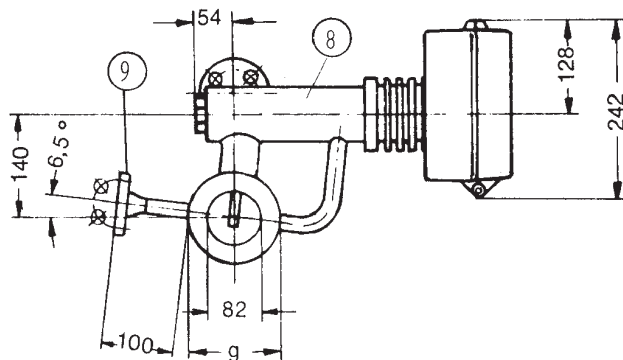
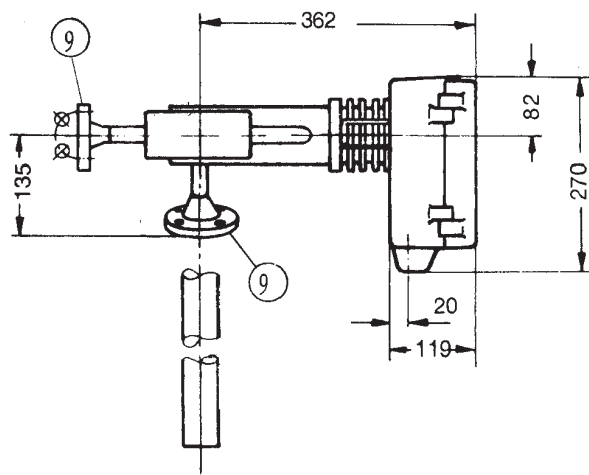
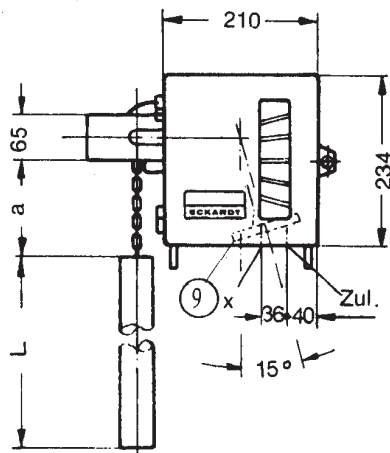
Pneumatic connections: Internal thread DIN 45141 – Q1/4-18-NPT	
x	signal output
Zul.	supply air

- 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	Length of displacer body
		64	DIN 2526	146		
		100		148		
		160	Form L	189		
		250	DIN 2696	215		
ANSI	3 in	150	Raised Face (RF)	144	138	
		300	ANSI B16.5	154		
		600		163		
		900	Ring Joint Face (RJF)	210	146	
		1500	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

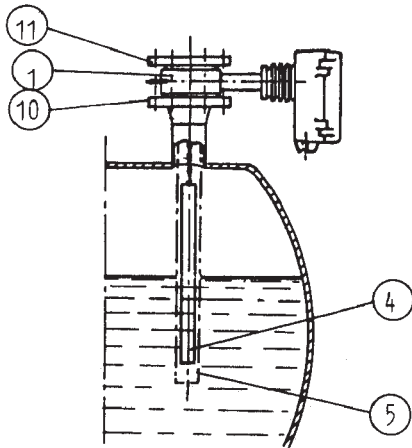
- ⑧ Heating jacket PN 25
- ⑨ Connecting flange for heating jacket DN 15, PN 25

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.

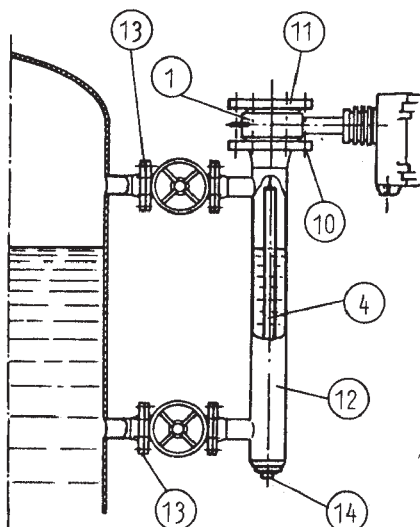


In the presence of turbulent liquid, a protection cage (5) or a pipe, which has a venting hole over the maximum liquid level, is to be installed in the tank. The distance between the protection cage or pipe and the displacer body (4) must, in the case of clean measuring mediums, be at least 5 mm all 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 - 14,71 N	MESSANFANG MIN. INPUT VALUE DEBUT DE MESURE	G _{W0} - 14,71 N ≤20N
AUSGANG OUTPUT SORTIE	0.2-1 bar 4-20 mA 0-15 psi 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

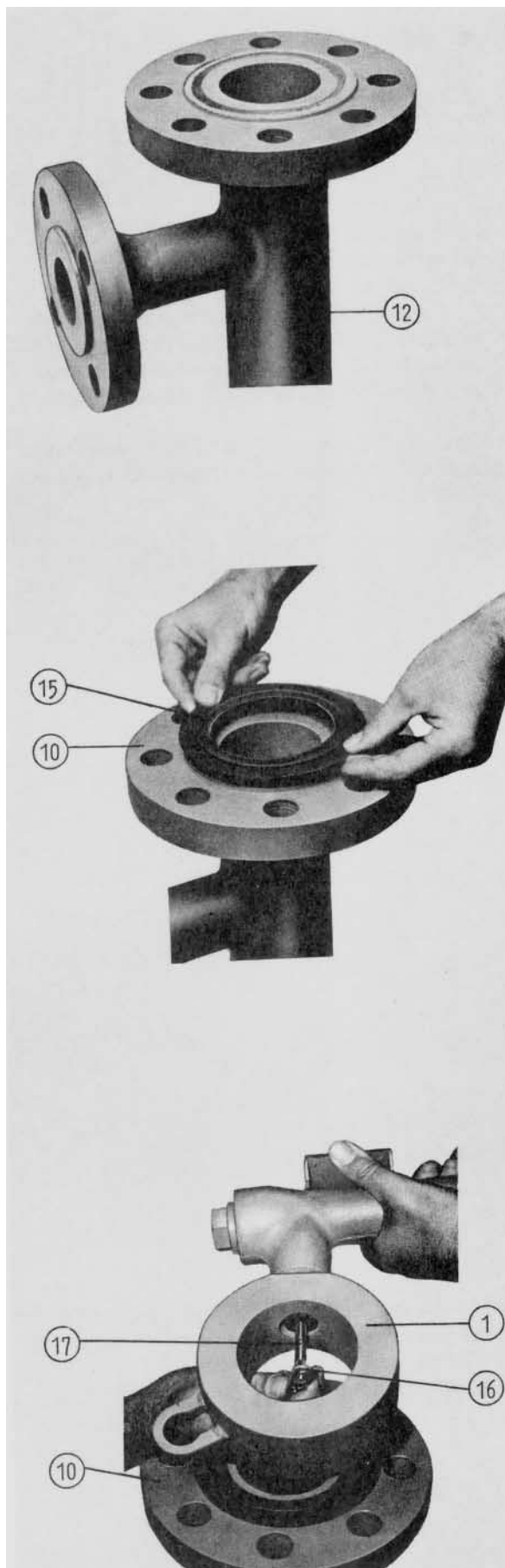
$$\text{Volume } V = \frac{L \cdot d^2 \cdot \pi}{4} \quad (L \text{ and } d \text{ in cm!})$$

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.

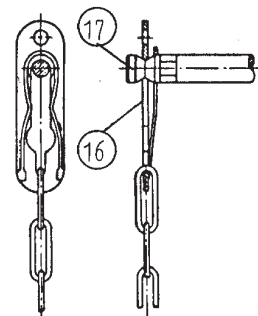
⑮ Place the seal onto the connecting flange (10).

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

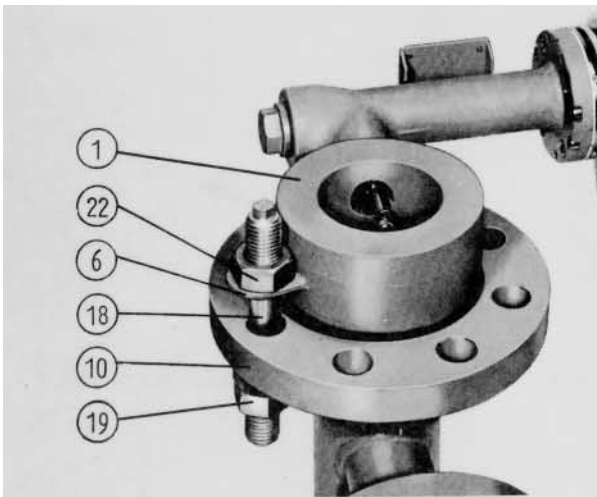
Hold the headpiece (1) above the connecting flange. Engage the

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

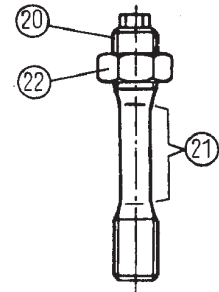
Caution:
In the case of transmitter of type BF 628 approved for Zone 0, Section 3.1 should be referred to before engaging the eyelet (16)!



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



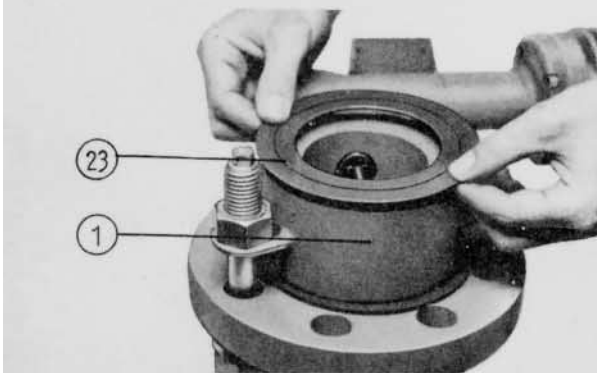
- ⑱ Screw bolt
- ⑲ Nuts
- ⑳ Thread
- ㉑ Reduced shaft of screw bolt
- ㉒ Nut



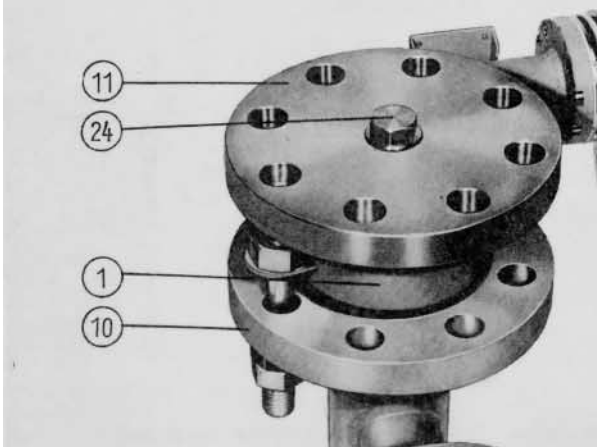
In order to make installation easier, the mounting bracket (6) of the headpiece is secured with a screw bolt (18) on the connecting flange (10).

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).

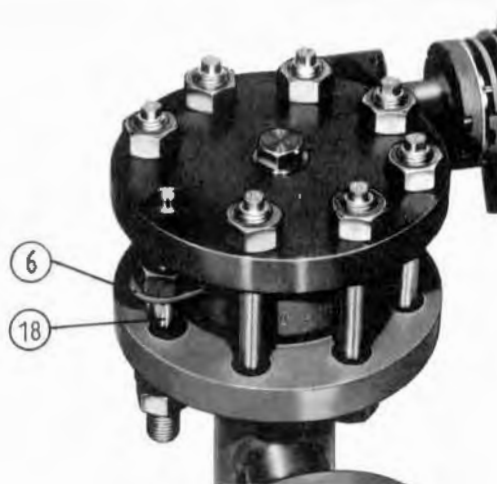
Assemble so many nuts (19) from underneath the connecting flange (10) onto the thread and the reduced shaft, until the headpiece (1) does not move.



- 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.

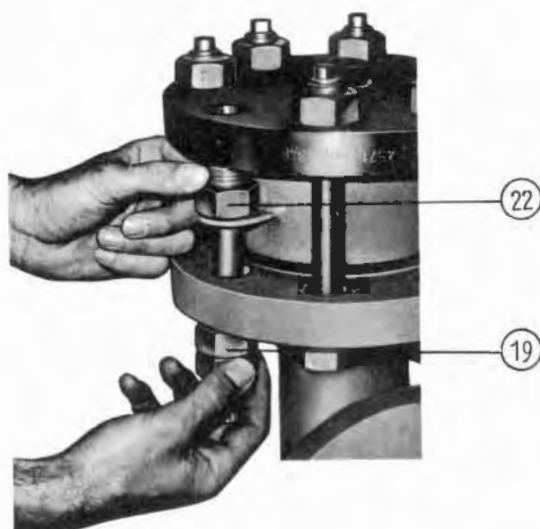


Place the screw bolt (18) in the mounting bracket (6) and insert the remaining seven screw bolts. Screw on the nuts and tighten gently.

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 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	A 2 - 70	A 2 - 70
	- 10 to +400°C	GA	G
Special materials	- 10 to +400°C	GA	G
W.Nr. 1.4541	-196 to +400°C	A 2 - 70	A 2 - 70



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



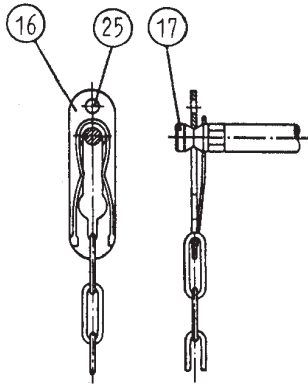
Push the screw bolt (18) upwards through the connecting flange (10), the mounting bracket (6) and the blind flange (11). Replace nut (22) and screw it down gently on the screw bolt.

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.

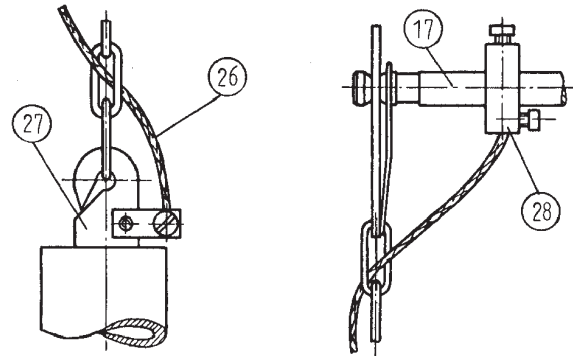
3 EXPLOSION PROTECTION (Zone 0)

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.

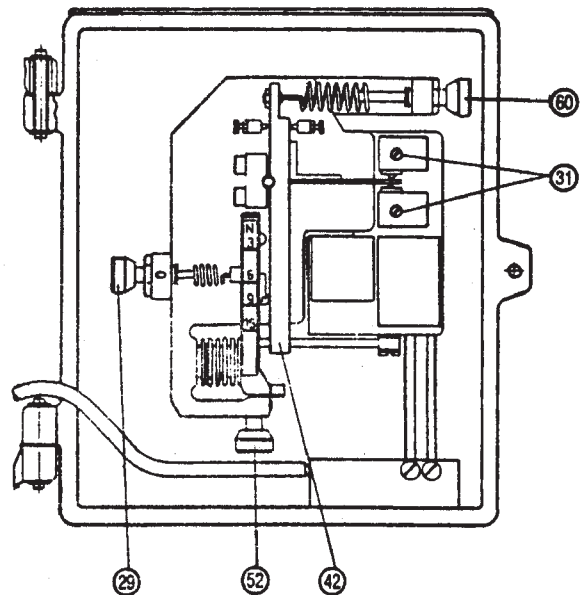
5 TESTING NEW EQUIPMENT

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 ϕ 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 ϕ 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).

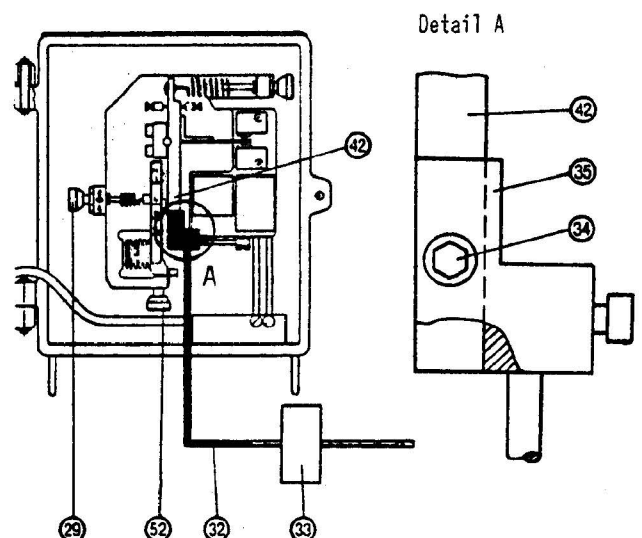
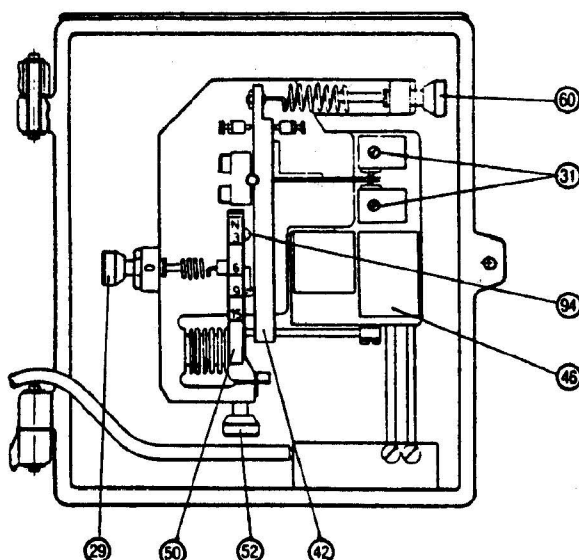
Unscrew the setting unit again.

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 3 N ... 15 N
BOUYANCE FORCE
FORCE ASCENSIONELLE

LIC 3200

FOXBORO
ECKARDT CDS 521 110

Ⓢ 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
21CrMoV57 (A2, A4)

UN PN 100 / Class 600 ANSI

ZULASSIGE ÜBERDRÜCKE IN ABHÄNGIGKEIT DER TEMPERATUR
PERMISSIBLE PRESSURE - TEMPERATURE RATINGS
SURPRESSION ADMISSIBLE

-60 -10	°C	-10 +120	+200	+250	+300	+350
73	DIN	98	80	70	60	48
76	bar	92	87	83	77	73

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

FOXBORO
ECKARDT CDS 524 187 03

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DOKT 535 755 082
FD-MI-L-002-EN

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