

# Operating Instructions

## Float level gauge LT5

Mechanical tank gauge for measuring liquid level





A0023555

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# 1 Document information

## 1.1 Document function

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

## 1.2 Symbols used

### 1.2.1 Safety symbols



This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.



This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.



This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.



This symbol contains information on procedures and other facts which do not result in personal injury.

### 1.2.2 Electrical symbols



Alternating current



Direct current and alternating current



Direct current



Ground connection

A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

#### **Protective earth (PE)**

Ground terminals that must be connected to ground prior to establishing any other connections.

The ground terminals are located on the interior and exterior of the device:

- Interior ground terminal: protective earth is connected to the mains supply.
- Exterior ground terminal: device is connected to the plant grounding system.

### 1.2.3 Tool symbols



Phillips head screwdriver



Flat blade screwdriver



Torx screwdriver



Allen key



Open-ended wrench

## 1.2.4 Symbols for certain types of information and graphics



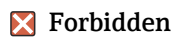
### Permitted

Procedures, processes or actions that are permitted



### Preferred

Procedures, processes or actions that are preferred



### Forbidden

Procedures, processes or actions that are forbidden



### Tip

Indicates additional information



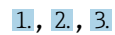
Reference to documentation



Reference to graphic



Notice or individual step to be observed



1., 2., 3.

Series of steps



Result of a step



Visual inspection



Operation via operating tool



Write-protected parameter

Write-protected parameter

1, 2, 3, ...

Item numbers

A, B, C, ...

Views



### Safety instructions

Observe the safety instructions contained in the associated Operating Instructions




### Temperature resistance of the connection cables

Specifies the minimum value of the temperature resistance of the connection cables

## 1.3 Documentation

The following documents can be found in the Download area of our website ([www.endress.com/downloads](http://www.endress.com/downloads)).

 For an overview of the scope of the associated Technical Documentation, refer to the following:  
*W@M Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): Enter the serial number from nameplate

### 1.3.1 Technical Information (TI)

#### Planning aid

The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

### 1.3.2 Brief Operating Instructions (KA)

#### Guide that takes you quickly to the 1st measured value

The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

### 1.3.3 Operating Instructions (BA)

The Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

### 1.3.4 Safety Instructions (XA)

Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions.

 The nameplate indicates the Safety Instructions (XA) that are relevant to the device.

## 2 Basic safety instructions

### 2.1 Requirements for personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- ▶ Be specialists who are trained and have a relevant qualification for this specific function and task.
- ▶ Be authorized by the plant owner-operator.
- ▶ Be familiar with local/national regulations.
- ▶ Before starting work, read and understand the instructions in the Operating Instructions and supplementary documentation as well as the certificates (depending on the application).
- ▶ Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:

- ▶ Be instructed and authorized according to the requirements of the task by the facility's owner-operator.
- ▶ Follow the instructions in this manual.

### 2.2 Designated use

#### **Application and measured materials**

Depending on the version ordered, the device can also be used with potentially explosive, flammable, poisonous or oxidizing materials.

Devices that are used in hazardous areas have corresponding labels on their nameplates.

To ensure that the device remains in proper condition for the operation time:

- ▶ Only use the device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- ▶ Check the nameplate to verify if the device can be put to its intended use in hazardous areas.
- ▶ If the device is not operated at an atmospheric temperature, compliance with the relevant basic conditions specified in the relevant device documentation is absolutely essential.
- ▶ Protect the device permanently against corrosion from environmental influences.
- ▶ Observe the limit values in the "Technical Information".

The manufacturer is not liable for damage caused by improper or non-designated use.

### 2.3 Workplace safety

For work on and with the device:

- ▶ Wear the required personal protective equipment according to local/national regulations.

## 2.4 Operational safety

Risk of injury!

- ▶ Operate the device in proper technical conditions and fail-safe conditions only.
- ▶ The plant owner-operator is responsible for interference-free operation of the device.

### Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:

- ▶ If modifications are nevertheless required, contact your Endress+Hauser Sales Center.

### Repair

To ensure continued operational safety and reliability:

- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe local/national regulations pertaining to repair of an electrical device.
- ▶ Use only original spare parts and accessories from Endress+Hauser.

### Ex-area

Observe the following notes to eliminate the risk of danger to persons or the facility when the device is used in Ex-areas (e.g. explosion protection, pressure equipment safety):

- ▶ Check the model nameplate to ensure that the ordered device is explosion proof.
- ▶ Observe the specifications in the separate supplementary documentation attached to these Instructions.

## 2.5 Product safety

This device was designed in accordance with GEP (Good Engineering Practice) to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. It meets the general safety standards and legal requirements.



### 3 Product description

#### 3.1 Intended use

Float level gauge LT5 is an important measuring instrument in the process industry. The structure does not require a power source and it is easy to install. Since it can be used for high-precision liquid level measurement and remote indication detection, it is ideal for the following operations:

- Inventory management
- Batch processing
- Process tank control
- Safe tank operation

#### 3.2 Technical data

Items		Description	
Measurement range		0 to 2.5, 5, 10, 16, 20, 30 m, 0 to 60 ft, 100 ft	
Accuracy		φ400 mm (15.75 in) float	±2 mm (0.08 in) (when the measured liquid's density is 1 g/cm <sup>3</sup> and the measurement range is 10 m (32.8 ft))
		φ140 mm (5.51 in) float	± 30 mm (1.18 in) (when the measured liquid's density is 1 g/cm <sup>3</sup> and the measurement range is 10 m (32.8 ft))
Maximum operating pressure		LT5-1	0 to 0.1961 bar/0.01961 MPa/2.84 psi
		LT5-4	0 to 0.9807 bar/0.09807 MPa/14.22 psi
		LT5-6	0 to 24.5 bar/2.45 MPa/355.25 psi
Operating temperature limits		LT5-1	Wetted parts: -200 to 200 °C (-328 to 392 °F) Gauge head: -20 to 70 °C (-4 to 158 °F)
		LT5-4/LT5-6	Wetted parts: -45 to 80 (-49 to 176) Gauge head: -20 to 70 °C (-4 to 157 °F)
Display		LT5	Two-pointer dial type or counter type (minimum readable scale: 1 mm) Only the counter type is available for 30 m and 100 ft
Gauge head connection		LT5-1 (threaded, low-pressure type)	Rp 1-1/2, w/o union nut, thread JIS B0203 Rc 1-1/2, union nut, SUS316, thread JIS B0203 NPT 1-1/2, union nut, SUS316, thread ANSI
		LT5-1 (flange, low-pressure type) Flange spec./material	10K 40A RF, aluminum (AC4A), flange JIS B2220 10K 40A RF, SUS316, flange JIS B2220 NPS 1-1/2" Cl.150 RF, aluminum (AC4A) flange ASME B16.5 NPS 1-1/2" Cl.150 RF, SUS316 flange ASME B16.5 40A 150 lbs RF, aluminum (AC4A), flange JPI 7S-15 40A 150 lbs RF, SUS316, flange JPI 7S-15
		LT5-4 (flange, medium-pressure type) Flange spec. / gauge material	10K 40A RF, aluminum (AC4CT6), flange JIS B2220 NPS 1-1/2" Cl.150 RF, aluminum (AC4CT6) flange ASME B16.5 40A 150 lbs RF, aluminum (AC4CT6), flange JPI 7S-15
		LT5-6 (flange, high-pressure type) Flange spec. / gauge material / bolt material	10K 40A RF, iron, flange JIS B2220 NPS 1-1/2" Cl.150 RF, iron flange ASME B16.5 40A 150 lbs RF, iron, flange JPI 7S-15 20K 40A RF, iron, flange JIS B2220 NPS 1-1/2" Cl.300 RF, iron flange ASME B16.5 40A 300 lbs RF, iron, flange JPI 7S-15
Float φ400	Low-pressure type	Weight: 4.2 kg	ρ: Liquid density (g/cm <sup>3</sup> ): 0.5 ≤ ρ < 0.65

Items		Description	
	Low-pressure type	Weight: 5.0 kg	$\rho$ : Liquid density (g/cm <sup>3</sup> ): $0.65 \leq \rho < 1.05$
	Low-pressure type	Weight: 8.0 kg	$\rho$ : Liquid density (g/cm <sup>3</sup> ): $1.05 \leq \rho < 2.0$
	High-pressure type	Weight: 8.3 kg	$\rho$ : Liquid density (g/cm <sup>3</sup> ): $0.5 \leq \rho < 0.7$
Float $\phi$ 140	Low-pressure type	Weight: 2.1 kg	$\rho$ : Liquid density (g/cm <sup>3</sup> ): $0.5 \leq \rho < 0.94$
	Low-pressure type	Weight: 2.4 kg	$\rho$ : Liquid density (g/cm <sup>3</sup> ): $0.94 \leq \rho < 2.0$
Display coupling (coupling between the internal parts of the gauge head and the display)		LT5-1 (threaded, low-pressure type)	Coupling: Penetration shaft
		LT5-4 (flange, medium-pressure type)	Coupling: Pressure bulkhead magnet coupling
		LT5-6 (flange, high-pressure type)	Coupling: Pressure bulkhead magnet coupling
Total weight	LT5-1	Threaded/flange, low-pressure type	Approx. 8 kg
	LT5-4	Flange, medium-pressure type	Approx. 22 kg
	LT5-6	Flange, high-pressure type	Approx. 100 kg
Painting color		Gauge head	E+H Blue
		Other parts	Silver

 For the low-pressure type, select SUS316 or PVC as the material.

### 3.3 List of material standards

#### Aluminum

Code	Description
ADC12	Aluminum alloy die casting (SI-Si-Cu)
AC4CT6	Aluminum alloy casting (Si7Mg)
AC4A	Aluminum alloy casting (Si10Mg)

#### Stainless steel

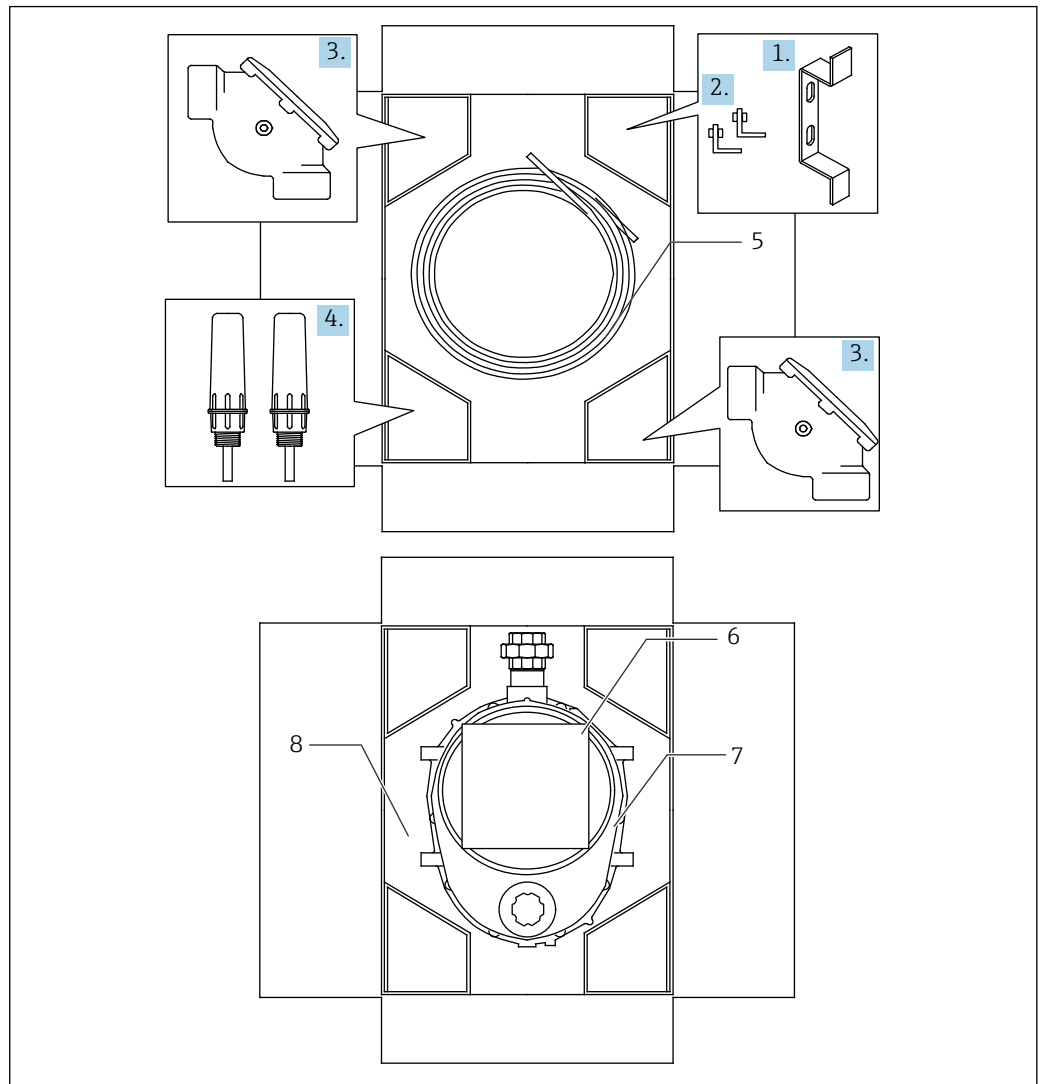
Code	Description
SUS304	Stainless steel (18Cr-8Ni)
SUS316	Stainless steel (18Cr-12Ni-2.5Mo)
SCS13	Stainless cast steel equivalent to SUS304
SCS14	Stainless cast steel equivalent to SUS316

#### Other

Code	Description
SGP (white pipe)	Carbon steel pipe
PVC	Polyvinyl chloride

### 3.4 Delivery examples

The packing method will differ based on the order code, etc. For the flange type, sheave elbows will be packed in a separate box.



A0039945

☑ 1 Packing


- 1 Gauge supporter
- 2 Anchor hook
- 3 Sheave elbow
- 4 Top anchor
- 5 Guide wire
- 6 Measuring tape
- 7 Gauge head
- 8 Float (below the gauge head)

## 4 Incoming acceptance and product identification

### 4.1 Incoming acceptance

Upon receipt of the goods, check the following:

- Are the order codes on the delivery note and the product label identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): Are the Safety Instructions (XA) enclosed?

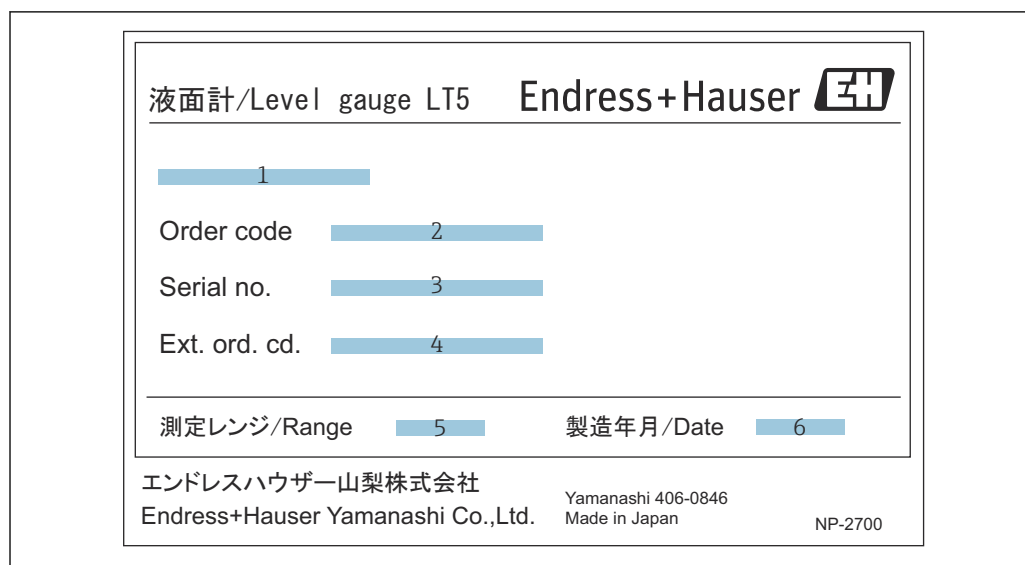
 If one of these conditions is not satisfied, contact your Endress+Hauser Sales Center.

### 4.2 Product identification

The following options are available for identification of the device:

- Nameplate specifications
- Extended order code with breakdown of the device features on the delivery note
- *W@M Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): Enter the serial number from the nameplate; this will display all the information about the device.

#### 4.2.1 Nameplate



 2 LT5 nameplate

- 1 Serial code (option)
- 2 Order code
- 3 Serial number
- 4 Extended code
- 5 Measurement range
- 6 Manufacturing date (year/month)

### 4.3 Manufacturer contact address

Endress+Hauser Yamanashi Co., Ltd.  
406-0846  
862-1 Mitsukunugi, Sakaigawa-cho, Fuefuki-shi, Yamanashi

## 4.4 Storage and transport

### 4.4.1 Storage conditions

- Storage temperature: -20 to +70 °C (-4 to 158 °F)
- Store the device in its original packaging.

### 4.4.2 Transport

#### **NOTICE**

**The housing may become damaged or dislodged.**

Risk of injury

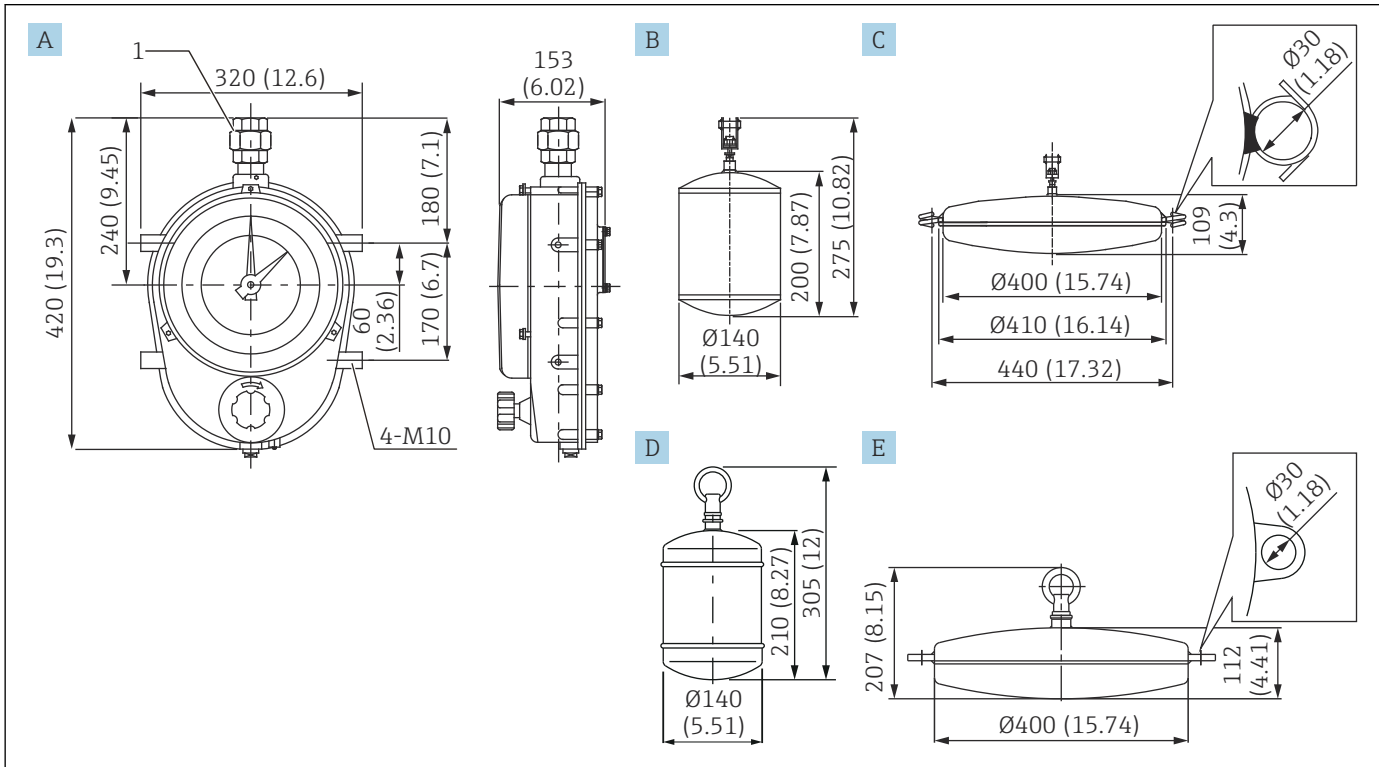
- ▶ When transporting the device to the measuring point, either use the device's original packaging or hold by the process connector.
- ▶ Secure a hoisting device (such as a hoisting ring or a lifting eye bolt) to the process connector, not to the housing. Pay attention to the device's center of gravity to prevent unexpected tilting.
- ▶ Comply with the safety precautions and transportation conditions for devices that weigh 18 kg (39.6 lbs) or more (IEC61010).

## 5 Installation

### 5.1 Dimensions of LT5

Dimensions of common components are used for the installation conditions. Contact your Endress+Hauser Sales Center if you are using different components.

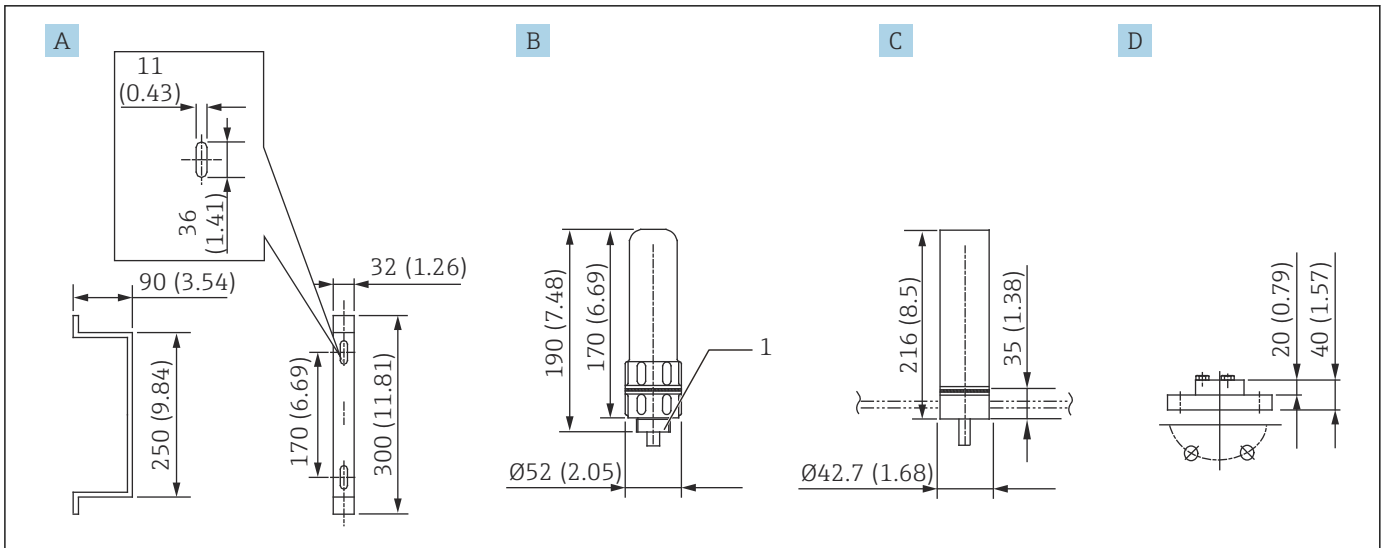
#### 5.1.1 Dimensions of LT5-1 (threaded, low-pressure type)



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3 LT5-1 / float dimensions. Unit of measurement mm (in)

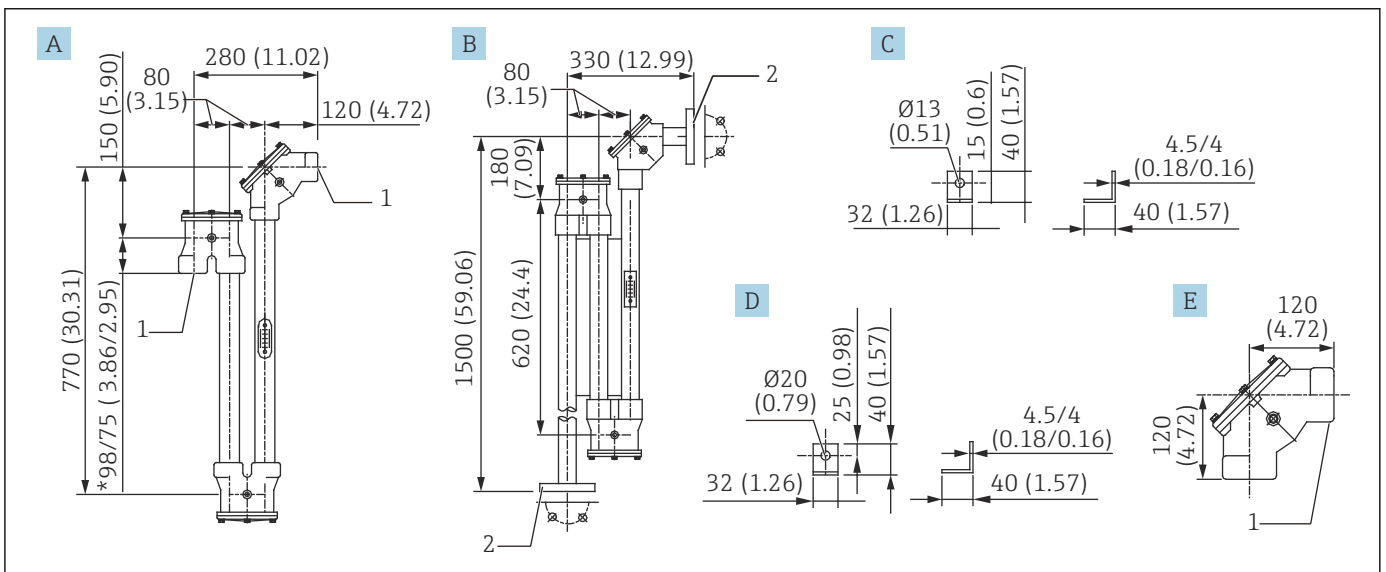
- A Gauge head (ADC12)
- B Float  $\phi$ 140 (SUS316)
- C Float  $\phi$ 400 (SUS316)
- D Float  $\phi$ 140 (PVC)
- E Float  $\phi$ 400 (PVC)
- 1 Union nut (select from JIS Rc 1-1/2 /ANSI NPT 1-1/2; if there is no union nut, select Rp 1-1/2)



A0041188

4 Accessory 1. Unit of measurement mm (in)

- A Gauge supporter (select from iron / SUS304)
- B Top anchor (ADC6)
- C Top anchor (SUS316 / socket welding type)
- D Top anchor (PVC) (only flange type is available for PVC.)
- 1 Select from JIS R1 / ANSI NPT1



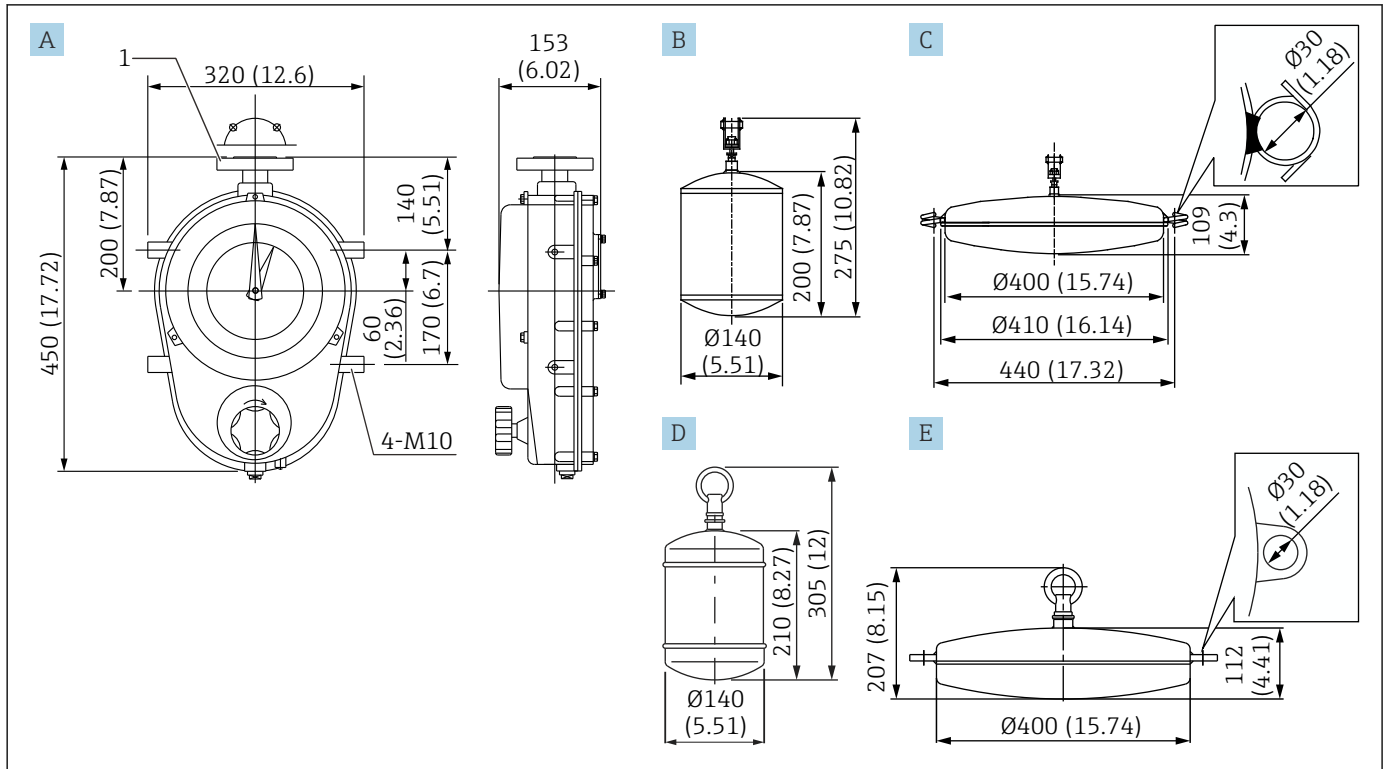
A0041189

5 Accessory 2. Unit of measurement mm (in)

- A Seal pot (select from aluminum / SUS316)
- B Seal pot (PVC) (only flange type is available for PVC)
- C Anchor hook (select from iron / SUS316)
- D Anchor hook (PVC bolt)
- E 90° sheave elbow (select from ADC6 / SCS14)
- 1 Threaded (select from Rp1-1/2 / NPT1-1/2 as an option)
- 2 Flange (select from JIS 10K 40A FF / ASME NPS1-1/2" Cl.150 FF / JPI 40A 150 lbs FF)

**i** The 75 mm in seal pot 98/75 indicates the dimension for SUS316.

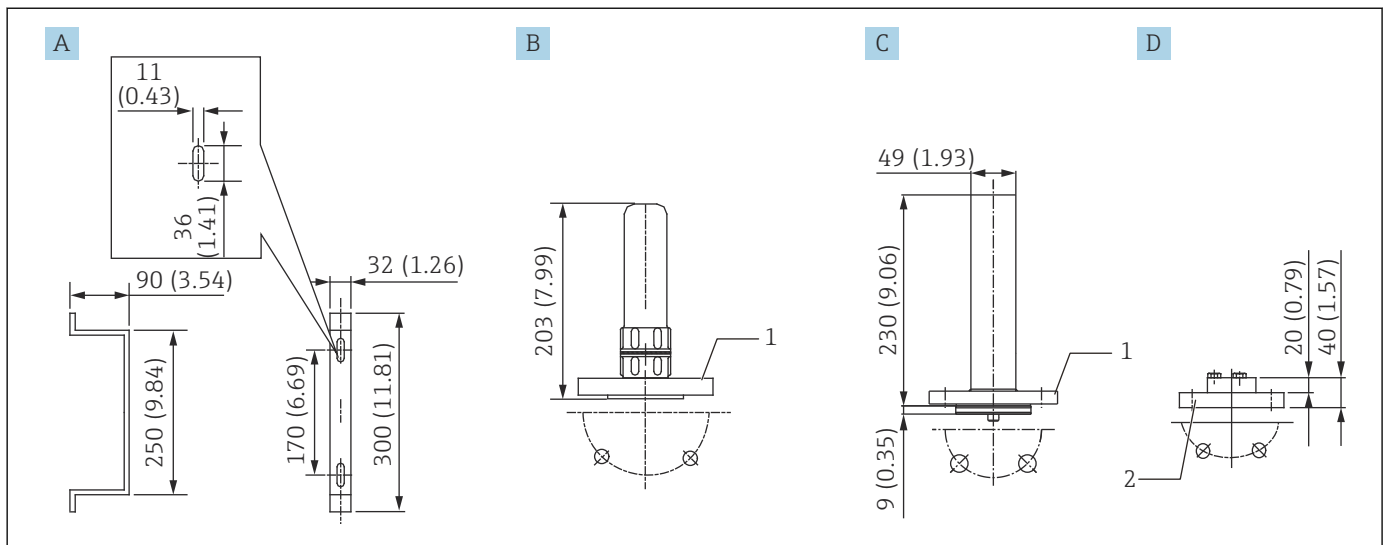
### 5.1.2 Dimensions of LT5-1 (flange, low-pressure type)



A0041187

6 Dimensions of LT5-1. Unit of measurement mm (in)

- A Gauge head (ADC12)
- B Float  $\phi$ 140 (SUS316)
- C Float  $\phi$ 400 (SUS316)
- D Float  $\phi$ 140 (PVC)
- E Float  $\phi$ 400 (PVC)
- 1 Flange (select from JIS 10K 40A RF / ASME NPS1-1/2" Cl.150 RF / JPI 40A 150 lbs RF)

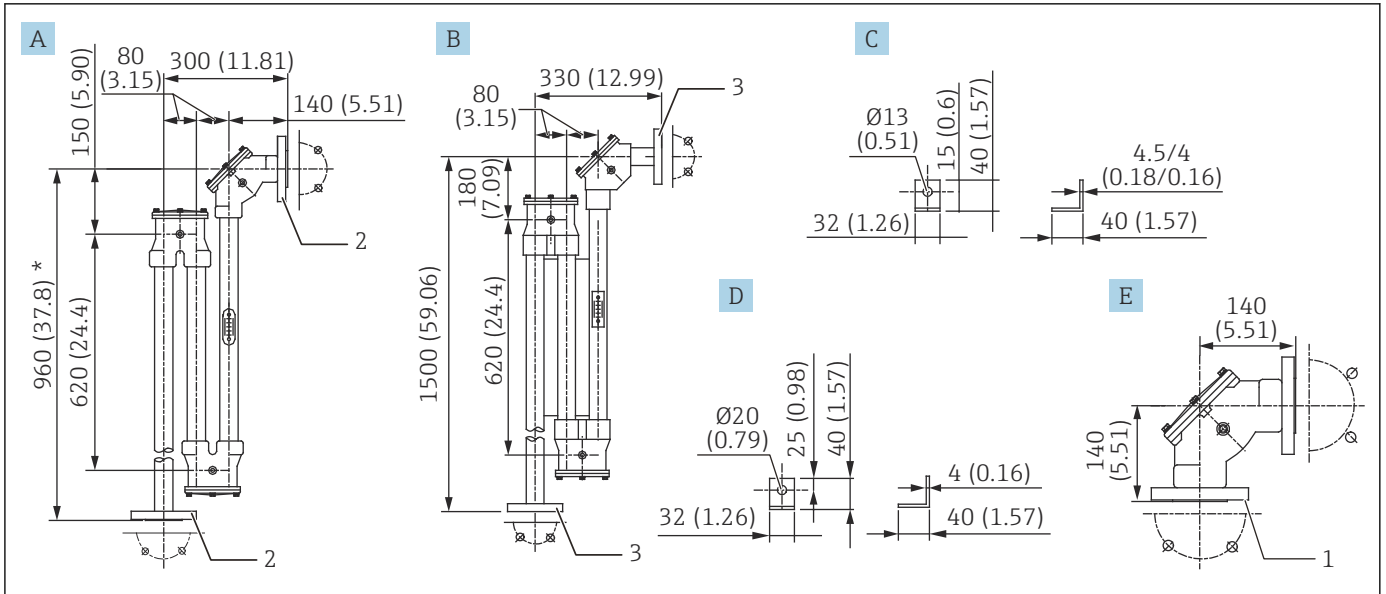


A0041191

7 Accessory 1. Unit of measurement mm (in)

- A Gauge supporter (select from iron / SUS304)
- B Top anchor (ADC6+AC4A)
- C Top anchor (SUS316)
- D Top anchor (PVC)
- 1 Flange (select from JIS 10K 40A RF / ASME NPS 1-1/2" Cl.150 RF / JPI 40A 150 lbs RF)
- 2 Flange (select from JIS 10K 40A FF / ASME NPS 1-1/2" Cl.150 FF / JPI 40A 150 lbs FF)





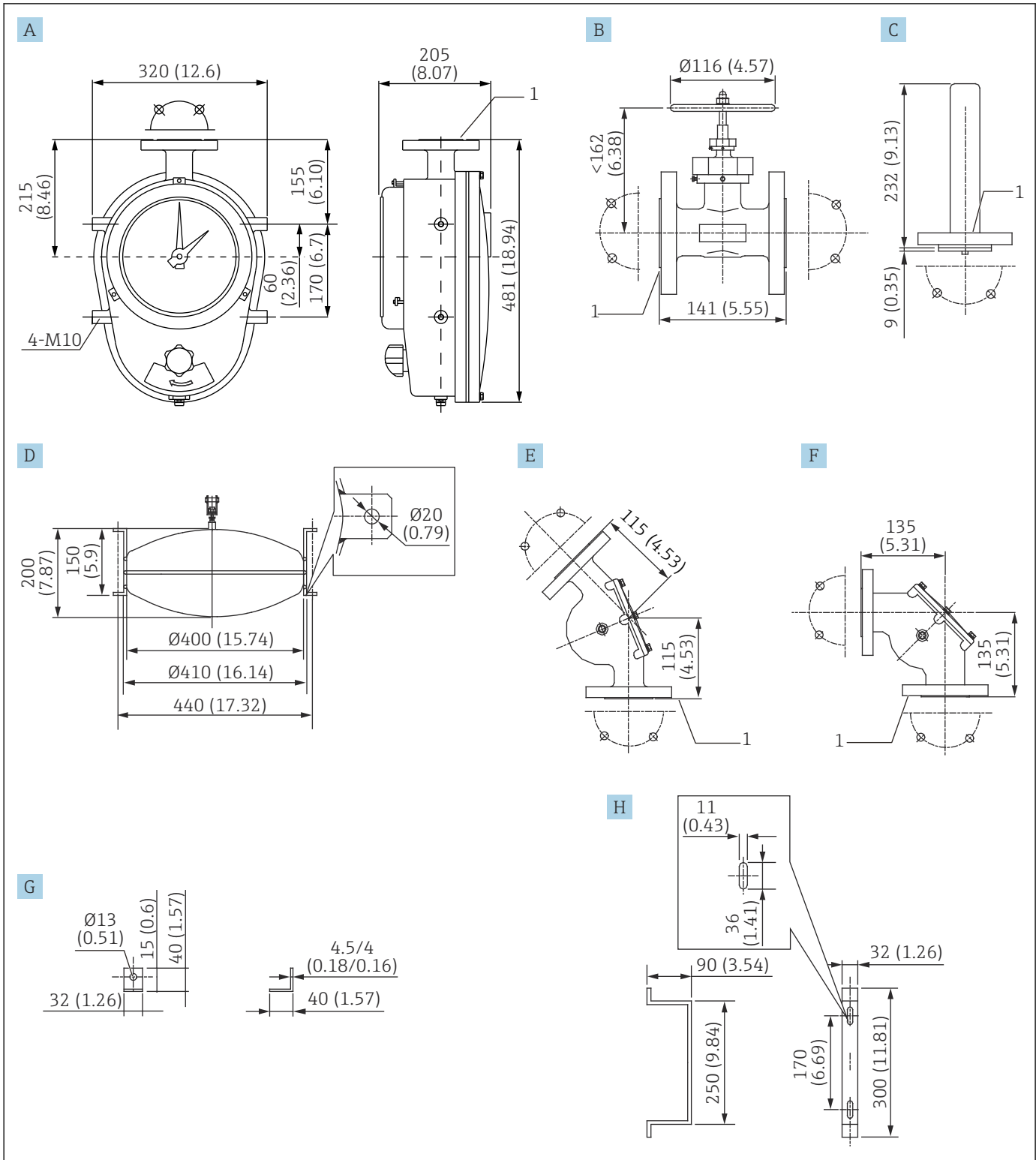
A0041192

**8** Accessory 2. Unit of measurement mm (in)

- A Seal pot (select from aluminum+iron / SUS316; see notes below)
- B Seal pot (PVC)
- C Anchor hook (select from iron / SUS316)
- D Anchor hook (PVC bolt)
- E 90° sheave elbow (select from ADC6+AC4A / 5CS14+SUS316)
- 1 Flange (select from JIS 10K 40A RF / ASME NPS 1-1/2" RF / JPI 40A 150 lbs RF)
- 2 Flange (select from JIS 10K 40A RF / ASME NPS 1-1/2" Cl.150 RF / JPI 40A 150 lbs RF)
- 3 Flange (select from JIS 10K 40A FF / ASME NPS 1-1/2" Cl.150 FF / JPI 40A 150 lbs FF)

- i** ■ Tape only: 960 mm (37.8 in)
- Tape + wire: 1 500 mm (59.06 in)

### 5.1.3 Dimensions of LT5-4 (flange, medium-pressure type)



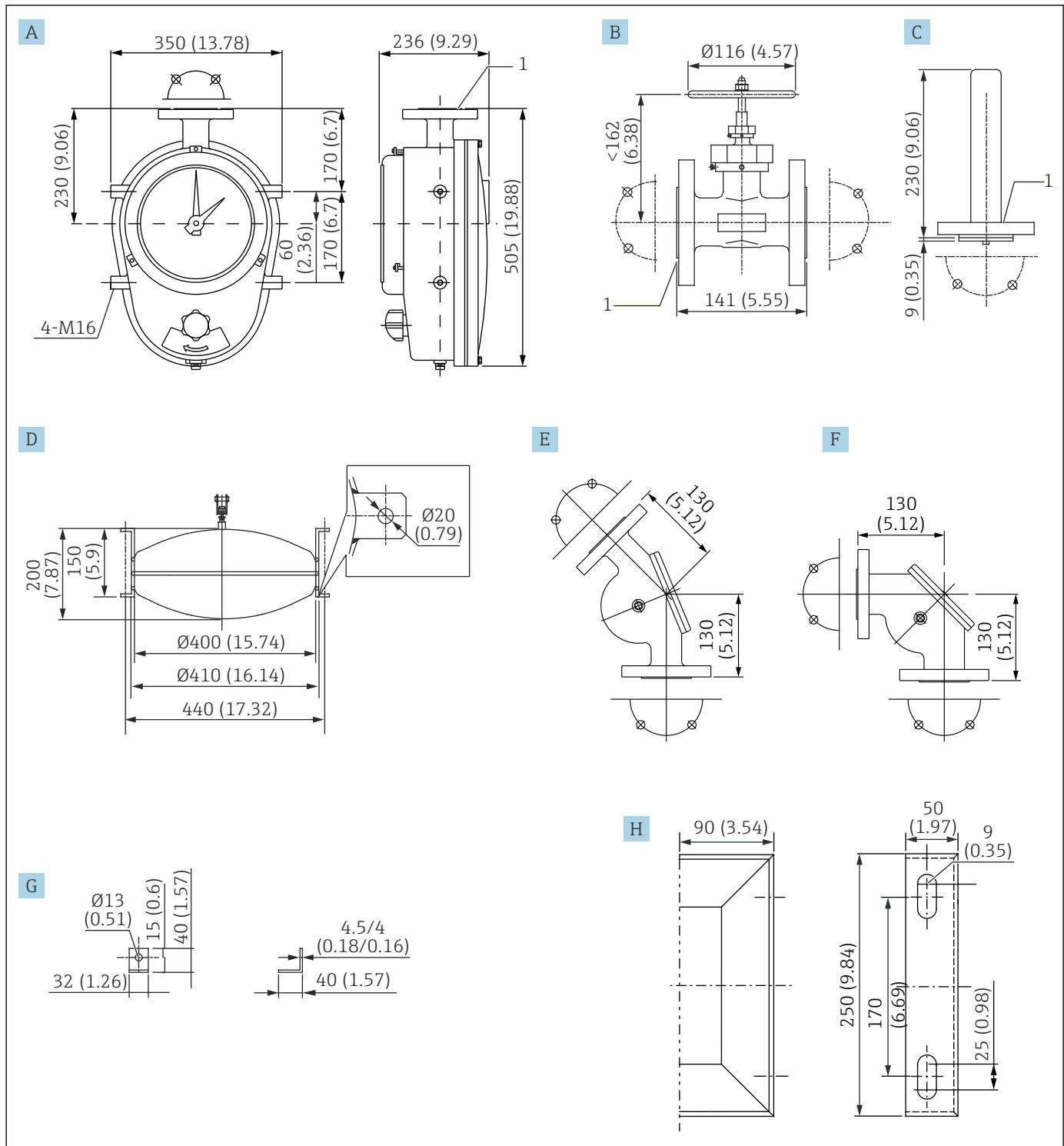
A0041193

9 Dimensions of LT5-4. Unit of measurement mm (in)

- A Gauge head (AC4CT6)
- B Gate valve (SCS13)
- C Top anchor (AC4CT6)
- D Float  $\phi$ 400 (SUS316)
- E 135° sheave elbow (AC4CT6)
- F 90° sheave elbow (AC4CT6)

- G* Anchor hook (select from iron / SUS316)
- H* Gauge supporter (select from iron / SUS304)
- 1* Flange (select from JIS 10K 40A RF / ASME NPS 1-1/2" Cl.150 RF/ JPI 40A 150 lbs RF)

### 5.1.4 Dimensions of LT5-6 (flange, high-pressure type)



A0041194

10 Dimensions of LT5-6. Unit of measurement mm (in)

- A Gauge head (iron)
- B Gate valve (SCS13)
- C Top anchor (select from iron / SUS316)
- D Float φ400 (SUS316)
- E 135° sheave elbow (iron)
- F 90° sheave elbow (iron)
- G Anchor hook (select from iron / SUS316)
- H Gauge supporter (select from iron / SUS304)
- 1 Flange (select from JIS 10K/20K 40A RF / ASME NPS 1-1/2" Cl.150/300 RF / JPI 40A 150/300 lbs. RF)

## 5.2 Installation preparation

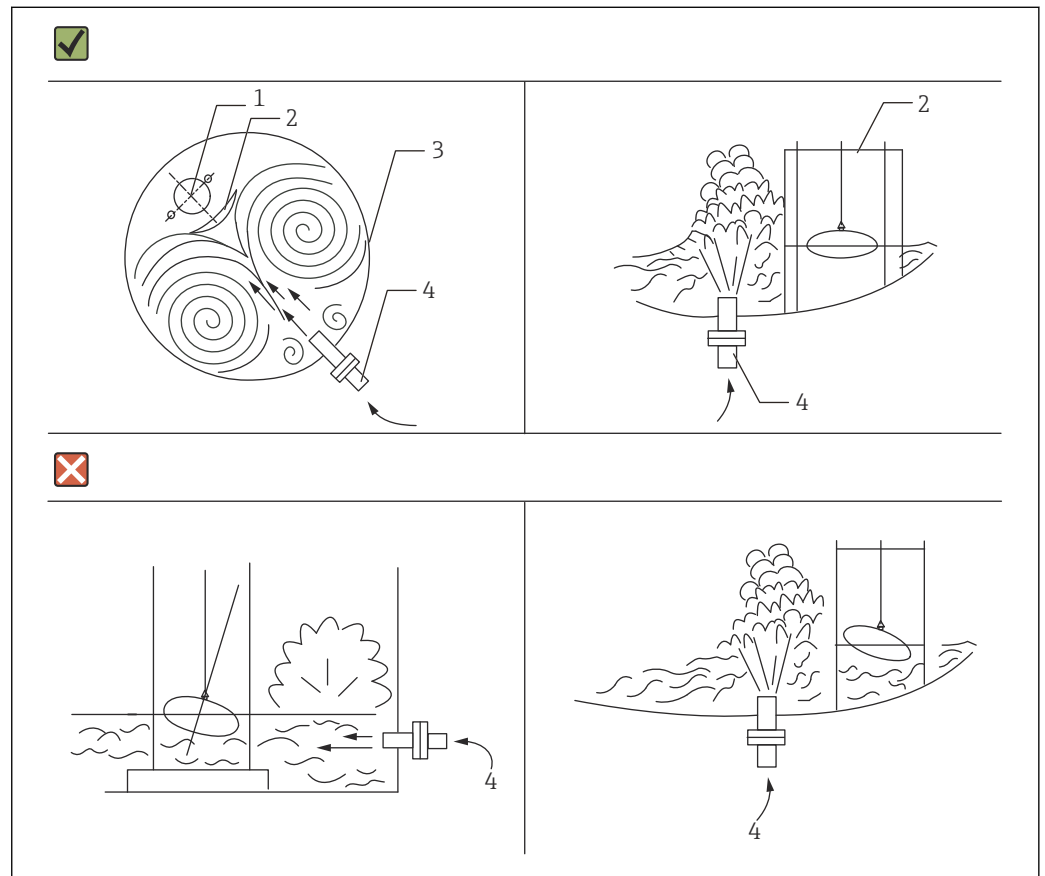
When installing LT, exercise the following precautions:

- Select the gauge head installation site based on where it is the easiest to read the meter.
- The float must be installed so that it is positioned near the tank sidewall.
- In a spherical tank, the float must be installed so that it is positioned near the center of the tank.
- If the roof of a dome-roof tank has a steep incline, the float must be installed so that it is positioned near the center of the tank.
- Use an appropriate gasket on the flange connection to maintain airtightness.

**⚠ CAUTION**

**Risk of tape severing**

- ▶ The float should be installed as far from the tank inlet or stirrer as possible so that waves do not impact the float directly. If there is no other choice but to install the float where there are waves and liquid flow, install a wave guard to protect the float. Rapid injection of liquid near the float may cause the tape to sever.



11 Installation conditions

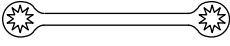
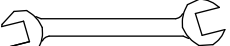

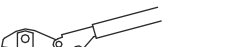
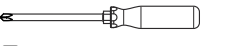



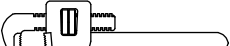
- 1 Center of the float
- 2 Wave guard installation
- 3 Tank
- 4 Liquid inlet


A0039946

### 5.3 Tools

Have the following tools ready to install LT5.

*Required tools*

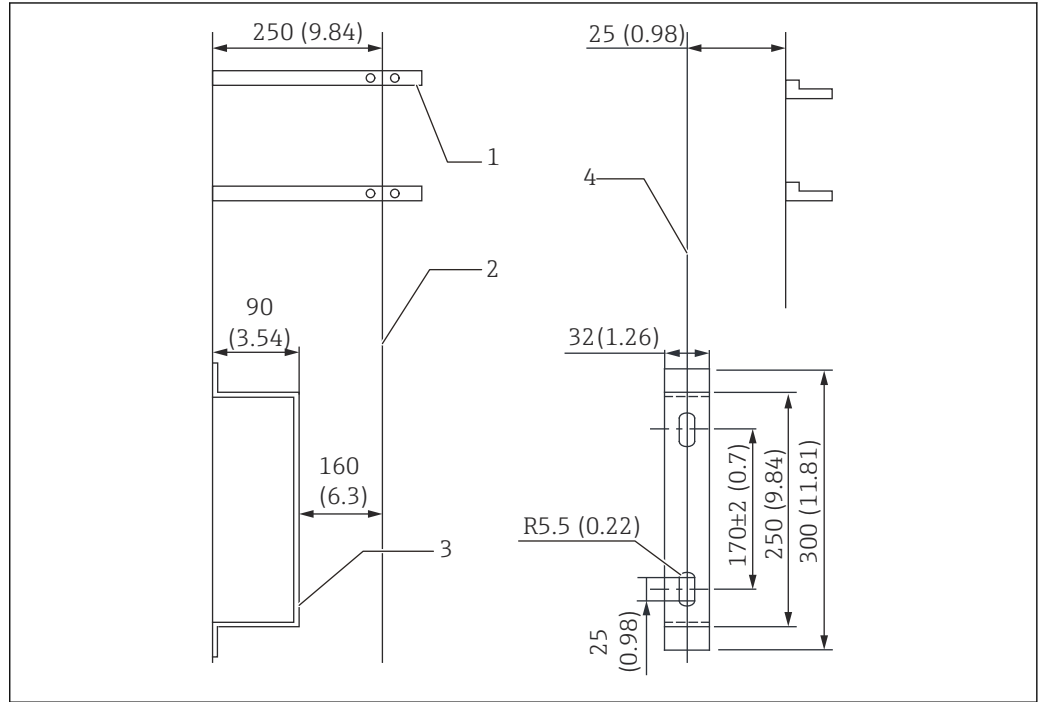
Tools	Intended use	LT5-1 (threaded)	LT5-1 (flange)	LT5-4	LT5-6
 <p>12 Box-end wrench</p>	13 mm: Sheave elbow cover	●	●	●	-
	24 mm: Sheave elbow cover	-	-	-	●
	17 mm: Gauge head for a device supporter	○	○	○	-
	24 mm: Gauge head for a device supporter	-	-	-	●
	24 mm: JIS flange (M16 x 2)	-	⊙	⊙	⊙
	21 mm: 150 lbs flange (1/2" x 2)	-	-	-	-
	32 mm: 300 lbs flange (3/4" x 2)	-	-	-	-
 <p>13 Open-end wrench</p>	19 mm: Securing guide wires and compressing tension springs	●	●	●	●
 <p>14 Water pump pliers</p>	25 mm or more: Threaded top anchor	●	-	-	-
 <p>15 Wire rope cutter</p>	Trimming excess guide wire to the appropriate length	●	●	●	●
 <p>16 Phillips screwdriver</p>	Tape clamps and for calibrating a counter display	○	○	-	○
 <p>17 Nut driver</p>	5.5 mm: Tape clamps and for calibrating a dial display 8 mm: Display cover	○	○	○	○
 <p>18 Pliers</p>	Threads used to install a tape clamp	○	○	○	○
 <p>19 Sheet metal scissors</p>	Trimming excess measuring tape to the appropriate length	○	○	○	○
 <p>20 Pipe wrench</p>	600 mm or more: Guide pipe for a threaded gauge head	○	-	-	-

-  ●: Use on tank roof
- : Use at ground level
- ⊙: Use on tank roof and at ground level
- : Do not use

### 5.4 Welding a gauge supporter

See the following diagram for reference when welding a gauge supporter. Note that pipe supporters are not supplied.

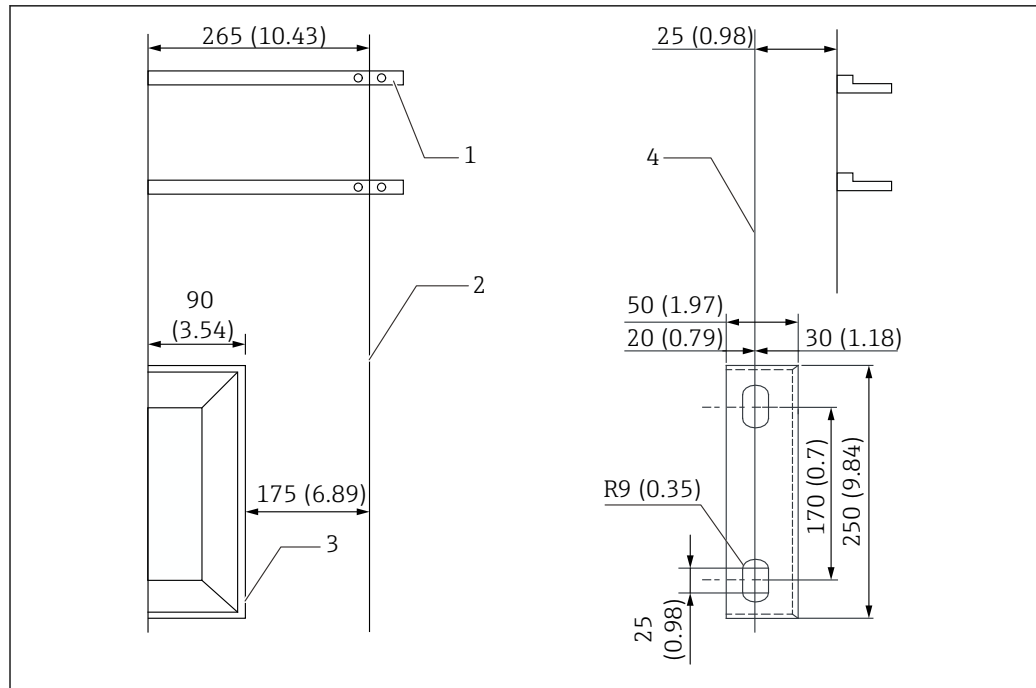
**i** In LT5-6 (high-pressure gauge head), the distance between the tank's external wall and the center of the gauge head is 15 mm (0.59 in) longer compared to that of LT5-1 (low-pressure gauge head) / LT5-4 (medium-pressure gauge head).



A0041179

**21** Gauge supporter (low/medium pressure). Unit of measurement mm (in)

- 1 Pipe supporter (not supplied)
- 2 Center line of the mounting position
- 3 Gauge supporter (based on the selected option SS400: t = 4.5 / SUS304: t = 4.0), mounting bolt
- 4 Center line of the gauge supporter



22 Gauge supporter (high pressure). Unit of measurement mm (in)

- 1 Pipe supporter (not supplied)
- 2 Center line of the mounting position
- 3 Gauge supporter (based on the selected option SS400:  $t = 4.0$  / SUS304:  $t = 4.0$ ), mounting bolt
- 4 Center line of the gauge supporter



## 5.5 Guide pipes

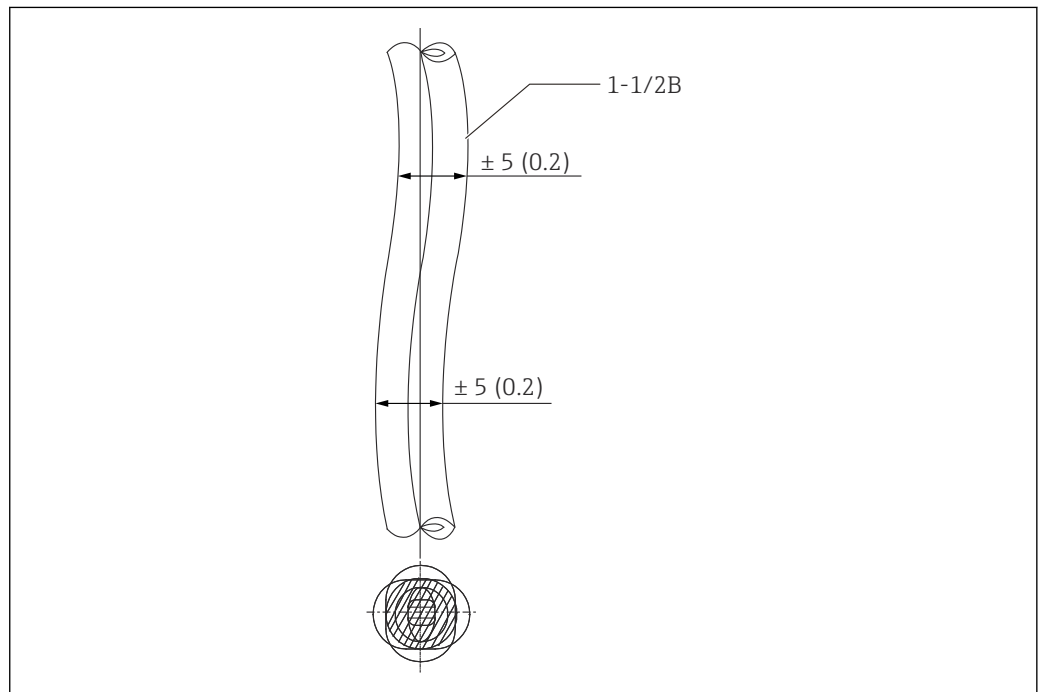
### 5.5.1 Selecting and mounting guide pipes

Guide pipes are required for most installations, except for tank top and underground applications. Guide pipes are usually used in three locations:

- Gauge head to sheave elbow
- Sheave elbow to sheave elbow
- Sheave elbow to tank roof

#### Precautions regarding installation

- Note that guide pipes and pipe supporters are not supplied by Endress+Hauser.
- Ensure that any bends in guide pipes are 5 mm (0.17 in) or smaller.
- The space (piping distance) between a sheave elbow and a sheave elbow must be no more than 2.5 m (8.2 ft).



23 Mounting guide pipes. Unit of measurement mm (in)

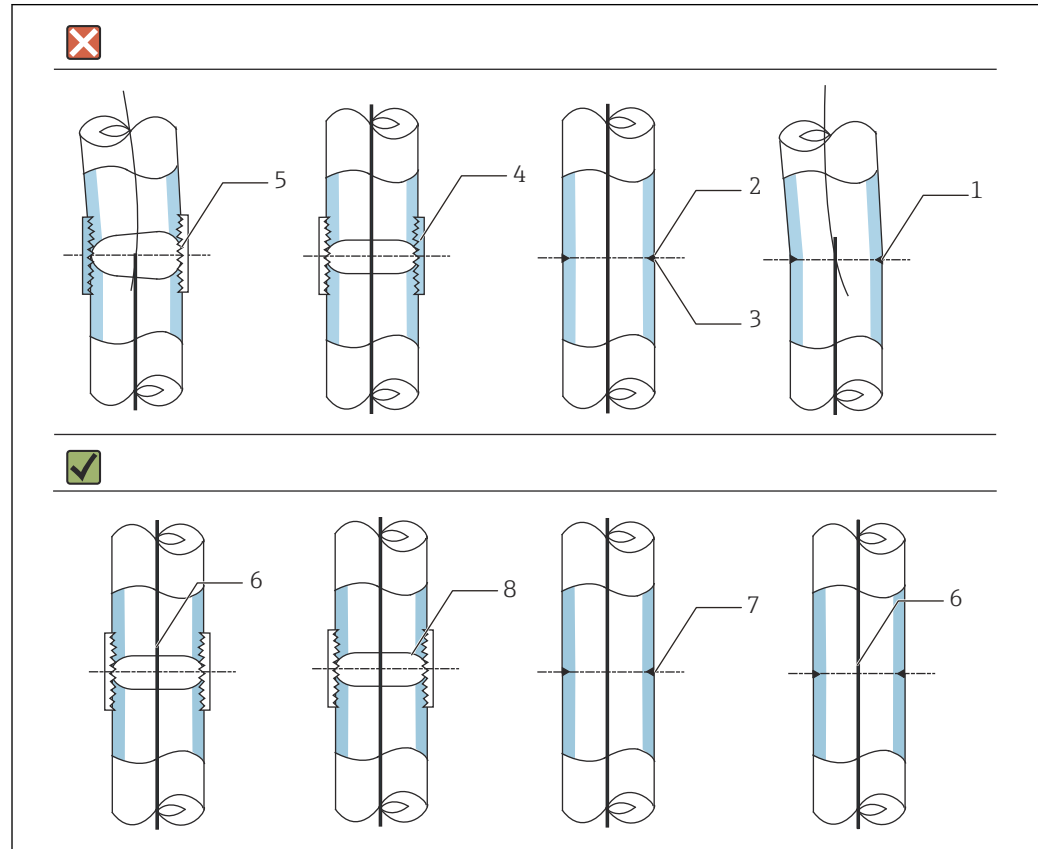
#### NOTICE

##### Recommended materials for guide pipes

- ▶ Always use a galvanized carbon steel pipe ("white gas pipe") for guide pipes. When the application involves use of an extremely corrosive gas, use of rigid PVC pipes, stainless steel pipes or resin inner lining is recommended.

### 5.5.2 Connecting guide pipes

- Use PTFE sealing tape and gaskets on the unions and flanges in order to maintain airtightness against gas and rain.
- Ensure that union connection is secure; otherwise, rain water may enter the gauge from the joint.
- When connecting the pipes, watch out for nonlinearity caused by a bent thread in a socket connection, internal protrusion of the cut section of the pipe, bending of the joint caused by welding, and the presence of welding burrs on the inside.



A0041182

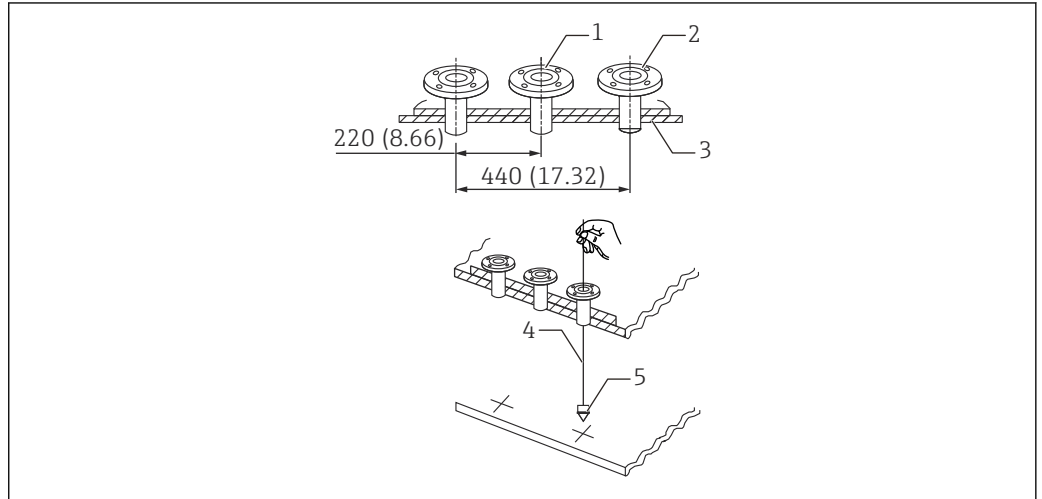
24 Connecting guide pipes

- 1 Bend due to welding
- 2 Welding
- 3 Welding burr
- 4 Burr
- 5 Bent thread
- 6 Vertical
- 7 No welding burr inside
- 8 Chamfering

### 5.6 Top anchor and anchor hook

When installing an anchor hook, lower it so that it is perpendicular to the top anchor at the top of a tank, and use a plumb to determine the precise position.

**i** The flange will be a socket type depending on specifications.

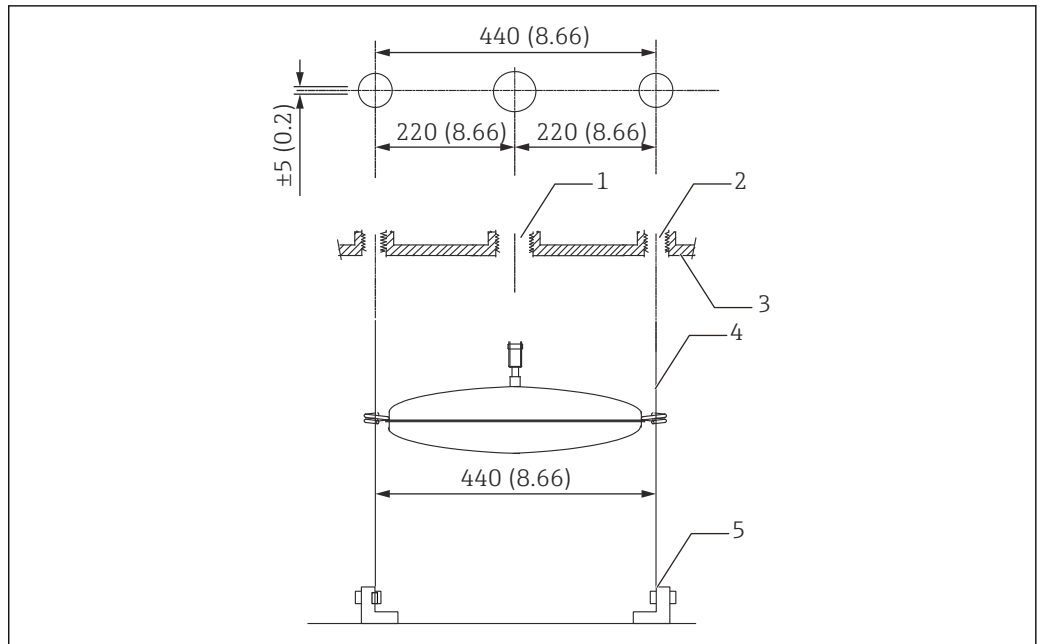


A0041183

**25** Top anchor pre-installation check. Unit of measurement mm (in)

- 1 Nozzle flange for gauge head
- 2 Nozzle flange for top anchor
- 3 Tank top
- 4 Leveling string
- 5 Plumb

#### Socket (threaded type)



A0041185

**26** Mounting anchor hooks. Unit of measurement mm (in)

- 1 1-1/2B socket
- 2 1B socket
- 3 Tank top
- 4 Guide wire (single wire)
- 5 Anchor hook

## 5.7 Measuring tape and wire lengths

The lengths of the measuring tape and wire are longer than the actual measurement length and vary depending on each option. The following tables show the actual lengths according to options in 060 for each option of specification 070. However, note that the maximum length that can be displayed on the display of the gauge head simply corresponds to the measurement range. See the following tables and select the appropriate length accordingly.

### 1. Measuring tape SUS316, CRT

060 measurement range		Length (total length)	Perforated tape (measurement length)	Non-perforated tape	Spare parts
1	2.5 m	13 m	7 m	6 m	56004412
2	5 m	13 m	7 m	6 m	56004412
3	10 m	24 m	12 m	12 m	017860-5302
4	16 m	45 m	22 m	23 m	017860-5304
5	20 m	45 m	22 m	23 m	017860-5304
6	30 m	65 m	32 m	33 m	017860-5305
F	60 ft	134.50 ft	69.89 ft	65.61 ft	Contact Endress+Hauser
H	100 ft	216.52 ft	108.26 ft	108.26 ft	Contact Endress+Hauser

### 2. Measuring tape SUS316, tank top mounting

060 measurement range		Length (total length)	Perforated tape (measurement length)	Non-perforated tape	Spare parts
1	2.5 m	7.15 m	7 m	0.15 m	017860-5306
2	5 m	7.15 m	7 m	0.15 m	017860-5306
3	10 m	12.15 m	12 m	0.15 m	017860-5307
4	16 m	22.15 m	22 m	0.15 m	017860-5309
5	20 m	22.15 m	22 m	0.15 m	017860-5309
6	30 m	32.15 m	32 m	0.15 m	017860-5310
F	60 ft	72.17 ft	69.89 ft	3.28 ft	Contact Endress+Hauser
H	100 ft	111.54 ft	108.26 ft	3.28 ft	Contact Endress+Hauser

### 3. Measuring tape SUS316, seal pot/BT

060 measurement range		Length (total length)	Perforated tape (measurement length)	Non-perforated tape	Spare parts
1	2.5 m	24 m	7 m	17 m	Contact Endress+Hauser
2	5 m	24 m	7 m	17 m	Contact Endress+Hauser
3	10 m	35 m	12 m	23 m	Contact Endress+Hauser
4	16 m	55 m	22 m	33 m	Contact Endress+Hauser
5	20 m	55 m	22 m	33 m	Contact Endress+Hauser
6	30 m	75 m	32 m	43 m	017860-5210

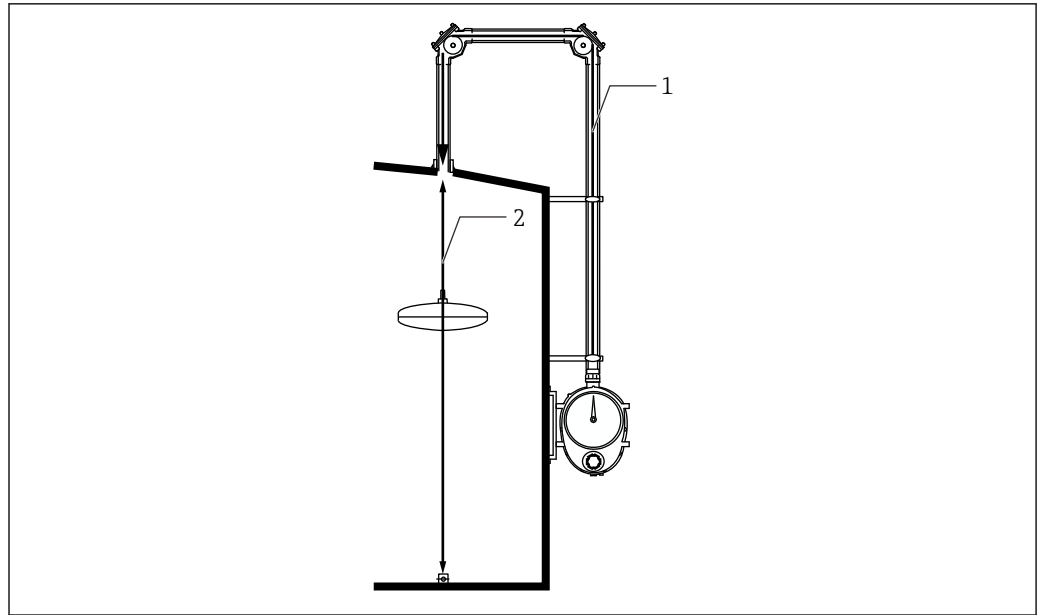
060 measurement range		Length (total length)	Perforated tape (measurement length)	Non-perforated tape	Spare parts
F	60 ft	167.31 ft	69.89 ft	98.42 ft	Contact Endress+Hauser
H	100 ft	249.33 ft	108.26 ft	141.07 ft	Contact Endress+Hauser

4. Measuring tape SUS316 + wire SUS316, FRT

060 measurement range		Length (total length)	Perforated tape (measurement length)	Non-perforated tape	Wire	Spare parts
1	2.5 m	16 m	6.7 m	0.3 m	9 m	017860-0005
2	5 m	16 m	6.7 m	0.3 m	9 m	017860-0005
3	10 m	26 m	11.7 m	0.3 m	14 m	017860-0007
4	16 m	46 m	21.7 m	0.3 m	24 m	017860-0011
5	20 m	46 m	21.7 m	0.3 m	24 m	017860-0011
6	30 m	66 m	31.7 m	0.3 m	34 m	017860-0013
F	60 ft	147.63 ft	67.91 ft	67.91 ft	78.74 ft	Contact Endress +Hauser
H	100 ft	219.80 ft	107.28 ft	67.91 ft	111.54 ft	Contact Endress +Hauser

5. Measuring tape SUS316 + PFA-coating SUS316 wire, seal pot/CRT

060 measurement range		Length (total length)	Perforated tape (measurement length)	Non-perforated tape	Wire	Spare parts
1	2.5 m	18 m	6.7 m	0.3 m	11 m	017860-0006
2	5 m	18 m	6.7 m	0.3 m	11 m	017860-0006
3	10 m	28 m	11.7 m	0.3 m	16 m	017860-0008
4	16 m	48 m	21.7 m	0.3 m	26 m	017860-0012
5	20 m	48 m	21.7 m	0.3 m	26 m	017860-0012
6	30 m	68 m	31.7 m	0.3 m	36 m	017860-0014
F	60 ft	154.19 ft	67.91 ft	67.91 ft	86.30 ft	Contact Endress +Hauser
H	100 ft	226.37 ft	107.28 ft	67.91 ft	118.11 ft	Contact Endress +Hauser



A0041195

27 Measuring tape and wire (example: option 1 for specification 070 and option 5 for specification 060)

- 1 Perforated tape
- 2 Non-perforated tape / wire

**i** In the above diagram, the maximum measurable distance is 22 mm, and there is up to 23 m of clearance. For this reason, the total length of the measuring tape is 45 m.

## 5.8 Sealing for wetting liquid and gas parts

### 5.8.1 List of materials

Product name	Units	Sealing material name	Sealing material type	Materials of packing/o-ring
LT5-1	Gauge head	Rear cover	Cover packing	V#6502
		Check shaft	O-ring	FKM
		Sprocket shaft	Oil seal	FKM
		Blind board	Packing	NBR
	90 ° sheave elbow	Aluminum sheave elbow	Cover packing	V#6502
		Stainless steel sheave elbow		
		Bearing	O-ring	Silicon rubber
	U-seal pot	Aluminum sheave elbow	Cover packing	V#6502
			Bearing o-ring	Silicon rubber
		Stainless steel sheave elbow	Cover packing	V#6502
			Bearing o-ring	Silicon rubber
		PVC sheave elbow	Cover packing	V#6502
			Bearing o-ring	PTFE
	Top anchor	Aluminum, threaded type	Cover packing	V#6502
Stainless tank welding type				
Top anchor	Aluminum flange, threaded type	Spring negator packing		
	Stainless flange welding type			
LT5-4/LT5-6	Gauge head	Rear cover	Cover packing	PTFE
		Check handle unit	Gland packing	PTFE/CR
		Internal magnet cover	O-ring	PTFE
		External magnet cover	O-ring	NBR *CR for ammonia specification
		Coupling	O-ring	PTFE
	Gate valve	Shaft	Shaft packing	PTFE
		Cap nut	Packing	PTFE
LT5-4	90° sheave elbow	Cover	Cover packing	PTFE
		Bearing	O-ring	PTFE
	135° sheave elbow	Cover	Cover packing	PTFE
		Bearing	O-ring	PTFE
	Top anchor	Aluminum flange integrated type	Spring negator packing	PTFE
		Stainless flange welding type		
LT5-6	90° sheave elbow	Cover	Cover packing	PTFE
		Bearing	O-ring	PTFE
	135° sheave elbow	Cover	Cover packing	PTFE
		Bearing	O-ring	PTFE
	Top anchor	Iron flange welding type	Spring negator packing	PTFE
		Stainless flange welding type		

## 5.9 Material certificates

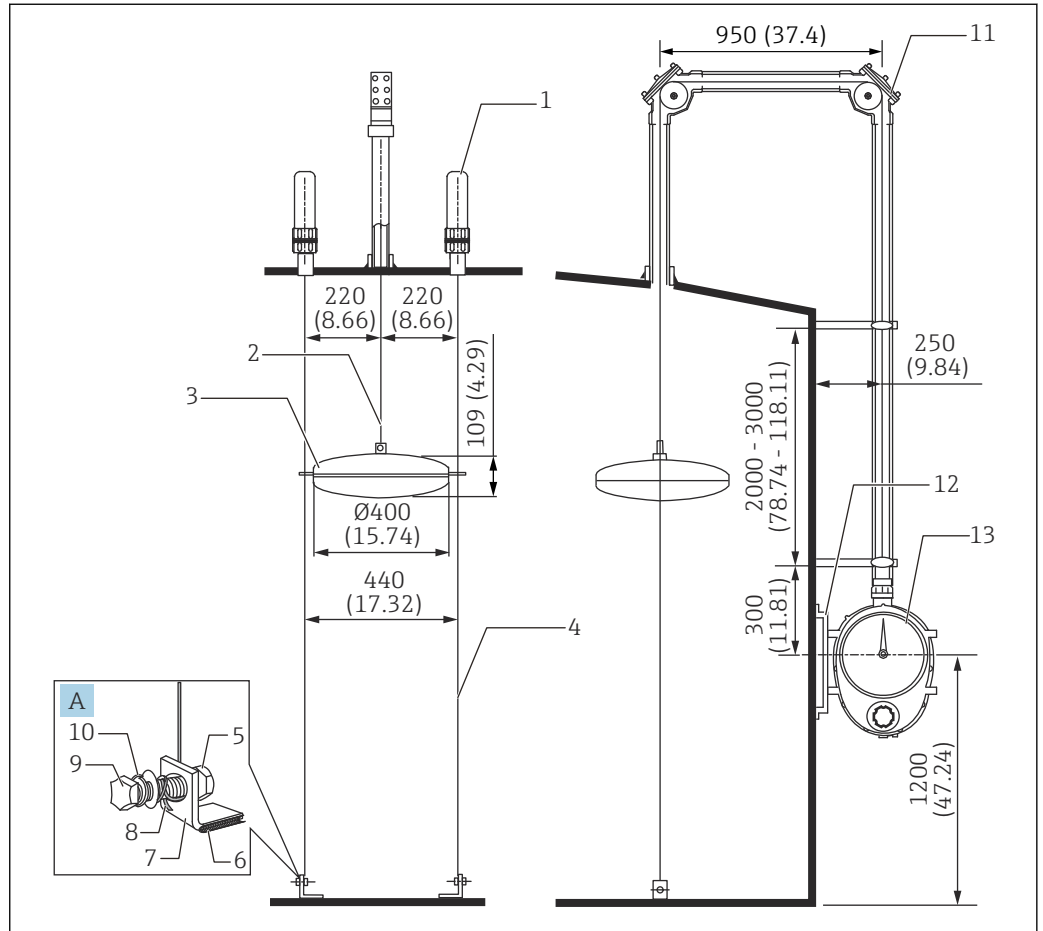
When material certificates are required, order them when ordering the products. Certificates can be provided for the following parts.

- Iron high-pressure gauge head (the flange is the same, as it is integrated with the gauge head), cover, magnet cover, check shaft (with no hoisting), plug
- Stainless steel measuring tape and wire (excluding PFA-coated wire)
- Stainless steel float
- Stainless steel or iron high-pressure top anchor main body, cover, flange
- Stainless steel guide wire (excluding PFA-coated wire)
- Stainless steel anchor hook
- Iron high-pressure sheave elbow main body (same for the flange as it is integrated with the sheave elbow main body), cover
- Stainless steel gate valve



## 5.10 Installation reference diagram and order codes

### 5.10.1 For a cone roof tank (CRT)



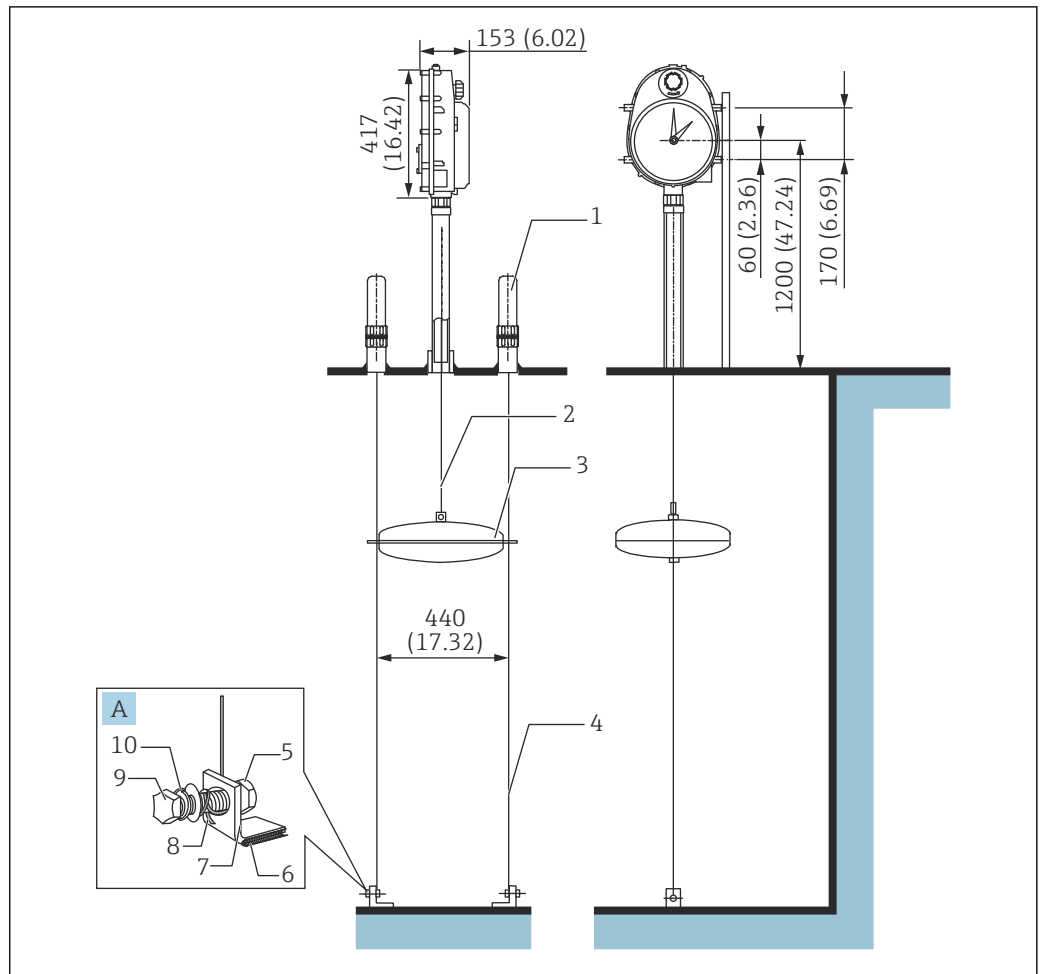
28 Mounting on a cone roof tank. Unit of measurement mm (in)

- A Anchor hook
- 1 Top anchor
- 2 Measuring tape
- 3 Float
- 4 Guide wire
- 5 Nut
- 6 Wetted part (welded to the tank)
- 7 Anchor hook
- 8 Guide wire
- 9 Bolt
- 10 Washer
- 11 90° sheave elbow
- 12 Gauge supporter
- 13 Gauge head

## Order code examples (LT5-111A031B11A111200000+PA)

Items	Target	Code	Specifications	Quantity
020	Gauge head	1	0.01961 MPa/2.84 psi, aluminum (ADC12)	1
030	Gauge head process connection	11	Rc 1-1/2, union nut, SUS316, thread JISB0203	
040	Display; cover	A	Dial display: Acrylic	
050	Crank unit	0	None	
060	Measuring range	3	10 m	
070	Measuring tape	1	Measuring tape, CRT	
080	Float	B	D 400 mm SUS316 tape connection 5.0 kg, $0.65 \leq \text{density} 1.05$ , with ring	
090	Top anchor	11	2x R1, aluminum (ADC6), thread JIS B0203	
100	Guide wire	A	Single wire with 3 mm diameter x 2 wires	
110	Anchor hook; mounting bolt	1	Iron; SUS316	
120	90 ° sheave elbow	112	2x Rp1-1/2, aluminum (ADC6), thread B0203	
130	135 ° sheave elbow	000	None	
140	Seal pot	0	None	-
150	Gate valve	0	None	
620	>>Enclosed accessories	PA	Gauge supporter SS400 low/medium-pressure gauge head	1

### 5.10.2 Mounting on a tank top (for an underground tank)



A0041197

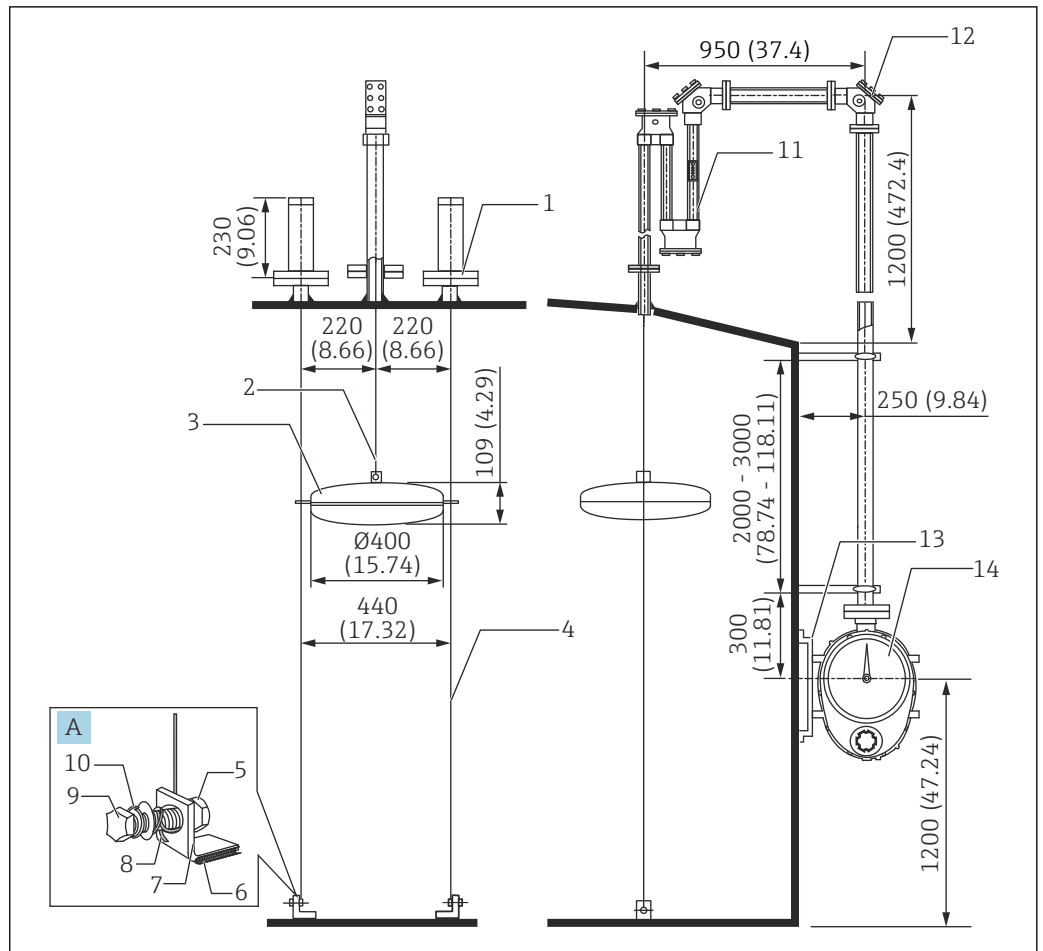
29 Mounting for an underground tank, unit. Unit of measurement mm (in)

- A Anchor hook
- 1 Top anchor
- 2 Measuring tape
- 3 Float
- 4 Guide wire
- 5 Nut
- 6 Wetted part (welded to the tank)
- 7 Anchor hook
- 8 Guide wire
- 9 Bolt
- 10 Washer

*Order code examples (LT5-111C022B11A100000000)*

Items	Target	Code	Specifications	Quantity
020	Gauge head	1	0.01961 MPa/2.84 psi, aluminum (ADC12)	1
030	Gauge head process connection	11	Rc 1-1/2, union nut, SUS316, thread JISB0203	
040	Display; cover	C	Reverse mounting, dial display, acrylic	
050	Crank unit	0	None	
060	Measuring range	2	5 m	
070	Measuring tape	2	Measuring tape, tank top mounting	
080	Float	B	D 400 mm SUS316 tape connection 5.0 kg, 0.65 ≤ density 1.05, with ring	
090	Top anchor	11	2x R1, aluminum (ADC6), thread JIS B0203	
100	Guide wire	A	Single wire with 3 mm diameter x 2 wires	
110	Anchor hook; mounting bolt	1	Iron; SUS316	
120	90 ° sheave elbow	000	None	-
130	135 ° sheave elbow	000	None	
140	Seal pot	0	None	
150	Gate valve	0	None	

### 5.10.3 Cone roof tank (with seal pot for CRT)



A0041198

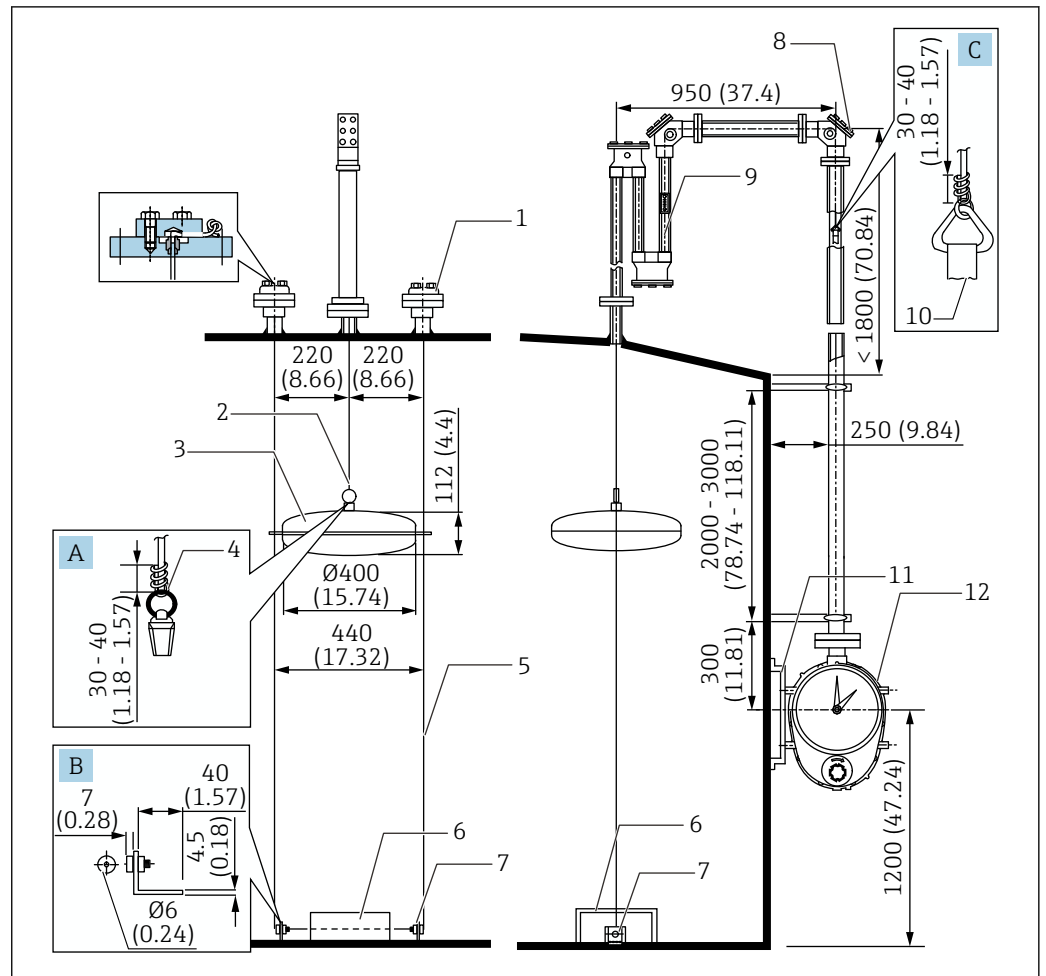
30 Installation on a cone roof tank with seal pot for CRT. Unit of measurement mm (in)

- A Anchor hook
- 1 Top anchor
- 2 Measuring tape
- 3 Float
- 4 Guide wire
- 5 Nut
- 6 Wetted part (welded to the tank)
- 7 Anchor hook
- 8 Guide wire
- 9 Bolt
- 10 Washer
- 11 Seal pot
- 12 90° sheave elbow
- 13 Gauge supporter
- 14 Gauge head

*Order code examples (LT5-11AA023B1BA21A1000F0+PA)*

Items	Target	Code	Specifications	Quantity
020	Gauge head	1	0.01961 MPa/2.84 psi, aluminum (ADC12)	1
030	Gauge head process connection	1A	10K 40A RF, aluminum (AC4A), flange JIS B2220	
040	Display; cover	A	Dial display: Acrylic	
050	Crank unit	0	None	
060	Measuring range	2	5 m	
070	Measuring tape	3	Measuring tape, seal pot /BT	
080	Float	B	D 400 mm SUS316 tape connection 5.0 kg, 0.65 ≤ density 1.05, with ring	
090	Top anchor	1B	2x10K 40A RF, SUS316, flange JIS B2220	2
100	Guide wire	A	Single wire with 3 mm diameter x 2 wires	
110	Anchor hook; mounting bolt	2	SUS316; SUS316	
120	90 ° sheave elbow	1A1	1x 10K 40A RF, aluminum (ADC6+AC4A), flange JIS B2220	1
130	135 ° sheave elbow	000	None	-
140	Seal pot	F	10K 40A RF, SUS316, flange JIS B2220	1
150	Gate valve	0	None	-
620	>>Enclosed accessories	PA	Gauge supporter SS400 low/medium-pressure gauge head	1

### 5.10.4 Cone roof tank (with seal pot PVC for CRT)



31 Installation on a cone roof tank with seal pot PVC for CRT. Unit of measurement mm (in)

- A Float tip
- B Anchor hook details
- C Triangle bracket for measuring wire
- 1 Top anchor
- 2 Measuring wire
- 3 Float
- 4 Teflon tube
- 5 Guide wire (PFA-coated wire)
- 6 Wire protection stand (not supplied)
- 7 Anchor hook
- 8 90° sheave elbow
- 9 Seal pot
- 10 Measuring tape
- 11 Gauge supporter
- 12 Gauge head

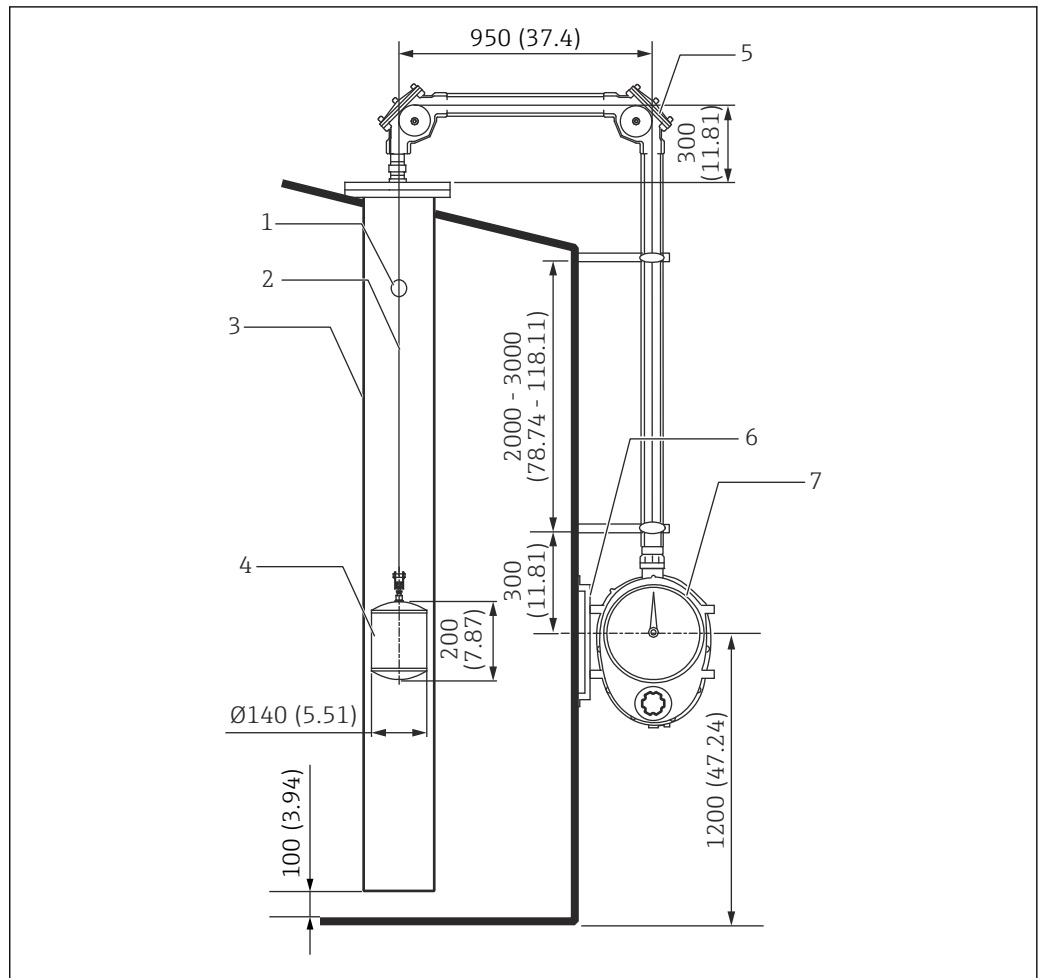
- i**
  - Coil the enclosed Teflon tube around the measuring wire 10 to 15 times.
  - Coat the anchor hook if necessary.
  - Position the connection part C in the diagram so that it is approx. 10 mm (0.39 in) below the sheave elbow when the liquid level is 0 and approx. 100 mm (3.94 in) from the gauge head when the tank is full.

## Order code examples (LT5-11AA025H1NC41A1000N0+PA)

Items	Target	Code	Specifications	Quantity
020	Gauge head	1	0.01961 MPa/2.84 psi, aluminum (ADC12)	1
030	Gauge head process connection	1A	10K 40A RF, aluminum (AC4A), flange JIS B2220	
040	Display; cover	A	Dial display: Acrylic	
050	Crank unit	0	None	
060	Measuring range	2	5 m	
070	Measuring tape	5	Tape + PFA-coated wire, seal pot/CRT	
080	Float	H	D 400 mm SUS316 tape connection 5.0 kg, $0.65 \leq \text{density} 1.05$ , with ring	
090	Top anchor	1N	2x10K 40A RF, PVC, flange JIS B2220	2
100	Guide wire	C	4.6 mm diameter, strand wire, PFA-coated wire x 1 wire	1
110	Anchor hook; mounting bolt	4	SUS316; PVC	2
120	90 ° sheave elbow	1A1	1x 10K 40A RF, aluminum (ADC6+AC4A), flange JIS B2220	1
130	135 ° sheave elbow	000	None	-
140	Seal pot	N	10K 40A FF, PVC, flange JIS B2220	1
150	Gate valve	0	None	-
620	>>Enclosed accessories	PA	Gauge supporter SS400 low/medium-pressure gauge head	1



### 5.10.5 Compact cone roof tank (guide pipe method)



A0041200

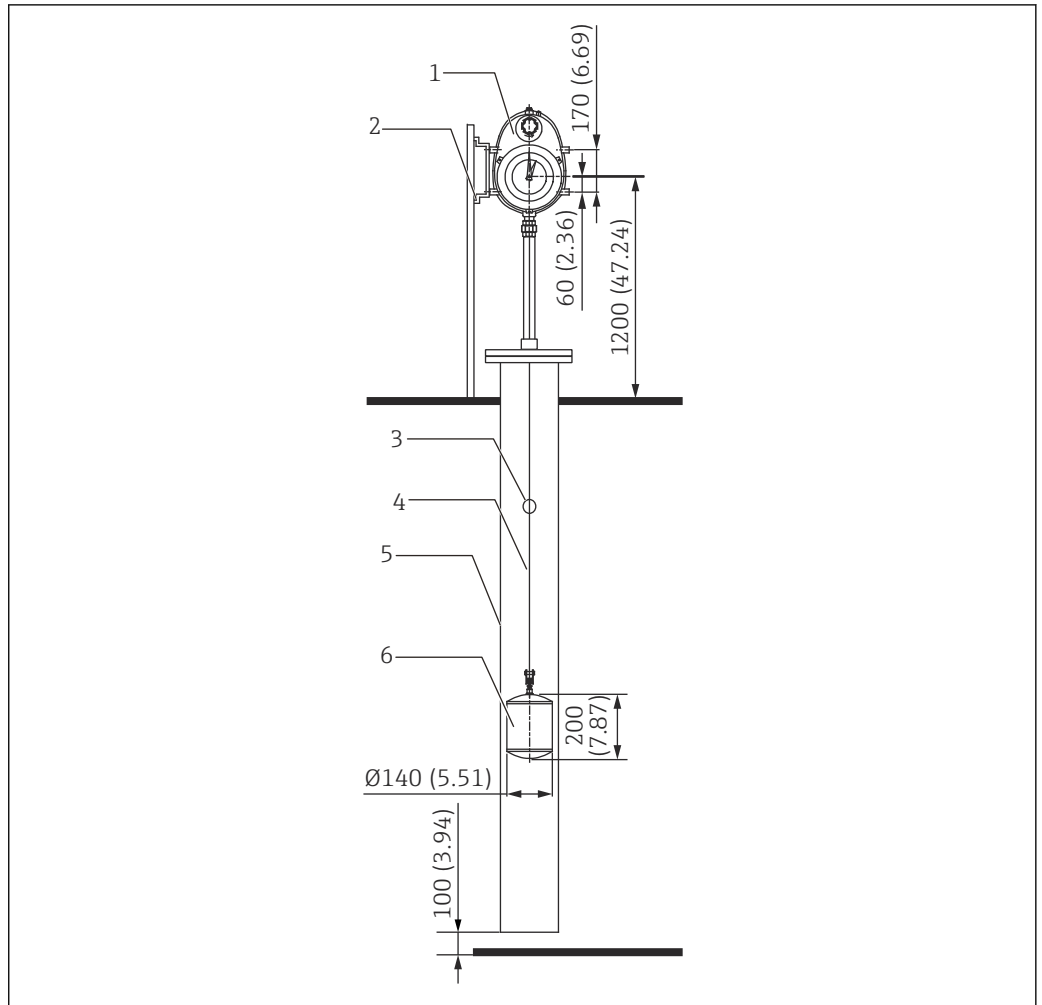
32 Mounting on a compact cone roof tank. Unit of measurement mm (in)

- 1 Ventilation hole
- 2 Measuring wire
- 3 Guide pipe (Stillwell)
- 4 Float
- 5 90° sheave elbow
- 6 Gauge supporter
- 7 Gauge head

*Order code examples (LT5-111A021L000011200000+PA)*

Items	Target	Code	Specifications	Quantity
020	Gauge head	1	0.01961 MPa/2.84 psi, aluminum (ADC12)	1
030	Gauge head process connection	11	Rc 1-1/2, union nut, SUS316, thread JISB0203	
040	Display; cover	A	Dial display: Acrylic	
050	Crank unit	0	None	
060	Measuring range	2	5 m	
070	Measuring tape	1	Measuring tape, CRT	
080	Float	L	D 140 mm SUS316 tape connection 2.4 kg, 0.94 ≤ density 2.0, without ring	
090	Top anchor	00	None	-
100	Guide wire	0	None	
110	Anchor hook; mounting bolt	0	None	
120	90 ° sheave elbow	112	2x Rp1-1/2, aluminum (ADC6), thread JIS B0203	2
130	135 ° sheave elbow	000	None	-
140	Seal pot	0	None	
150	Gate valve	0	None	
620	>>Enclosed accessories	PA	Gauge supporter SS400 low/medium-pressure gauge head	1

### 5.10.6 Mounting on a tank top (guide pipe method)



A0041201

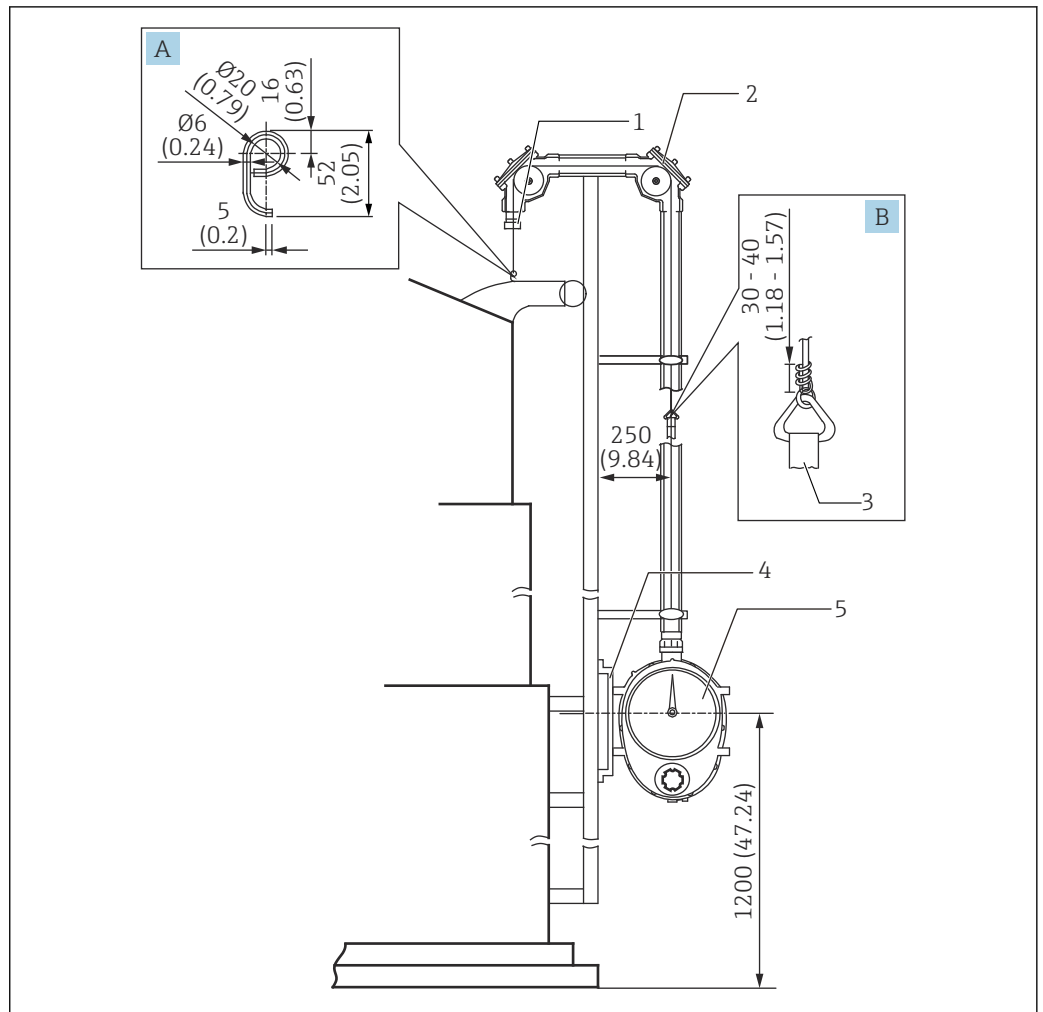
33 Tank top mounting, unit. Unit of measurement mm (in)

- 1 Gauge head
- 2 Gauge supporter
- 3 Ventilation hole
- 4 Triangle bracket for measuring wire
- 5 Guide pipe (Stillwell)
- 6 Float

Order code examples (LT5-111C022L000000000000+PA)

Items	Target	Code	Specifications	Quantity	
020	Gauge head	1	0.01961 MPa/2.84 psi, aluminum (ADC12)	1	
030	Gauge head process connection	11	Rc 1-1/2, union nut, SUS316, thread JISB0203		
040	Display; cover	C	Reverse mounting, dial display, acrylic		
050	Crank unit	0	None		
060	Measuring range	2	5 m		
070	Measuring tape	2	Measuring tape, tank top mounting		
080	Float	L	D 140 mm SUS316 tape connection 2.4 kg, 0.94 ≤ density 2.0, without ring		
090	Top anchor	00	None		-
100	Guide wire	0	None		
110	Anchor hook; mounting bolt	0	None		
120	90 ° sheave elbow	000	None		
130	135 ° sheave elbow	000	None		
140	Seal pot	0	None		
150	Gate valve	0	None		
620	>>Enclosed accessories	PA	Gauge supporter SS400 low/medium-pressure gauge head	1	

### 5.10.7 Gas holder



A0041202

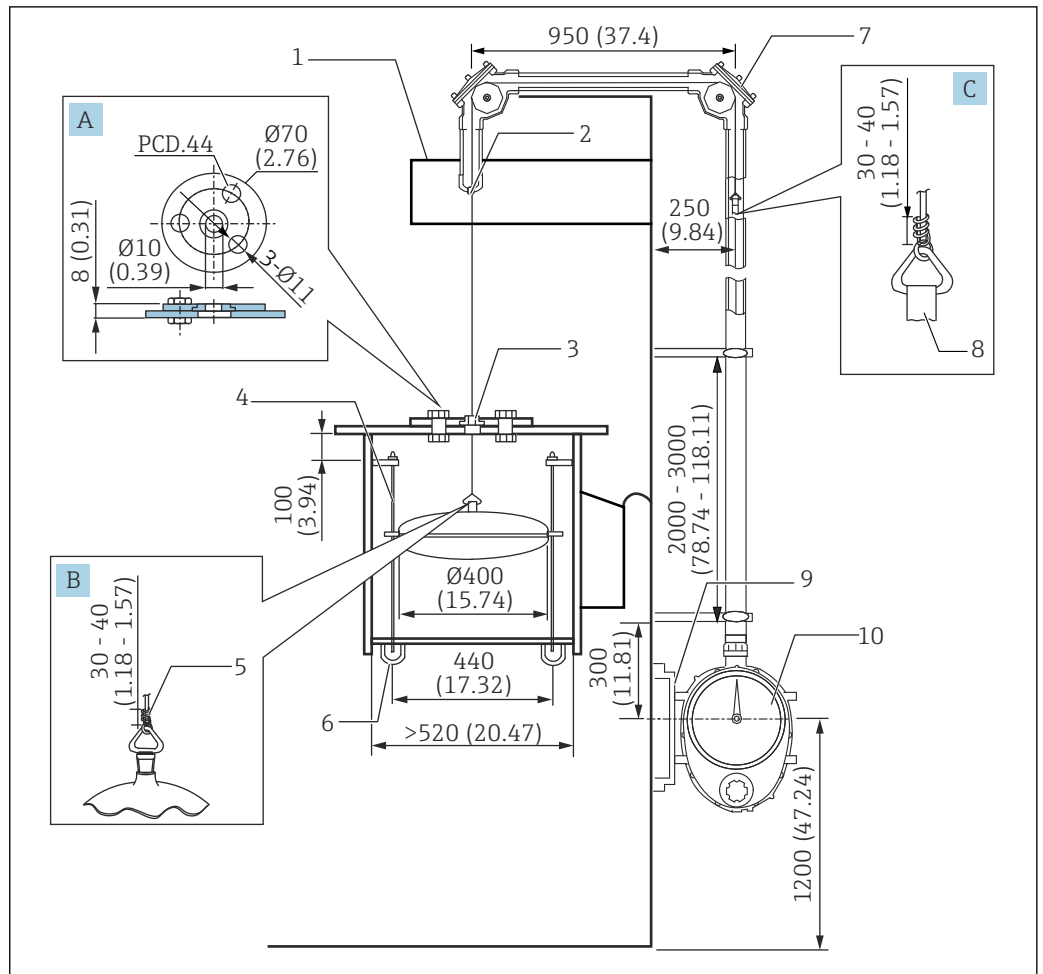
34 Mounting a gas holder. Unit of measurement mm (in)

- A Gas holder wire hook
- B Triangle bracket for measuring wire
- 1 Wire guide socket
- 2 90° sheave elbow
- 3 Measuring tape
- 4 Gauge supporter
- 5 Gauge head

Order code examples (LT5-111A0340000011200000+PAPFPH)

Items	Target	Code	Specifications	Quantity	
020	Gauge head	1	0.01961 MPa/2.84 psi, aluminum (ADC12)	1	
030	Gauge head process connection	11	Rc 1-1/2, union nut, SUS316, thread JISB0203		
040	Display; cover	A	Dial display: Acrylic		
050	Crank unit	0	None		
060	Measuring range	3	10 m		
070	Measuring tape	4	Tape + wire, FRT		
080	Float	0	None		-
090	Top anchor	00	None		
100	Guide wire	0	None		
110	Anchor hook; mounting bolt	0	None		
120	90 ° sheave elbow	112	2x Rp1-1/2, aluminum (ADC6), thread JIS B0203	2	
130	135 ° sheave elbow	000	None	-	
140	Seal pot	0	None		
150	Gate valve	0	None		
620	>>Enclosed accessories	PA	Gauge supporter SS400 low/medium-pressure gauge head	1	
620	>>Enclosed accessories	PF	Wire guide socket, Rc1-1/2		
620	>>Enclosed accessories	PH	Gas holder wire hook		

### 5.10.8 For a floating roof tank (FRT)



A0041203

35 Mounting on a floating roof tank. Unit of measurement mm (in)

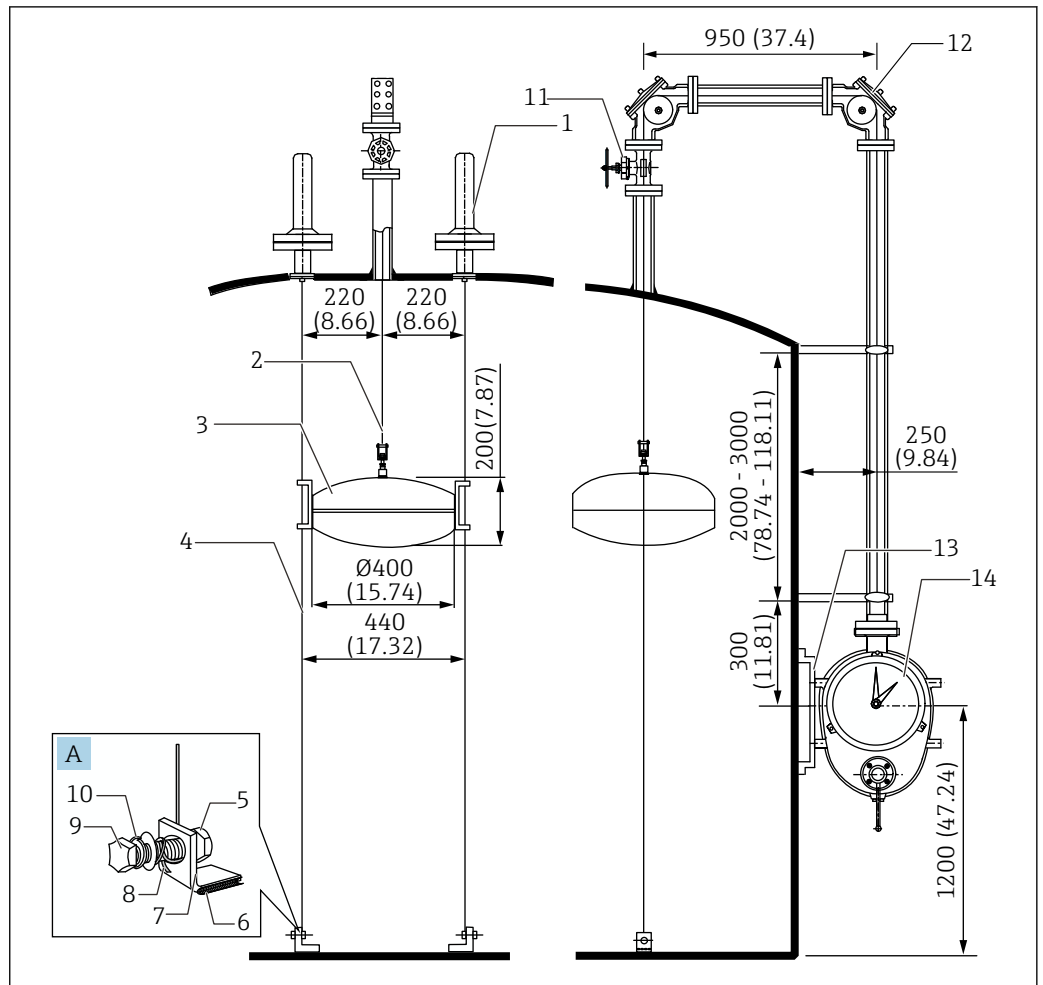
- A Wire guide metal
- B Top of the float
- C Triangle bracket for measuring wire
- 1 Roof stand
- 2 Wire guide socket
- 3 FRT wire guide metal
- 4 Guide bar:  $\phi 16$  mm (0.63 in)
- 5 Stainless steel wire (accessory)
- 6 Pipe end: 1<sup>B</sup> Sch 40 to 80
- 7 90° sheave elbow
- 8 Measuring tape
- 9 Gauge supporter
- 10 Gauge head

## Order codes (LT5-111A054E000011200000+PAPEPF)

Items	Target	Code	Specifications	Quantity
020	Gauge head	1	0.01961 MPa/2.84 psi, aluminum (ADC12)	1
030	Gauge head process connection	11	Rc 1-1/2, union nut, SUS316, thread JISB0203	
040	Display; cover	A	Dial display: Acrylic	
050	Crank unit	0	None	
060	Measuring range	5	20 m	
070	Measuring tape	4	Tape + wire, FRT	
080	Float	E	D 400 mm SUS316 wire connection 5.0 kg, 0.65 ≤ density 1.05, with ring	
090	Top anchor	00	None	-
100	Guide wire	0	None	
110	Anchor hook; mounting bolt	0	None	
120	90 ° sheave elbow	112	2x Rp1-1/2, aluminum (ADC6), thread JIS B0203	2
130	135 ° sheave elbow	000	None	-
140	Seal pot	0	None	
150	Gate valve	0	None	
620	>>Enclosed accessories	PA	Gauge supporter SS400 low/medium-pressure gauge head	1
620	>>Enclosed accessories	PE	FRT wire guide metal	
620	>>Enclosed accessories	PF	Wire guide socket, Rc1-1/2	



### 5.10.9 Medium-pressure dome roof tank



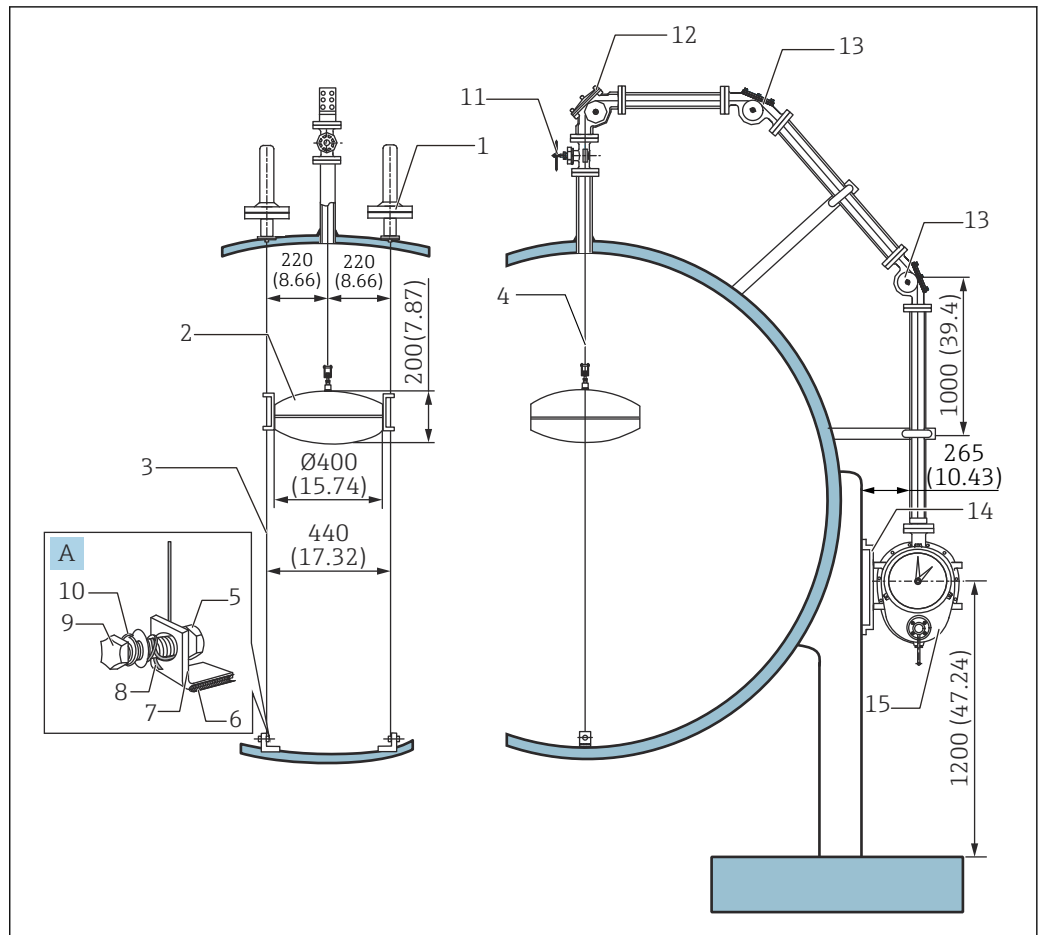
36 Mounting on a medium-pressure dome roof tank. Unit of measurement mm (in)

- A Anchor hook
- 1 Top anchor
- 2 Measuring tape
- 3 Float
- 4 Guide wire
- 5 Stainless steel wire (accessory)
- 6 Nut
- 7 Anchor hook
- 8 Guide wire
- 9 Bolt
- 10 Washer
- 11 Gate valve
- 12 90° sheave elbow
- 13 Gauge supporter
- 14 Gauge head

## Order code examples (LT5-44AB151R4AA24A200001+PA)

Items	Target	Code	Specifications	Quantity
020	Gauge head	4	0.09807 MPa/14.22 psi, aluminum (AC4CT6)	1
030	Gauge head process connection	4A	10K 40A RF, aluminum (AC4CT6), flange JIS B2220	
040	Display; cover	B	Dial display; glass + iron	
050	Crank unit	1	Selected	
060	Measuring range	5	20 m	
070	Measuring tape	1	Measuring tape, CRT	
080	Float	R	D 400 mm SUS316 wire connection 8.3 kg, 0.5 ≤ density 0.7, with ring	
090	Top anchor	4A	2x10K 40A RF, aluminum (AC4CT6), flange JIS B2220	2
100	Guide wire	A	Single wire with 3 mm diameter x 2 wires	
110	Anchor hook; mounting bolt	2	SUS316; SUS316	
120	90 ° sheave elbow	4A2	2x 10K 40A RF, aluminum (ADC6), flange JIS B2220	
130	135 ° sheave elbow	000	None	
140	Seal pot	0	None	-
150	Gate valve	1	10K 40A RF, SCS13, flange JIS B2220	
620	>>Enclosed accessories	PA	Gauge supporter SS400 low/medium-pressure gauge head	

### 5.10.10 High-pressure sphere tank



A0041205

37 Mounting on a high-pressure sphere tank. Unit of measurement mm (in)

- A Anchor hook
- 1 Top anchor
- 2 Float
- 3 Guide wire
- 4 Measuring tape
- 5 Nut
- 6 Wetted part (welded to the tank)
- 7 Anchor hook
- 8 Guide wire
- 9 Bolt
- 10 Washer
- 11 Gate valve
- 12 90° sheave elbow
- 13 135° sheave elbow
- 14 Gauge supporter
- 15 Gauge head

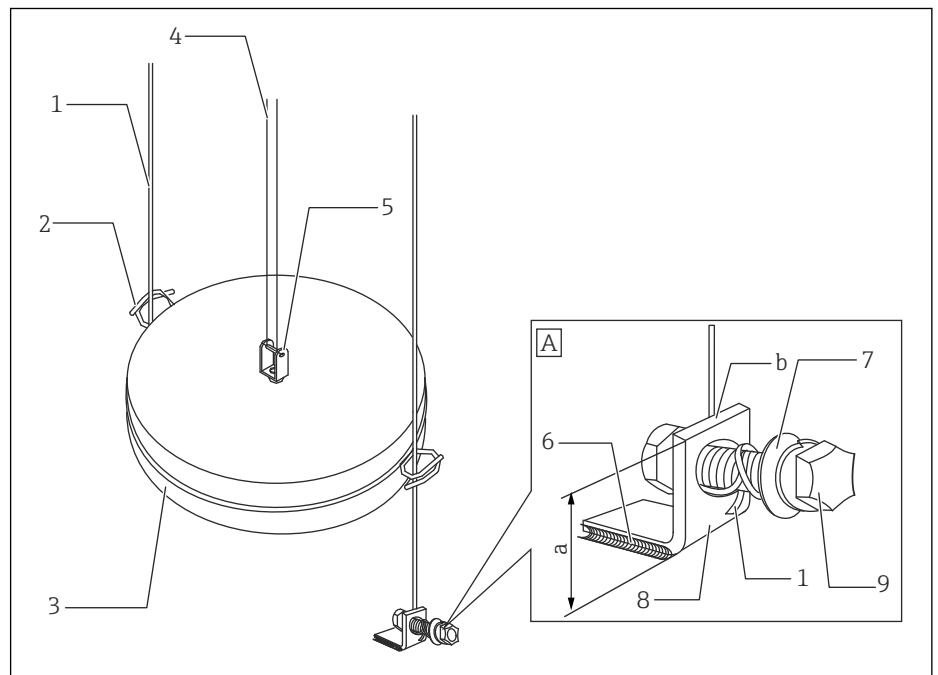
*Order code examples (LT5-66GB153R6GA26G16G204+PC)*

Items	Target	Code	Specifications	Quantity
020	Gauge head	6	2.45 MPa/355.25 psi, iron (SCPL1)	1
030	Gauge head process connection	6G	20K 40A RF, iron, flange JIS B2220	
040	Display; cover	B	Dial display; glass + iron	
050	Crank unit	1	Selected	
060	Measuring range	5	20 m	
070	Measuring tape	3	Measuring tape, seal pot / BT	
080	Float	R	D 400 mm SUS316 wire connection 8.3 kg, 0.5 ≤ density 0.7, with ring	
090	Top anchor	6G	2x20K 40A RF, iron, flange JIS B2220	2
100	Guide wire	A	Single wire with 3 mm diameter x 2 wires	
110	Anchor hook; mounting bolt	2	SUS316; SUS316	
120	90 ° sheave elbow	6G1	1x 20K 40A RF, iron, flange JIS B2220	1
130	135 ° sheave elbow	6G2	2x 20K 40A RF, iron, flange JIS B2220	2
140	Seal pot	0	None	-
150	Gate valve	4	20K 40A RF, SCS13, flange JIS B2220	1
620	>>Enclosed accessories	PC	Gauge supporter SS400 high-pressure gauge head	

## 5.11 Mounting guide wires

### Mounting procedure

- i**
    - Do not bend the guide wires.
    - Two guide wires should be arranged in parallel to one another and perpendicular to the tank floor.
    - Two washers are inserted in the packing between the top anchor and the mounting flange on the tank side. Check this before installing the guide wires.
    - Carefully check the strength of the guide wire and the anchor hook at the tank bottom as they are difficult to repair once the tank is filled with liquid.
1. Open the cover of the top anchor located at the tank top.
  2. Pass the guide wire through the guide ring at the tank bottom and secure it tightly to the anchor hook using a nut and a bolt.
  3. Cut and bend the tip of the guide wire so that it does not get caught on the float.
    - ↳ The tip of the guide wire is connected to (b) so that it is smaller than the dimension of the anchor hook (a).  
Coil the guide wire one to two times from inside the anchor hook, and then pass it through the hole and coil it one to two times on the outside. Adjust the number of coils as necessary.



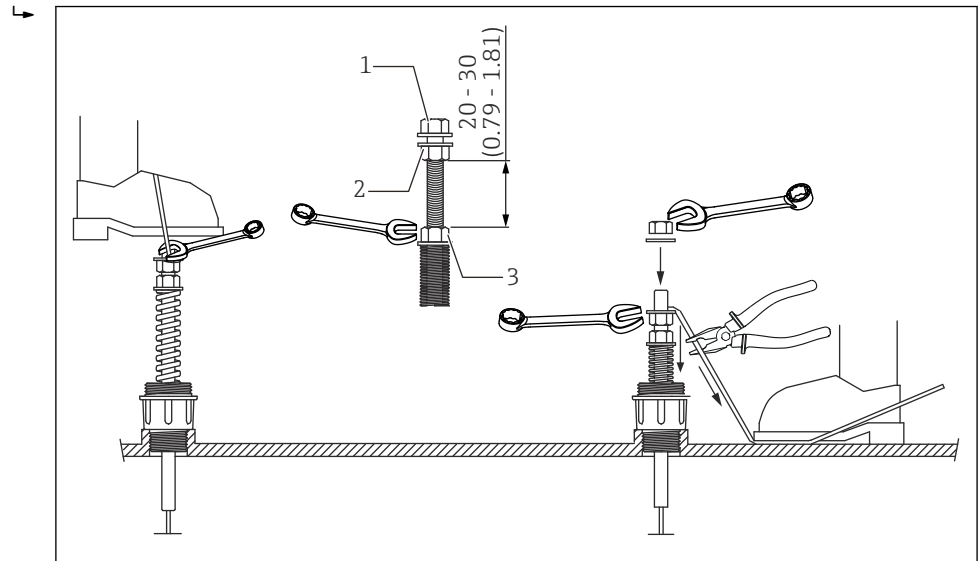
A0041206

38 Guide wire mounting 1

- A Anchor hook
- 1 Guide wire
- 2 Guide ring
- 3 Float
- 4 Measuring tape
- 5 Universal joint
- 6 Welding part
- 7 Washer
- 8 Anchor hook
- 9 Bolt

4. Secure the guide wire in place while extending it to the tank top again.
5. Bend the end of the guide wire along the shaft, and cut it off leaving approx. 100 mm.
6. Tighten the end nuts [1] and [2].

7. Tighten nut [3] and fully release the spring.



39 Guide wire mounting 2. Unit of measurement mm (in)

- 1 Nut 1
- 2 Nut 2
- 3 Nut 3

This completes the guide wire mounting process.

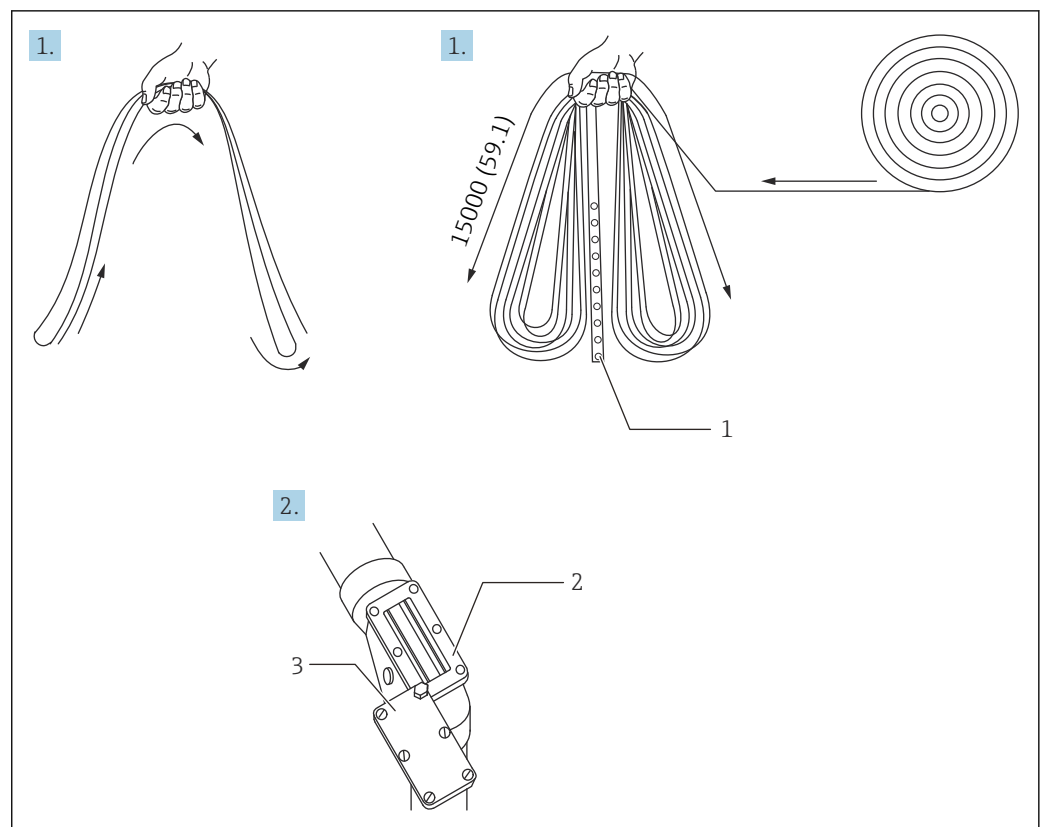
## 5.12 Mounting the measuring tape and measuring wire

- i** ■ Never bend or damage the measuring tape.
- Ensure that the measuring tape does not become twisted inside the tank or while the pipes are being laid out.
- Approximately half of the measuring tape is perforated with small holes at 20-mm intervals (1-inch intervals if using imperial units). Install the measuring tape so that the perforated side is wound by the gauge.
- During the mounting process, ensure that the measuring tape and the measuring wire do not come off of the sheave elbow roller, and always inspect them after the mounting process.
- If the measuring tape must be passed through the 135 ° sheave elbow, ensure safety before mounting the measuring tape as the footing is poor and extremely dangerous.
- Inspect the joint between the float and the measuring tape once they are connected as this cannot be fixed once the tank is filled with liquid.

### Mounting procedure

1. Extend the measuring tape while folding it back and forth in your hand approximately every 1.5 m to ensure that the tape does not become twisted.
2. Open the sheave elbow cover and the gauge head cover.
3. Mount the measuring tape so that it does not become twisted inside the guide pipe.

This completes the mounting preparation.




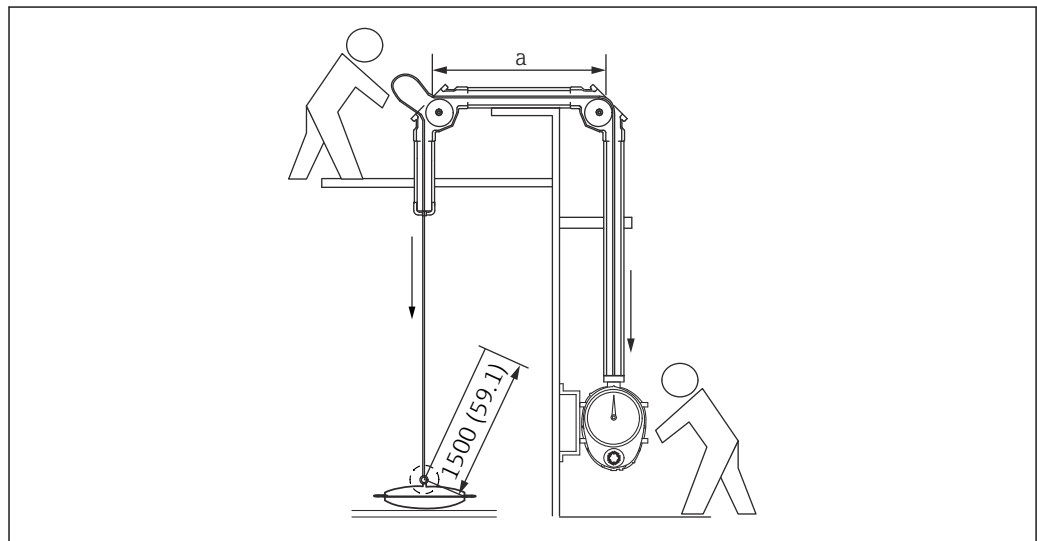
**40** Preparing the measuring tape. Unit of measurement mm (in)

- 1 Perforation
- 2 Sheave elbow
- 3 Cover


### 5.12.1 Cone roof tank

#### Mounting procedure

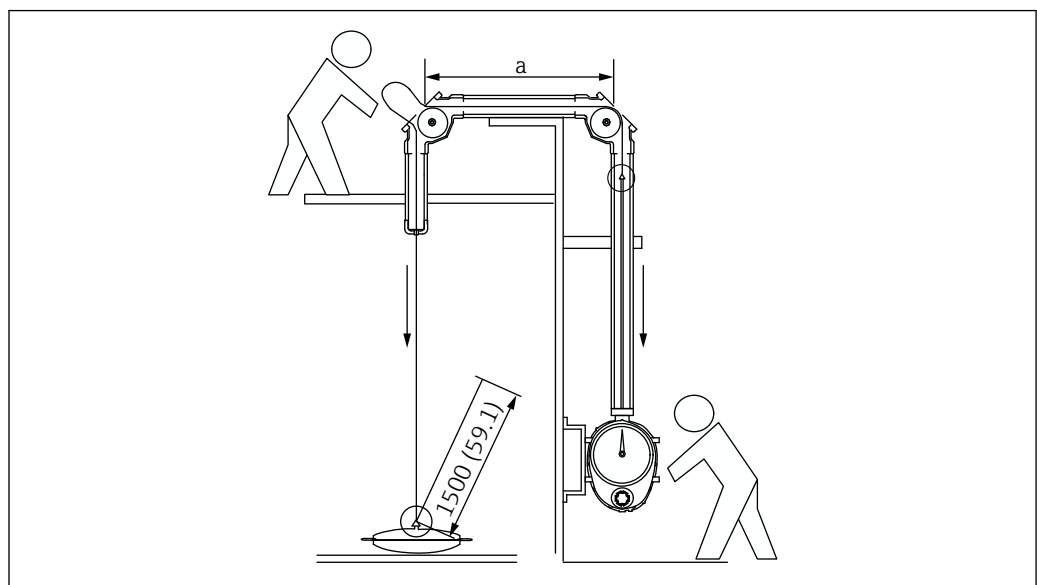
1. Insert one end of the measuring tape (non-perforated side) into the tank from the sheave elbow on that tank roof.
2. Pass the other end of the tape (perforated, looped side) through the sheave elbow on the gauge head's side and insert it into the gauge head.
3. Secure the end of the measuring tape to the tape drum. Rotate the tape drum twice, and then pull the measuring tape inside the tank.
4. For the length to the float, cut the measuring tape, leaving approx. 1.5 m.
5. Connect the measuring tape to the float.
  - ↳ For more information on the connection procedure, see →  57.




A0041209

 41 Mounting the measuring tape: Measuring tape. Unit of measurement mm (in)

a Guide pipe



A0041210

 42 Mounting the measuring tape and measuring wire: Measuring tape + measuring wire. Unit of measurement mm (in)

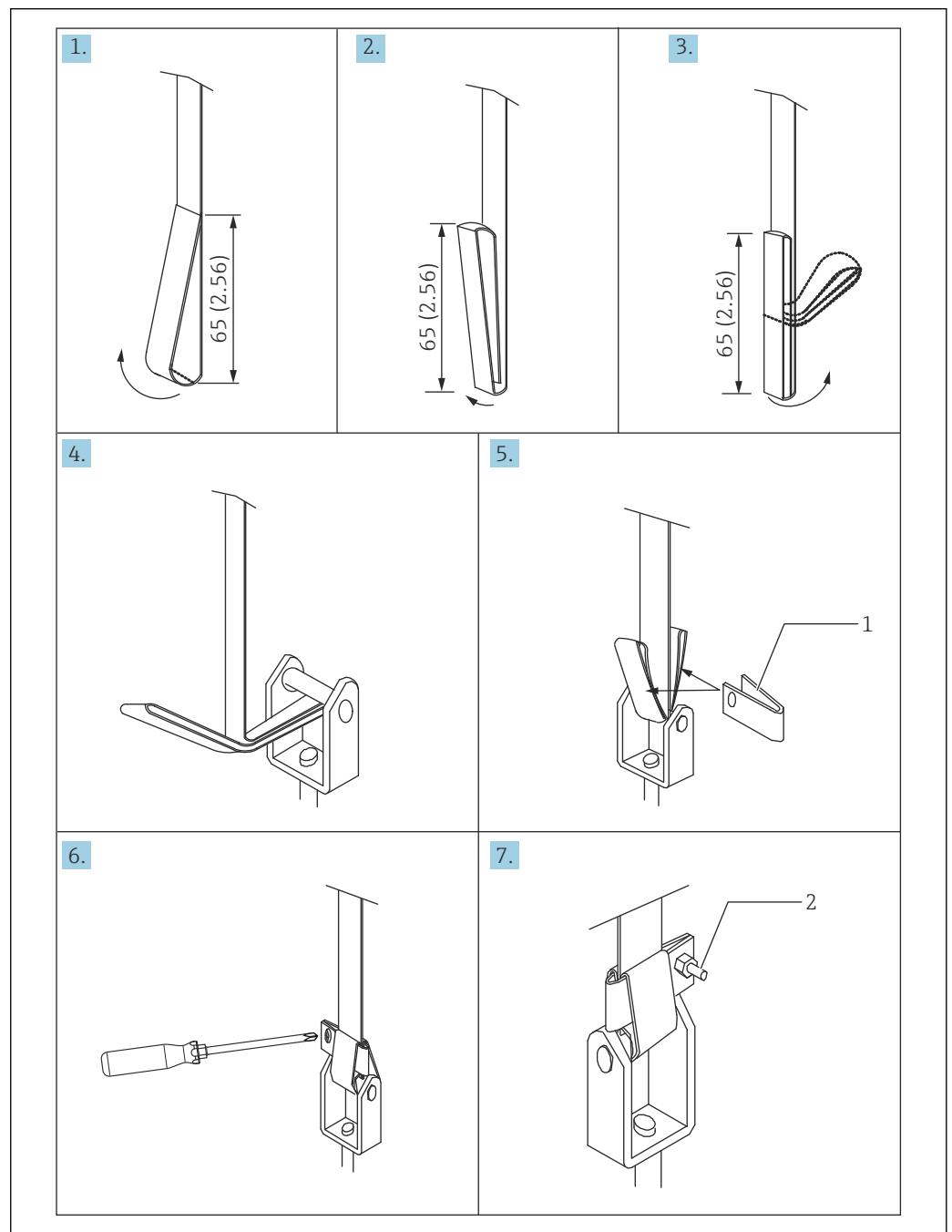
a Guide pipe



### 5.12.2 Measuring tape to float connection procedure

1. Bend the measuring tape at the length of 65 mm (2.56 in).
2. Bend the measuring tape once again at the length of 65 mm (2.56 in).
3. Bend the measuring tape, which has been folded twice, at the center.
4. Insert the joint shaft into the bent measuring tape.
5. Tighten the tape clamp with a bolt and a nut to secure it in place.
6. Pinch and crush the thread that is protruding to the nut side with a pair of pliers to prevent looseness.

This completes the connection procedure.



43 Measuring tape to float connection. Unit of measurement mm (in)

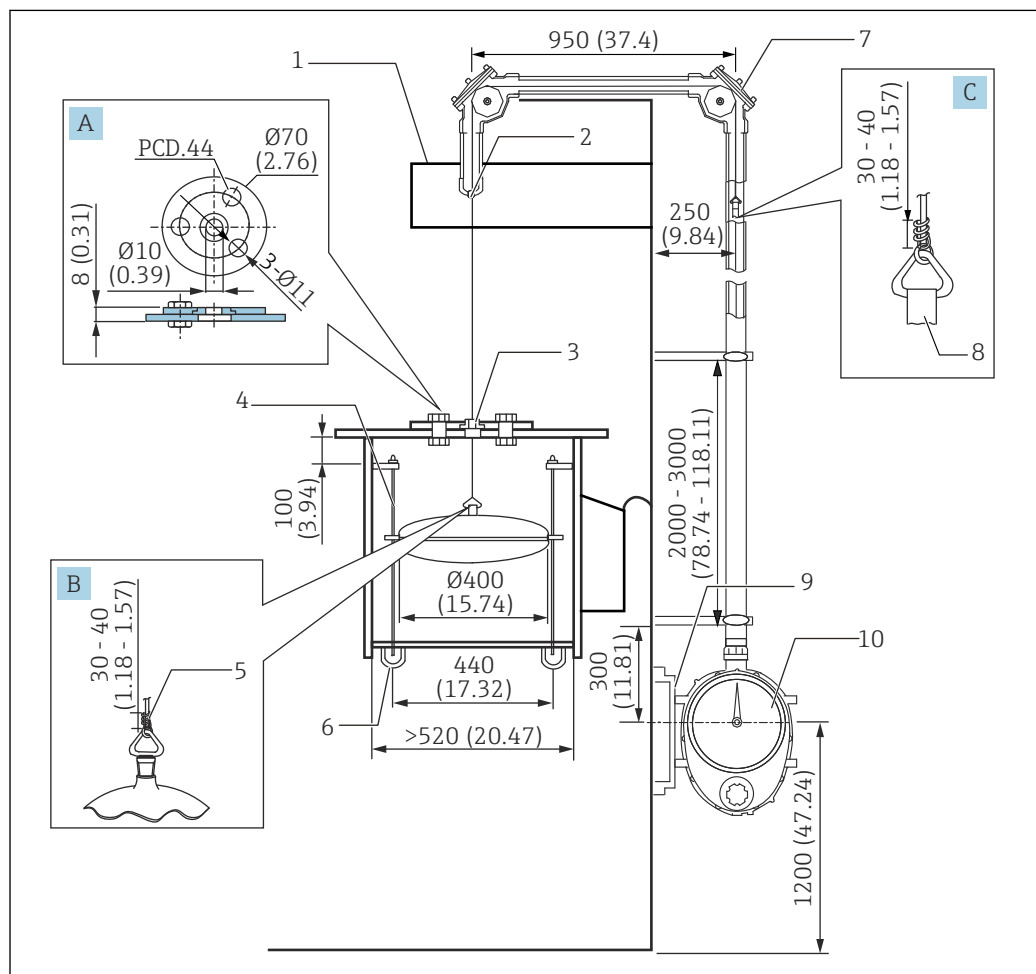
- 1 Measuring tape clamp
- 2 Screw thread

### 5.12.3 Floating roof tank

#### Mounting procedure

1. Insert the end of a measuring wire into the tank from the 90° sheave elbow on the gauge head and through the sheave elbow on the tank roof.
2. Temporarily secure the other end in place.
3. Connect the measuring wire to the float inside the tank.
4. Connect the measuring wire and the measuring tape once again at the top of the tank.
5. Make sure that the measuring tape is not twisted.
6. Close the sheave elbow cover.

This completes the mounting procedure.




A0041203


44 Mounting the measuring tape. Unit of measurement mm (in)

- A Wire guide metal
- B Top of the float
- C Measuring wire hook
- 1 Roof stand
- 2 Wire guide socket
- 3 FRT wire guide metal
- 4 Guide bar:  $\varphi 16$  mm (0.63)
- 5 Stainless steel wire (accessory)
- 6 Pipe end: 1<sup>B</sup> Sch 40 to 80
- 7 90° sheave elbow
- 8 Measuring tape
- 9 Gauge supporter
- 10 Gauge head

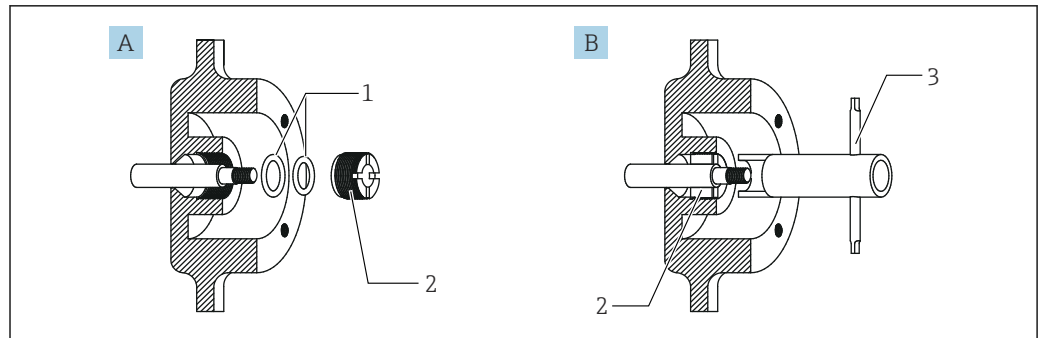
### 5.12.4 Medium/high-pressure tank

-  ■ Never bend or damage the measuring tape.
- Ensure that the measuring tape does not become twisted inside the tank or while the pipes are being laid out.
- Approximately half of the measuring tape is perforated with small holes at 20 mm (1 in) intervals. Install the measuring tape so that the perforated side is wound by the gauge.
- During the mounting process, ensure that the measuring tape and the measuring wire do not come off of the sheave elbow roller, and always inspect them after the mounting process.
- If the measuring tape must be passed through the 135 ° sheave elbow, ensure safety before mounting the measuring tape as the footing is poor and extremely dangerous.
- Inspect the joint between the float and the measuring tape once they are connected as this cannot be fixed once the tank is filled with liquid.

#### Mounting procedure

1. Fully open the gate valve by turning the handle counterclockwise, and remove the sheave elbow cover and the gauge rear cover.
  - ↳ Using the included gland fixing tool, remove the gland on the gauge head's rear cover.  
Remove the o-rings (two rings).
2. Remove the tape guide and the lock screw.
3. Insert one end of the measuring tape (non-perforated side) into the tank from the sheave elbow on top of the tank.
4. Pass the other end of the tape (perforated, looped side) through the sheave elbow on the gauge's side and insert it into the gauge.
5. Pass the inserted measuring tape through the dust-proof slit, fix it to the tape drum with a tape fixing thread and coil it around the tape drum twice.
6. Loosen the installation threads (two places) and adjust the position so that the measuring tape does not interfere with the dust-proof slit.
7. Pull the measuring tape inside the tank.
8. As for the length to the float, cut the measuring tape off, leaving approx. 1.5 mm (0.06 in).
9. Connect the measuring tape to the float.
  - ↳ For more information on the connection procedure, see →  57.
10. Make sure that the measuring tape is not twisted.
11. Close the sheave elbow cover.
12. Tighten the gland by following the diagram below.

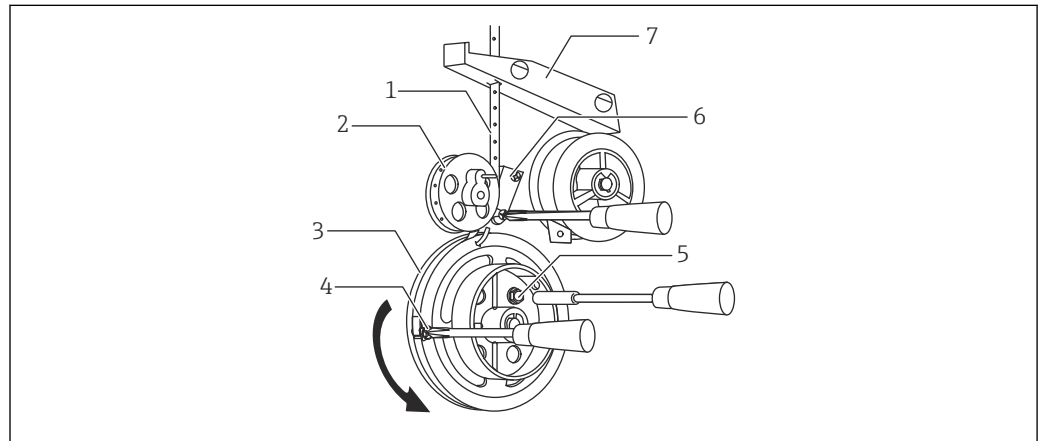
This completes the mounting procedure.



A0041212

45 Gland fixing tool

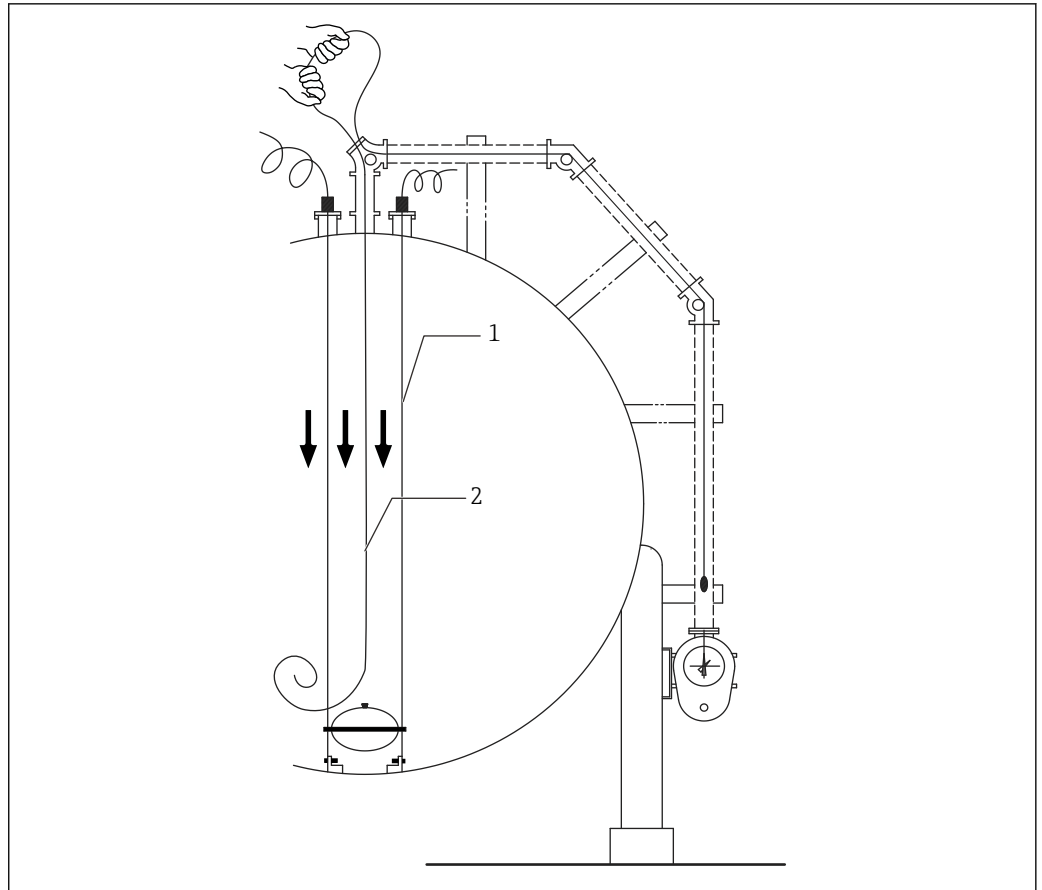
- A Before tightening
- B After tightening
- 1 O-ring
- 2 Gland
- 3 Gland fixing tool



A0041213

46 LT component parts

- 1 Measuring tape
- 2 Sprocket
- 3 Tape drum
- 4 Tape-holding thread
- 5 Lock screw
- 6 Tape guide
- 7 Dust protector



A0041214

47 Mounting the measuring tape

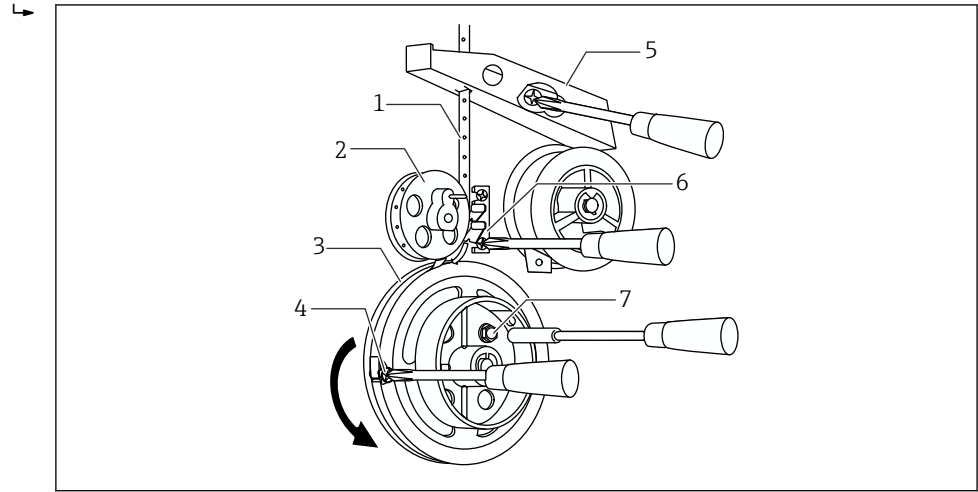
- 1 Guide wire
- 2 Measuring tape

**i** After connecting the measuring tape to the gauge head, cut the tape, leaving approx. 1.5 m (4.92 ft) from the float connection part.

### 5.12.5 Internal parts adjustment

#### Tape guide adjustment procedure

1. Turn the tape drum inside the gauge head in the direction of the arrow in the diagram below to make the measuring tape taut.



A0041215

48 Tape drum

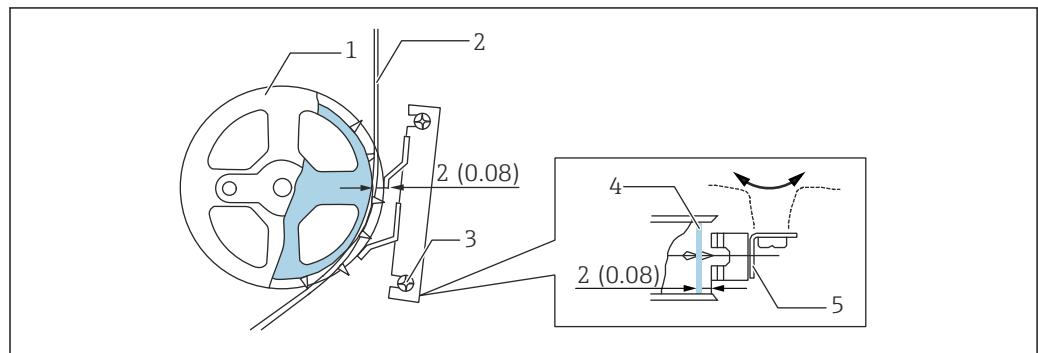
- 1 Measuring tape
- 2 Sprocket
- 3 Tape drum
- 4 Tape-holding thread
- 5 Dust protector
- 6 Tape guide
- 7 Lock screw

2. After the tape has been properly set, adjust the two tape guide heads so that they are positioned approx. 2 mm (0.08 in) from the measuring tape surface.

↳ The measuring tape may come off the sprocket pins due to sudden movement caused by waves of the liquid. The tape guide prevents this.

3. If a dust cover is installed, loosen the mounting threads (two places) and make adjustments so that the measuring tape does not interfere with the dust-proof slit.

This completes the adjustment procedure.



A0041216

49 Adjusting the tape guide. Unit of measurement mm (in)

- 1 Sprocket
- 2 Measuring tape
- 3 Mounting screws
- 4 Measuring tape
- 5 Tape guide

### 5.12.6 Mounting the conster

#### Mounting procedure

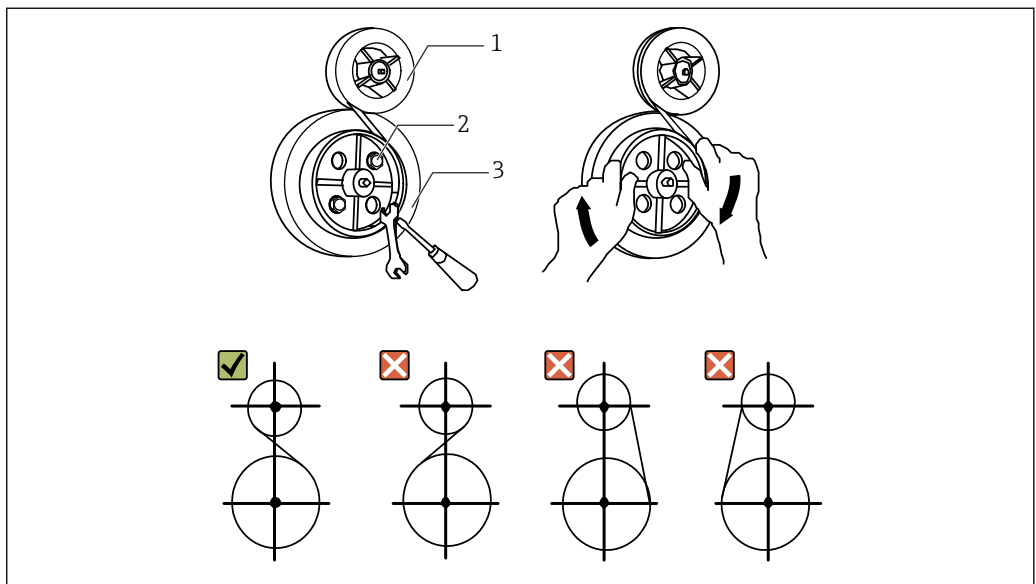
Mount the conster after mounting the measuring tape.

- i**
    - Mount the conster after mounting the measuring tape.
    - Never remove your hand when winding the conster. Letting it go may result in injury due to the spring recoiling.
    - Handle the conster with care as removing it from the large conster drum or applying excessive force may result in uneven torque generation, which may lead to inaccurate readings.
    - When winding the conster from the small conster drum to the large conster drum, keep a firm grip on the large conster drum until the force has been transferred to the measuring tape at the end.
1. After confirming that the lock screw has been removed, secure the head of the conster to the large conster drum with nuts and bolts.
  2. Rotate the large conster drum in the direction of the arrow.
  3. When securing the conster drum in place, rotate the tape drum counterclockwise to tighten the tape before securing the conster drum.
  4. If the tank is empty, wind the tape twice around the small conster drum and secure it with lock screws.
    - ↳ If there is liquid in the tank, measure the surface level of the liquid. Calculate the number of winding turns using the following equation, and turn the large conster drum based on the calculation result to wind and secure the tape in place.
  5. Close the gauge head cover.
  6. Close the gland of the LT5-4 or LT5-6 cover.

This completes the conster mounting procedure.

$$\text{Number of turns} = \frac{\text{Tank height (measuring span)} - \text{Actual liquid level}}{0.6 \text{ (unit: m)}}$$

A0041217-EN



A0041218

**50** Mounting the conster

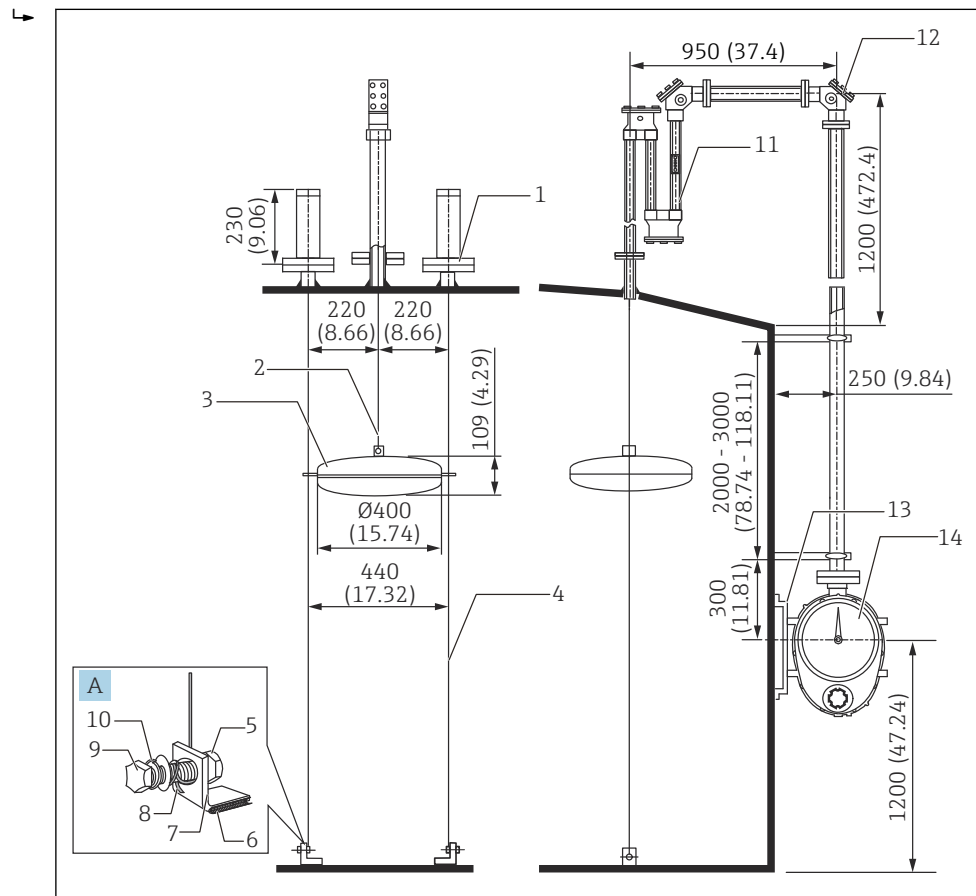
- 1 Small conster drum
- 2 Lock screw
- 3 Large conster drum

## 5.13 Liquid sealant for the seal pot

### 5.13.1 Filling the seal pot with liquid sealant (when installing a new gauge)

#### Liquid sealant filling procedure

1. Install the entire LT system, including the seal pot and float.
  - ↳ Parts of the drawing shown below may vary depending on the order code you have selected.
2. Hoist the float up and down manually to confirm that the dial (or counter) display changes accordingly.
  - ↳

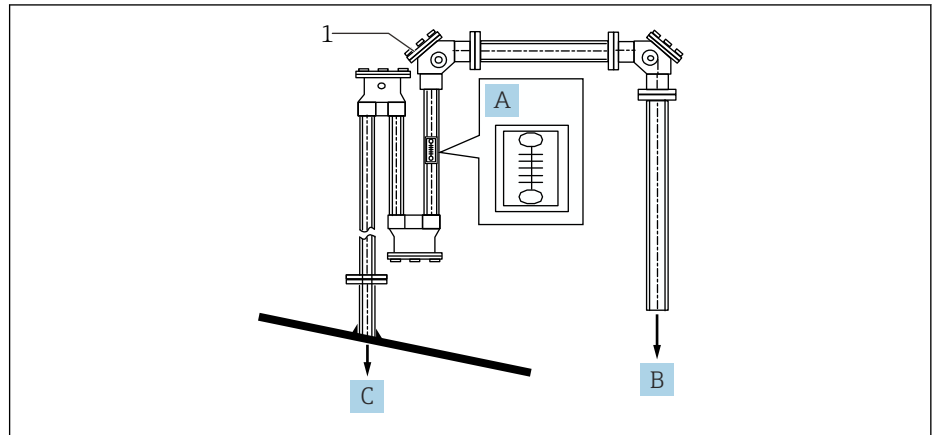


51 LT with seal pot. Unit of measurement mm (in)

- A Anchor hook
- 1 Top anchor
- 2 Measuring tape
- 3 Float
- 4 Guide wire
- 5 Nut
- 6 Wetted part (welded to the tank)
- 7 Anchor hook
- 8 Guide wire
- 9 Bolt
- 10 Washer
- 11 Seal pot
- 12 90° sheave elbow
- 12 Gauge supporter
- 13 Gauge head



3. After checking the operation of LT, remove the cover of the 90° sheave elbow for the seal pot and inject the liquid sealant.
  - ↳ Note that checking the operation of LT after filling it with liquid sealant may cause the liquid sealant to leak through the measuring tape.



A0041219

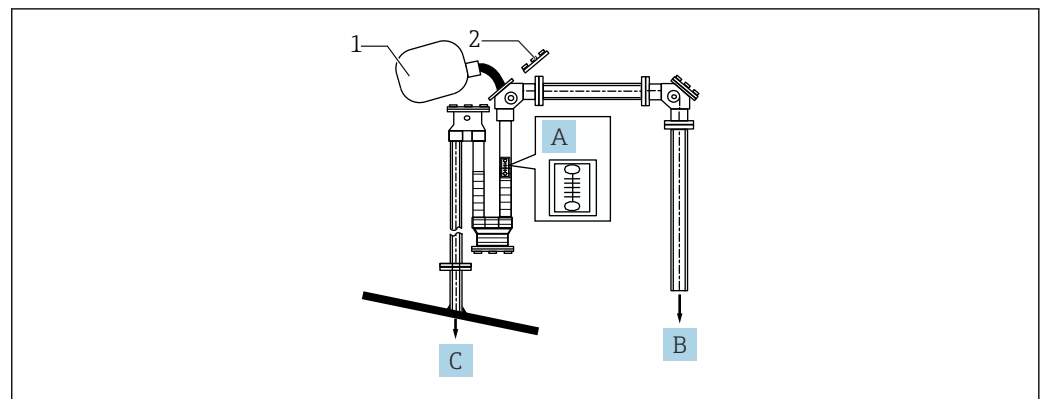
52 Filling with liquid sealant

- A Scale for liquid sealant
- B To the LT5 side
- C To the tank
- 1 90° sheave elbow

4. Fill up to the middle of the scale for liquid sealant.
5. Close the 90° sheave elbow cover.

This completes the liquid sealant filling process.

**i** Approx. 2 l (liters) of liquid sealant are included in the kit. This means that a small amount will remain in the bottle after the seal pot has been filled with the proper amount of liquid sealant. Do not discard the remaining liquid sealant as it is used as needed once the tank begins to operate.



A0041220

53 Amount of liquid sealant

- A Scale for liquid sealant
- B To the LT5 side
- C To the tank
- 1 Liquid sealant
- 2 90° sheave elbow cover

**i** If the tank is run without liquid sealant, the gas components inside the tank can erode the LT as well as the sheave elbow packing and o-rings and cause a malfunction. For this reason, always fill up with liquid sealant before running the tank.

### 5.13.2 Filling the seal pot with liquid sealant (when the gauge has already been installed)

#### Liquid sealant filling procedure

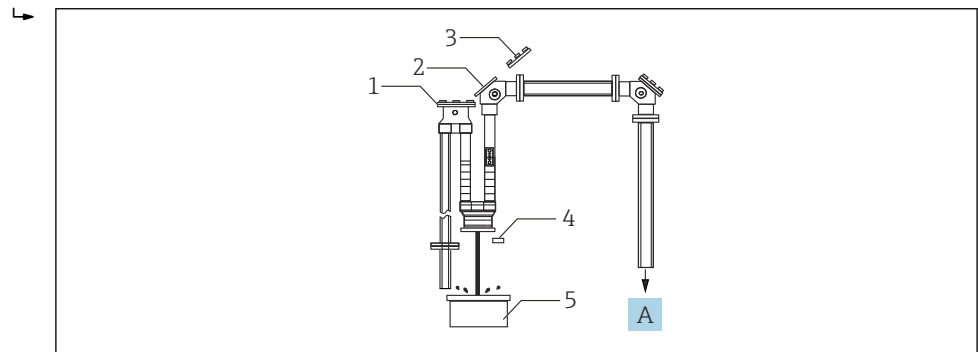
##### NOTICE

Used liquid sealant may be contaminated by the liquid inside the tank and turn into a hazardous substance.

► Never touch used liquid sealant with bare hands.

**i** Choose the material carefully for containers that are used as liquid sealant receptacles.

1. Set a container with a capacity of at least 2 l (liters) at the bottom of the drain.
2. After confirming the safety of the vicinity of the tank, remove the seal pot drain plug.
3. Drain the liquid sealant from the seal pot.
4. Open the 90° sheave elbow cover.



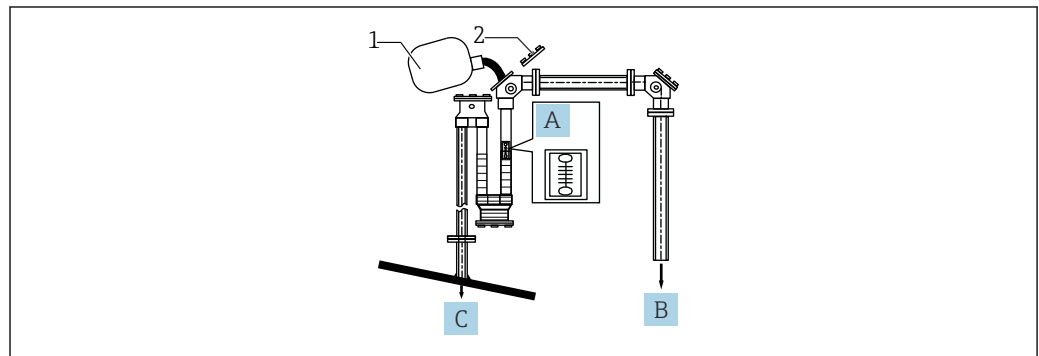
A0041230

54 Draining liquid sealant

- A To the LT5 side  
 1 Sheave elbow  
 2 90° sheave elbow  
 3 90° sheave elbow cover  
 4 Drain plug  
 5 Container that can hold at least 2 l

5. Close the drain plug and inject liquid sealant until it reaches the middle of the scale on the side of the seal pot.
6. Close the sheave elbow cover.

This completes the liquid sealant filling procedure.



A0041220

55 Filling with liquid sealant

- A Scale for liquid sealant  
 B To the LT5 side  
 C To the tank  
 1 Liquid sealant  
 2 90° sheave elbow cover

## 6 Commissioning

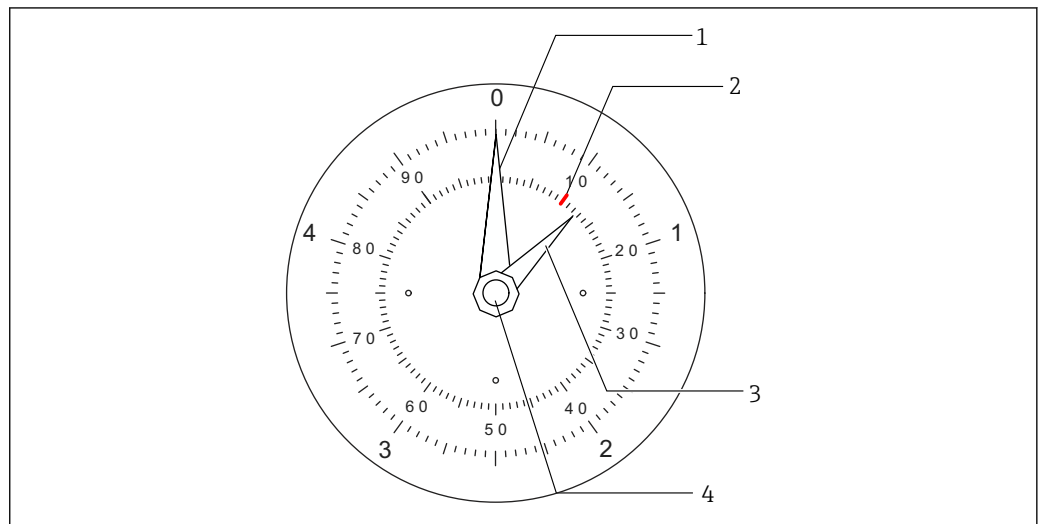
### 6.1 Dial display

#### Pointer setting and scale reading procedure

When calibrating (pointer setting) to the value that has been determined as the calculated value or measured value, the calibration procedure will vary depending on whether it is for a dial display or a counter display. Use a dial display when the tank height is no more than 20 m or 60 ft; for taller tanks, use a counter display.

1. Remove the indicator cover and loosen the cap nut.
  - ↳ Pull the short needle (yellow-green) forward while keeping the long needle (white) steady to free the short needle. Align the short needle with the inner scale (one scale notch: 1 mm (0.04 in)) so that it corresponds to the lower two digits of the liquid level.
2. Align the long needle with the outer scale.
  - ↳ Since one scale notch on the outer scale corresponds to 100 mm (3.94 in) of the liquid level, the outer scale is aligned visually based on the lower two digits of the liquid level.
3. After aligning the needles, tighten the cap nut firmly.
  - ↳ Use the long needle and the outer scale to read the 10 000 mm (393.7 in), 1 000 mm (39.37 in) and 100 mm (3.94 in) digits; use the short needle and the inner scale to read the 10 mm (0.34 in) and 1 mm (0.04 in) digits.  
Tightening torque: 0.315 N/m

This completes the indicator setting and scale reading process.



56 Dial display (scale plate for 5 m (16.4 ft))

- 1 Long needle (white)
- 2 Example: 10 mm position
- 3 Short needle (green)
- 4 Cap nut

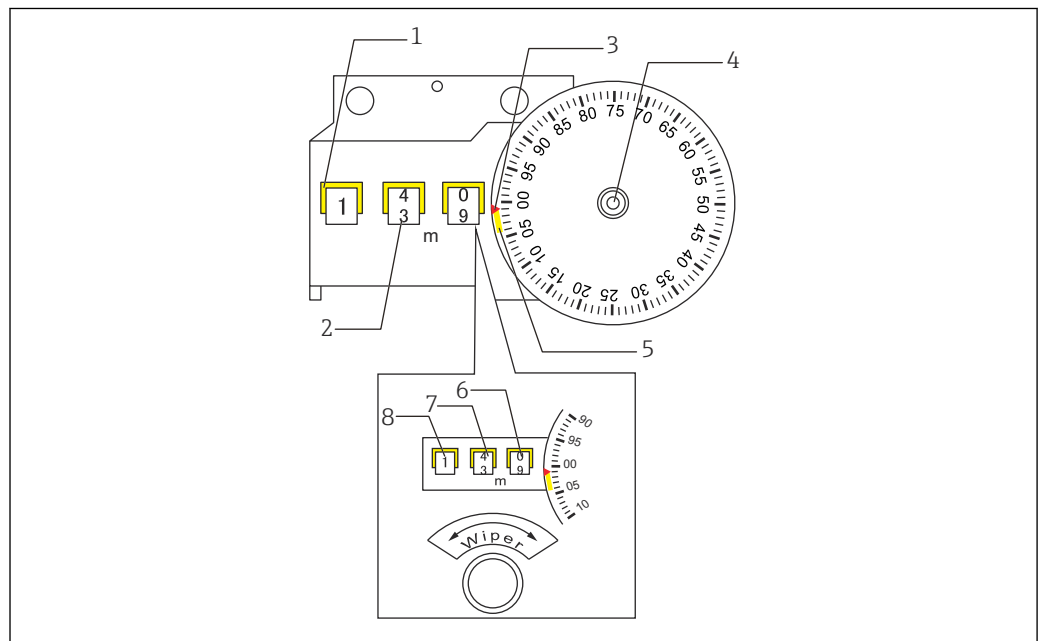
A0041231

## 6.2 Counter display

### Counter display procedure

- The scale plate (one scale notch: 1 mm (0.04 in)) can rotate freely.
  - The counter drum changes one digit on the first drum for every notch (100 mm (3.94 in)) the scale plate moves.
1. Remove the indicator cover.
  2. Loosen the thread at the center of the scale plate.
  3. Turn the scale plate so that the value on the counter drum matches the upper three digits of the liquid level.
  4. Align the scale plate so that the pointer corresponds to the lower two digits of the liquid level.
    - ↳ If the needle is pointing anywhere between 97 and 03 on the scale plate, the value on the counter drum will not change instantly. It will change gradually while maintaining a constant relationship between the scale plate and the rotation, and the counter will display half values. In order to prevent incorrect reading, the counter window and parts of the scale plate are color coded.

This completes the display procedure.



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57 Counter display

- 1 Counter (yellow)
- 2 Counter (black)
- 3 Pointer (red)
- 4 Thread
- 5 Range (yellow)
- 6 No. 1 drum
- 7 No. 2 drum
- 8 No. 3 drum

**i** When the pointer (red) is pointing towards the yellow section, the counter will read the value on the yellow side, and when it is pointing towards the black section, it will read the value on the black side.

(Example)

- Yellow: 14 000 mm (551.18 in)
- Black: 13 999 mm (551.14 in)

### 6.3 Indicator calibration

The following three methods can be used to calibrate indicators on level gauges, but a universal procedure applies to the operation of the indicators.

- Fill the tank with actual liquid and calibrate the indicator based on the measured volume
- With the tank empty, calibrate the indicator using formulaic calculations
- Fill the tank with water and calibrate the indicator based on the measured value

#### 6.3.1 Procedure for calibrating the indicator using actual liquid

In order to obtain reliable data, measure the liquid level two to three times using a measuring tape that has been officially certified to meet the tolerance as tested by a public institution ±0.3 mm (0.01 in) (however, ±1.2 mm (0.05 in)/10 m (32.81 ft)), and then calibrate the indicator based on the obtained data.

#### 6.3.2 Procedure for calibrating the indicator when the tank is empty

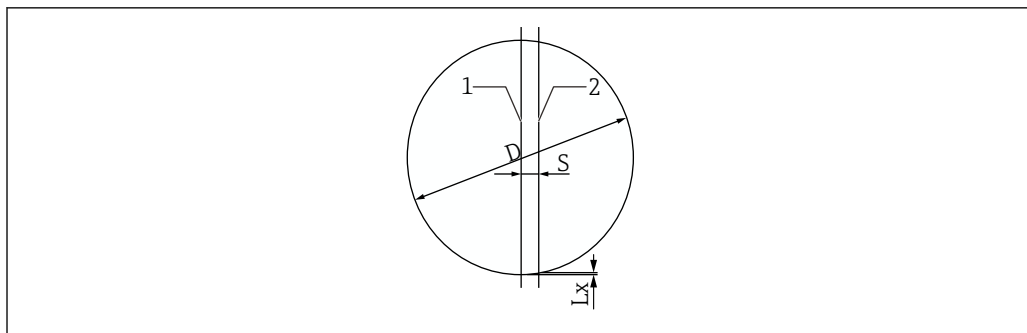
- Determine Lf from the equation below when the tank is empty and set the indicator to that value.
- When liquid level Lf is reached, the float will begin to gain buoyancy, the gauge will begin to run, and it will continue to indicate the accurate liquid level (see graphs 1 and 2).

1.	<b>Float draft when the tank is empty</b>				
$L_f = \frac{h}{2} + \frac{\frac{W - T}{\rho} - \frac{V}{2}}{S} = 80.11 \text{ mm}$					
Float diameter	D	400 mm (15.75 in)	Float height	h	200 mm (7.87 in)
Float mass	W	3 300 g (18.3 lb)	Float volume	V	19 200 cm <sup>3</sup>
Waterline cross section	S	1 256.64 cm <sup>2</sup>	Tape tension	T	1 200 g (2.65 lb)
Density of the measured liquid	ρ	1 g (0.002 lb)/cm <sup>3</sup>			

 Lf can be calculated by substituting density into the above equation.

If a float is being installed to a spherical tank away from the tank's center line, add Lx, which can be determined from the below equation, to Lf in 2 above.

$L_x = \frac{D}{2} - \sqrt{\frac{D^2}{4} - S^2}$	Lx	Correction amount for level indication for deviation caused by float installation
	D	Diameter of a spherical tank, etc.
	S	Deviation distance from the center of the tank to the center of the float (mm)



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58 Indicator calibration on a spherical tank

- 1 Center of the tank
- 2 Center of float installation

### 6.3.3 Procedure for calibrating the indicator when the tank is filled with water

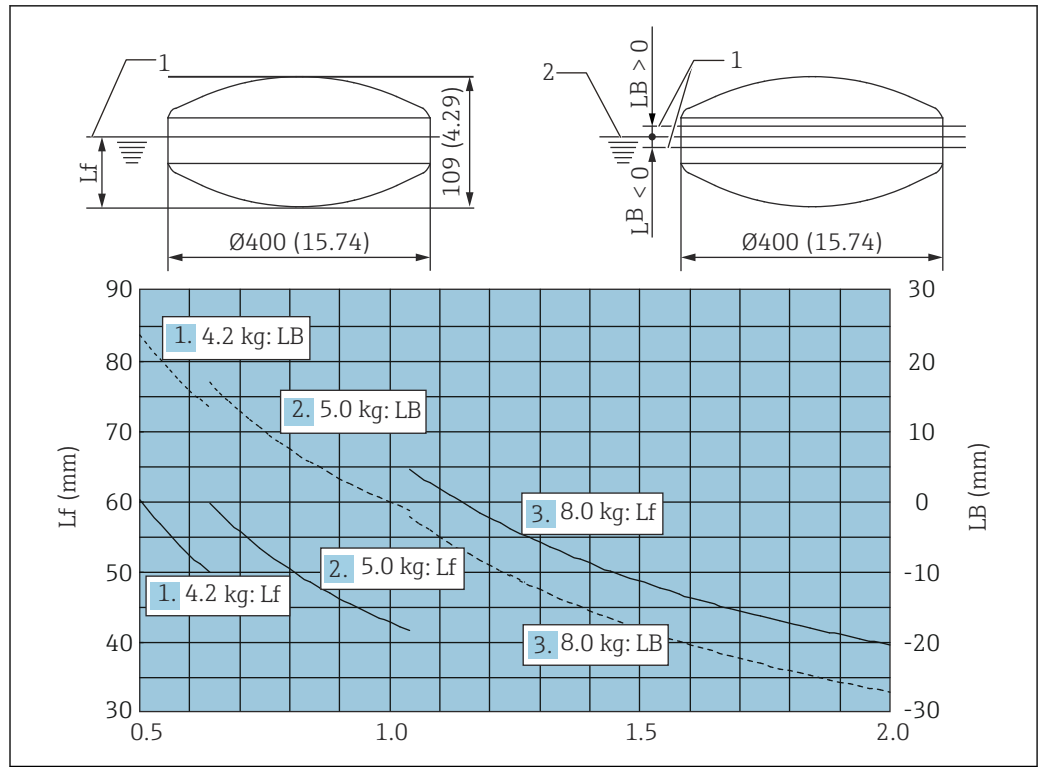
A water leakage test is generally performed when a tank is complete, but taking measurements after the tank has been filled with actual liquid is challenging. For this reason, the indicator is calibrated while the tank is filled with water and then it is readjusted when it is filled with actual liquid. In this case, the following equation is used to determine the difference in the initial floating position of the float when the tank is filled with water and actual liquid in order to correct the value that is indicated when the tank is filled with water.

**i** After setting the LT indicator to the measured value in water, determine  $L_B$  using the equation below. If  $L_B$  is a positive value, it is added to the determined indicator value, and if it is a negative value, it is subtracted from the determined indicator value to determine the final indicator value.

**Equation: For the  $\varnothing 400$  mm (15.75 in) float of LT5-1 5 000 g (11.02 lb)**

1. Float draft when the tank is empty					
$L_f = \frac{h}{2} + \frac{\frac{W - T}{\rho} - \frac{V}{S}}{2} = 42.88 \text{ mm}$					
Float diameter	D	400 mm (15.75 in)	Float height	h	109 mm (4.29 in)
Float mass	W	5 000 g (11.02 lb)	Float volume	V	10 520 cm <sup>3</sup>
Waterline cross section	S	1 256.64 cm <sup>2</sup>	Tape tension	T	1 200 g (2.65 lb)
Density of the measured liquid	$\rho$	1 g (0.002 lb)/cm <sup>3</sup> (assuming "empty = water")			

2. Correction of indicated value with simulated actual liquid					
$L_b = L_f \text{ (water)} - L_f \text{ (actual liquid)} = 56.50 \text{ mm}$					
Float diameter	D	400 mm (15.75 in)	Float height	h	109 mm (4.29 in)
Float mass	W	5 000 g (11.02 lb)	Float volume	V	10 520 cm <sup>3</sup>
Waterline cross section	S	1 256.64 cm <sup>2</sup>	Tape tension	T	1 200 g (2.65 lb)
Density of the measured liquid	$\rho$	0.8 g (0.001 lb)/cm <sup>3</sup> (actual liquid)			



59 Graph of LT5-1 φ400 mm (15.75 in) float: Density of the measured liquid ρ (g/cm³). Measurement unit: mm (in)

- 1 Draft surface at density ρ
- 2 Water (draft surface when the density is 1.0 g (0.002 lb)/cm³)

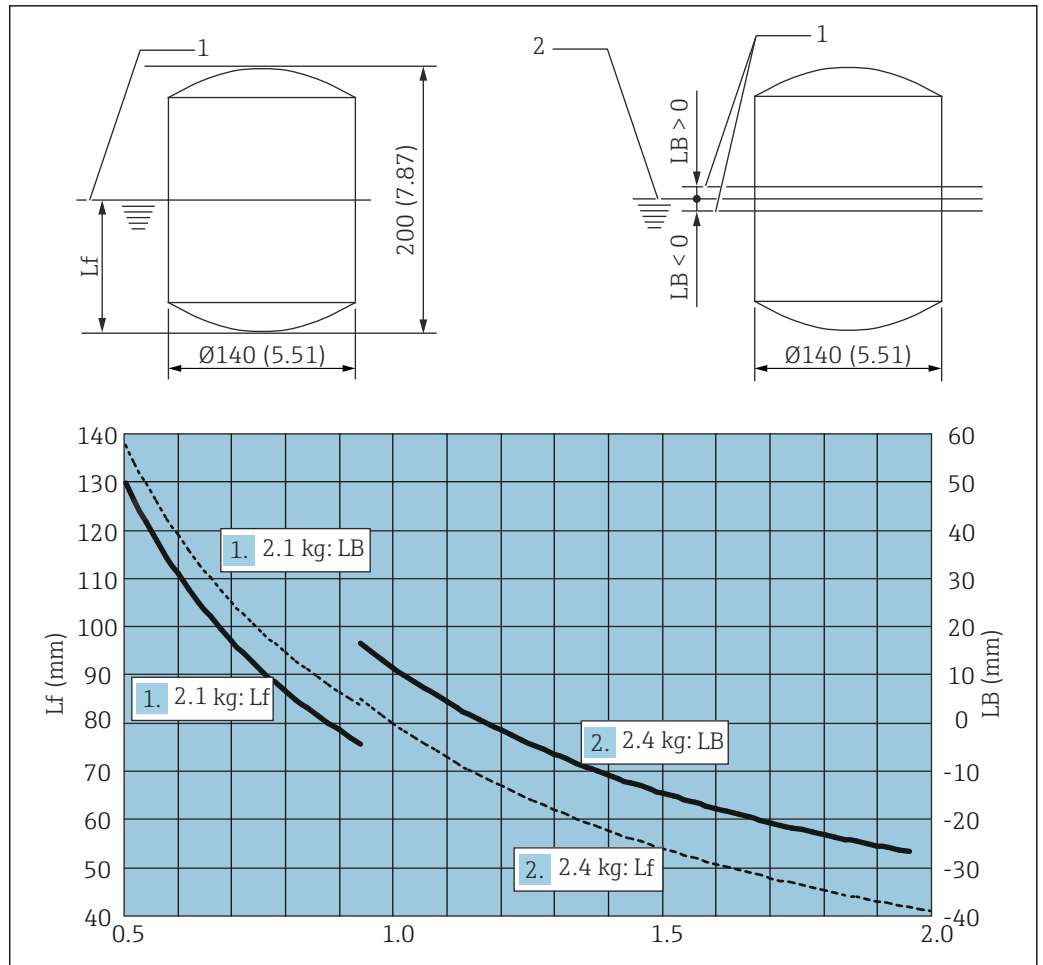
**Equation: For the φ140 mm (5.51 in) float of LT5-1 2 100 g (4.63 lb)**

Change the values used in the equation according to the float.

1. Float draft when the tank is empty					
$L_f = \frac{h}{2} + \frac{\frac{W - T}{\rho} - \frac{V}{2}}{S} = 72.03\text{mm}$					
Float diameter	D	140 mm (5.51 in)	Float height	h	200 mm (7.87 in)
Float mass	W	2 100 g (4.63 lb)	Float volume	V	2 661.2 cm³
Waterline cross section	S	153.94 cm²	Tape tension	T	1 200 g (2.65 lb)
Density of the measured liquid	ρ	1 g (0.002 lb)/cm³ (assuming "empty = water")			

2. Correction of indicated value with simulated actual liquid					
$L_b = L_f (\text{water}) - L_f (\text{actual liquid}) = 14.61\text{ mm}$					
Float diameter	D	400 mm (15.75 in)	Float height	h	109 mm (4.29 in)
Float mass	W	5 000 g (11.02 lb)	Float volume	V	10 520 cm³
Waterline cross section	S	1 256.64 cm²	Tape tension	T	1 200 g (2.65 lb)
Density of the measured liquid	ρ	0.8 g (0.001 lb)/cm³ (actual liquid)			





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60 Indicator value when the tank is filled with water. Measurement unit: mm (in)

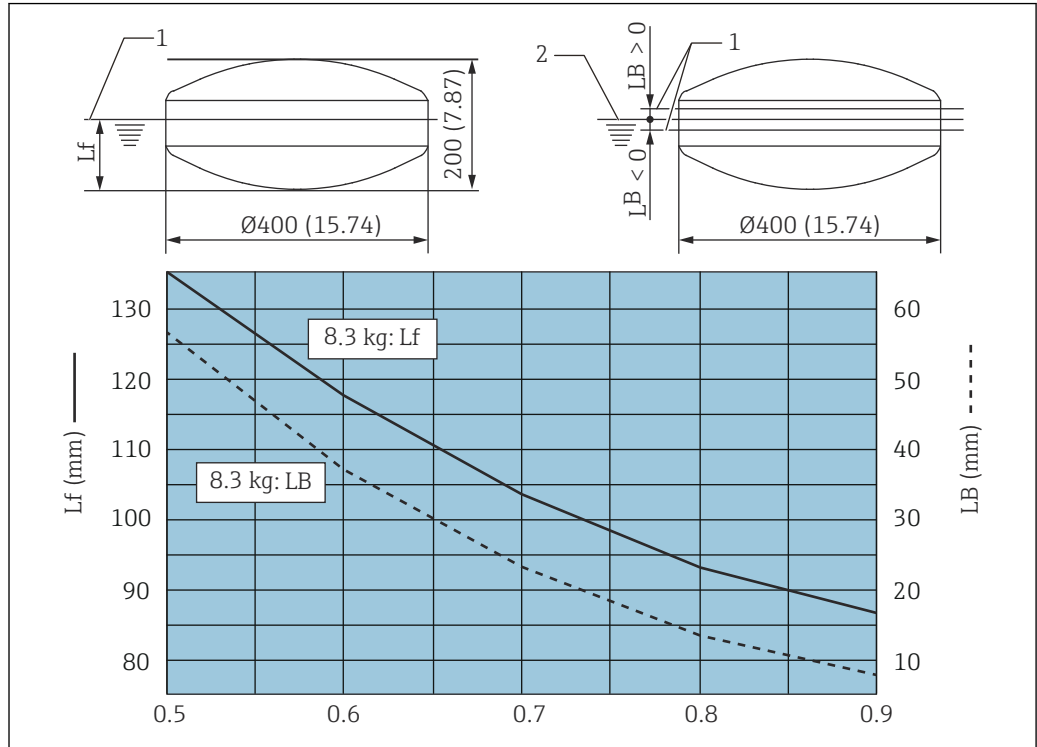
- 1 Draft surface at density  $\rho$
- 2 Water (draft surface when the density is 1.0 g (0.002 lb)/cm<sup>3</sup>)

**Equation: For the  $\phi$ 400 mm (15.75 in) float of LT5-4/LT5-6 8300 g (18.30 lb)**

1. Float draft when the tank is empty					
$L_f = \frac{h}{2} + \frac{\frac{W - T}{\rho} - \frac{V}{S}}{2} = 80.11\text{mm}$					
Float diameter	D	400 mm (15.75 in)	Float height	h	200 mm (7.87 in)
Float mass	W	8300 g (18.30 lb)	Float volume	V	19200 cm <sup>3</sup>
Waterline cross section	S	1256.64 cm <sup>2</sup>	Tape tension	T	1200 g (2.65 lb)
Density of the measured liquid	$\rho$	1 g (0.002 lb)/cm <sup>3</sup> (assuming "empty = water")			

2. Correction of indicated value with simulated actual liquid					
$L_b = L_f (\text{water}) - L_f (\text{actual liquid}) = 56.50\text{mm}$					
Float diameter	D	400 mm (15.75 in)	Float height	h	200 mm (7.87 in)
Float mass	W	8300 g (18.30 lb)	Float volume	V	19200 cm <sup>3</sup>

2. Correction of indicated value with simulated actual liquid					
Waterline cross section	S	1256.64 cm <sup>2</sup>	Tape tension	T	1200 g (2.65 lb)
Density of the measured liquid	$\rho$	0.5 g (0.001 lb)/cm <sup>3</sup> (actual liquid)			



61 Graph of LT5-4/LT5-6  $\varnothing 400$  mm (15.75 in) float: Density of the measured liquid  $\rho$  (g/cm<sup>3</sup>).  
Measurement unit: mm (in)

- 1 Draft surface at density  $\rho$
- 2 Water (draft surface when the density is 1.0 g (0.002 lb)/cm<sup>3</sup>)

## 6.4 Handling the gauge in water leak/airtightness tests and at gauge startup

When accidents such as damage to a measuring tape occur in a high-pressure tank such as a liquefied gas tank, not only do they have a grave impact on the operation of the tank, but repair work can also be very costly. It has been our experience that most issues involving damaged measuring tapes arise during the testing phase or in the initial operation of the tank. To prevent such incidents, be sure to complete the following procedures. By taking these steps, accidents in the early stage of operation can be avoided.

- For high-pressure tanks, always open the gate valve when performing a water leak test on the tank and set the LT to measurement mode. Failure to do so may result in damaged measuring tape.  
If you notice that the gate valve has not been opened after you started to fill the tank with water, either drain the water or open the sheave elbow cover and open the gate valve while applying a brake to the measuring tape with your hand, and allow the LT to gradually wind the measuring tape.
- When performing a water leak test, partially open the water-feed valve and slowly fill the tank with water until a depth of approx. 500 to 1000 mm (19.69 to 39.37 in) is reached.
- Filling with a large amount of water may damage the measuring tape. If the float is near the water inlet, install a wave guard to protect the float from being directly affected by the water surface.
- When performing an airtightness test on LT with the gate valve open, check the following LT parts in advance to ensure that they have been tightened. Failure to tighten the following parts will cause a massive release of air that will generate ultra high-speed air flow near the gate valve, causing the measuring tape to become damaged from vibration.
  - Drain plug on the bottom of the LT main body
  - Rear cover bolts
  - Gland of the gauge head rear cover
  - Elbow covers
- When opening the LT rear cover after an airtightness test, check to make sure that the tank's internal pressure is atmospheric pressure or that the gate valve is closed before opening the LT.  
Never open the LT or a sheave elbow cover in an attempt to quickly release the compressed air from the airtightness test. This will damage the measuring tape.
- Always open the gate valve when injecting actual liquid such as liquefied gas into a tank. The gate valve should only be closed in case of an emergency or when the liquid level is steady.

## 7 Operation

### 7.1 Using a check handle

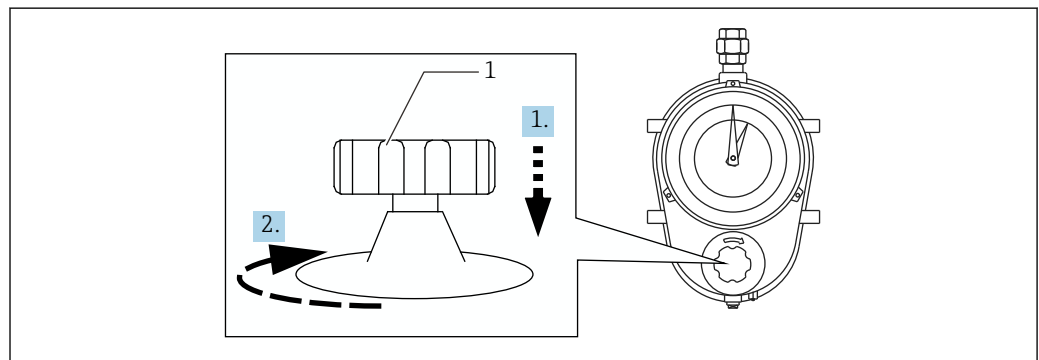
A check handle is used to confirm that LT operates properly.

- i** Use the check handle to verify the operation after the tank has been filled with liquid.
  - The check handle is not a float hoist handle. Do not forcibly hoist the float using the check handle.
  - For using a hoist handle, see → 76

#### Procedure for using the check handle

1. The check handle is located at the bottom of LT's main body. Push the check handle into the LT.
2. Return it to the left side when it points to 4 to 5 mm (0.16 to 0.20) above the indicator on the scale plate, and let go of the check handle.
3. Check the indicator on the LT's scale plate.

This completes the procedure for using the check handle.



62 Check handle

1 Check handle

### 7.2 Using a hoist handle

#### 7.2.1 Hoist handle (for LT5-1)

A hoist handle is used to hoist up the float when it is not being used to measure the liquid level. This helps to add life to LT when utilized for tanks with a stirrer and/or for tanks containing corrosive liquid.

- i** Never let go of the handle when hoisting or lowering the float. Letting go of the hoist handle may cause the float to fall and damage LT.
  - Stop turning the handle once the float has reached the liquid level after being lowered down.
  - When the hoist handle reaches position A in the following diagram, the float will be freed from the handle. Remove the handle while the float is in use.

**Hoisting procedure**

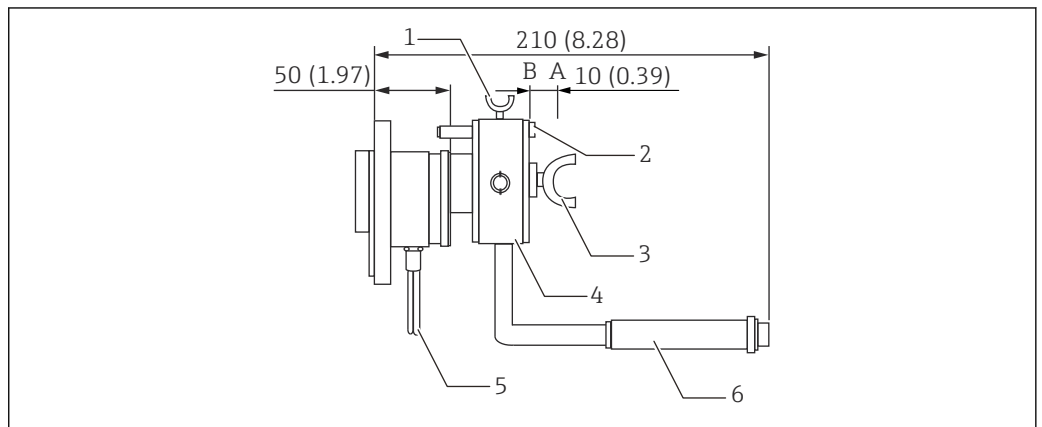
1. Secure the handle onto the knob using a wing bolt.
2. Push in the knob while pulling the puller, and release the puller once it has been fully pushed in to position B.
3. Confirm that the knob is securely positioned in position B, turn the handle counterclockwise at a rate of approx. one rotation every two seconds.
4. To stop the hoisting process in the middle, push in the stopper to the deepest level and secure it with a wing bolt.
5. Slowly put the handle back and push the stopper against the main body.
  - ↳ The float will not fall even when you let go of the handle.
  - Remove the handle when the hoist operation is complete.

This completes the hoisting procedure.

**Lowering procedure**

1. Insert the handle into the knob and secure it as shown in the diagram. Turn it counterclockwise slightly and then loosen the wing bolt. Return the stopper to its place and secure it with the wing bolt.
2. Rotate the handle clockwise.
  - ↳ The float will be lowered. Once the float reaches the liquid surface, the force on the handle will decrease suddenly and the LT indicator will stop. Do not rotate the handle any further.
3. Once the lowering process is complete, pull out the knob while retracting the puller, and let go of the puller once it reaches position A.
4. Remove the handle when the lowering operation is complete.

This completes the lowering procedure.



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63 Hoist handle (LT5-1). Unit of measurement mm (in)

- 1 Wing bolt 1
- 2 Stopper
- 3 Wing bolt 2
- 4 Knob
- 5 Puller
- 6 Handle

### 7.2.2 Hoist handle (for LT5-4/LT5-6)

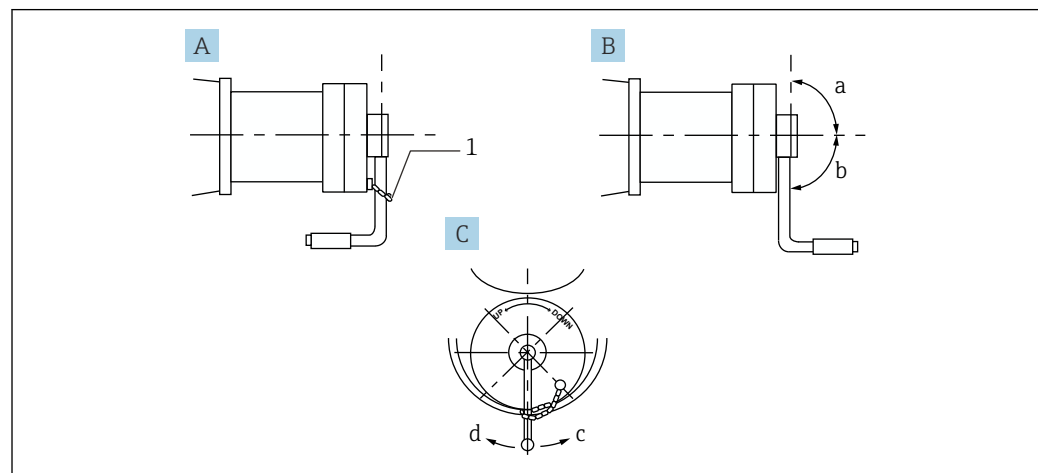
A hoist handle is used to hoist up the float when it is not being used to measure the liquid level. This helps to add life to LT when utilized for tanks with a stirrer and/or for tanks containing corrosive liquid.

- i** ■ Do not let go of the handle when hoisting or lowering the float. Letting go of the hoist handle may cause the float to fall and damage LT. If you must let go of the handle during the operation, lock the hoist handle.
  - Do not tilt the hoist handle more than 90 ° towards its axis. This may damage the float, tape and/or the conster.

#### Hoisting/lowering procedure

1. Remove the lock chain.
2. Slowly turn the handle to gradually rotate it 180 ° towards the axis.
  - ↳ The tape drum gear and the hoist shaft gear will begin to engage at 90 °.
3. Once the handle has been rotated to position B, rotate the handle counterclockwise to hoist the float.
4. Once the hoisting operation is complete, always secure the handle with a lock chain before letting go of the handle (see C).
  - ↳ Remove the lock chain when lowering the float.
5. Rotate the handle clockwise to lower the float.
  - ↳ Once the float reaches the liquid surface, the pointers or the counter display will stop at the current liquid level.
6. Once the lowering operation is complete, rotate the handle 180 ° towards the axis to put it in measurement mode.
7. To maintain the measurement mode, wrap the lock chain once or twice around the handle and place the hook on the end on a ring near the screw (see A).

This completes the hoisting/lowering procedure.



64 Hoist handle (LT5-4/LT5-6)

- A During measurement
- B During hoisting or lowering
- C Front
- a Dislodged gear
- b Meshed gear
- c Hoisting
- d Lowering
- 1 Lock chain

## 8 Diagnostics and troubleshooting

### 8.1 General troubleshooting

#### 8.1.1 Failure causes and countermeasures

Errors	Possible causes	Corrective measures
Indicator does not change at all	Severed measuring tape	Open the tank and replace the measuring tape.
	Float is caught on a guide wire	Open the tank and replace the guide wire if necessary.
	Breakage of conster	Replace the conster.
	Check handle is caught	Open the rear cover of the gauge, and perform a repair and inspection.
	Wear and tear of transmission gear connected to the indicator	Replace the entire reduction gear in the indicator unit.
	Improper sprocket setting or dislodged measuring tape	Open the rear cover of the gauge and inspect.
	Sunken float	Open the tank and replace the float.
Frequent indication error	Deterioration of conster	Check the variation in the indication values by operating the check handle. If the conster has deteriorated, replace the conster.
	Same as 2, 4, 5 and 6 above	Check the internal parts of the gauge head.
	Loosening of indicator pointer	Remove the indicator cover and inspect the pointer's cap nut.
	Improper setting of tape guide	Check the gap between the sprocket and tape guide.
	Twisted measuring tape	Open the sheave elbow cover and forcibly pull out the measuring tape to inspect it, and repair it if necessary.
Discrepancy between measured value and indicated value	Problem with the gauge	Perform the inspection and implement the countermeasures as described in the previous section.
	No problem with the gauge	Various measurement-related problems
		Effect of measurement techniques
		Effect of sludge deposition
		Effect of strong winds
Error in measurement scale		
Check handle does not rotate or return to position	Check shaft has rusted	Clean the shaft and replace the entire check handle unit.
	Spring in check unit has deteriorated	Replace the spring.
Check handle does not work (LT5-4/LT5-6)	Set screw of check handle is loose	Tighten the set screw.
	Breakage of check driver spring	Replace the entire check unit.
	Spring is caught in tape drum and does not move	Repair the check unit by hand or replace the entire unit.
Gas leak (LT5-4/LT5-6)	Compromised airtightness at junction of gauge head's rear cover	Replace packing or apply seal-end agent on the junction.
	Compromised airtightness at check handle shaft	Replace the seal metal.

## 9 Maintenance

### 9.1 Maintenance work

#### 9.1.1 Before performing maintenance

- i** ■ Exercise due caution when working with flammable liquid tanks. Allow flammable liquids plenty of time to diffuse before performing maintenance (see table below).
- When working with flammable liquid tanks, wear anti-static clothing, safety shoes and gloves.
- Perform maintenance in the presence of a safety supervisor.

Conductivity of charging material (S/m)	Flammable liquid (example)	Volume of charging material (m <sup>3</sup> )			
		10 or less	10 to 50	50 to 5000	5000 or more
10 <sup>-8</sup> or higher	Acetic acid Ethanol Ethyl chloride Methanol Light oil	1 minute or longer	1 minute or longer	1 minute or longer	1 minute or longer
10 <sup>-12</sup> to 10 <sup>-8</sup>	Vinyl acetate Toluene Benzene Gasoline	2 minutes or longer	3 minutes or longer	10 minutes or longer	30 minutes or longer
10 <sup>-14</sup> to 10 <sup>-12</sup>	Methyl cyclohexane	4 minutes or longer	5 minutes or longer	60 minutes or longer	120 minutes or longer
10 <sup>-14</sup> or lower	Carbon tetrachloride	10 minutes or longer	10 minutes or longer	120 minutes or longer	240 minutes or longer
		<p>Unit of measurement mm (in)</p>	<p>Unit of measurement mm (in)</p>	<p>Unit of measurement mm (in)</p>	



## 9.2 Periodical inspection

Follow the table below to perform the periodical inspection.

Products/parts	Inspection item	Inspection method
Gauge head (for all LT)	Corrosion check and cleaning of tape protective pipe	Open the gauge head's rear cover and check for rust deposition.
		If necessary, remove rust by tapping the protective pipe with a wooden hammer.
	Reduction gear engagement and bearing	Remove the indicator cover and rotate the reduction gear to see if the engagement backlash is within 1 mm (0.04 in).
		Check the wear and tear of the bearing in the same manner.
	Friction on tape drum and sprocket	After opening the gauge head's rear cover, check the bearings of drums for wear, corrosion or dust. Clean them as needed.
	Characteristic change of conster	Use the check handle to investigate. If the indicated value is not consistent, remove any deposits on the conster.
		If this does not fix the problem, replace the conster with a new one.
Condensation and fogging of the indicator window	Check to ensure that the indicator cover is tightened firmly and that there is no foreign matter embedded on the packing surface.	
Inspection of the check handle	Check to ensure that the check handle returns to the original position after it has been pushed in and then released.	
Gauge head (LT5-4/LT5-6)	Inspection of the check handle unit	Inspect the check spring inside the gauge head for any deformations and operation condition.
	Inspection of magnetic coupling	Remove the sprocket and completely remove any rust or debris (once to twice a year).
	Leakage inspection of the gauge head packing	Check the airtightness using soap water.
Sheave elbow	Sheave elbow friction	Remove the measuring tape from the roller surface of a sheave elbow and check to ensure that it rotates smoothly.
		Remove the bearing and check for wear.
		Clean any deposits from the guide roller.

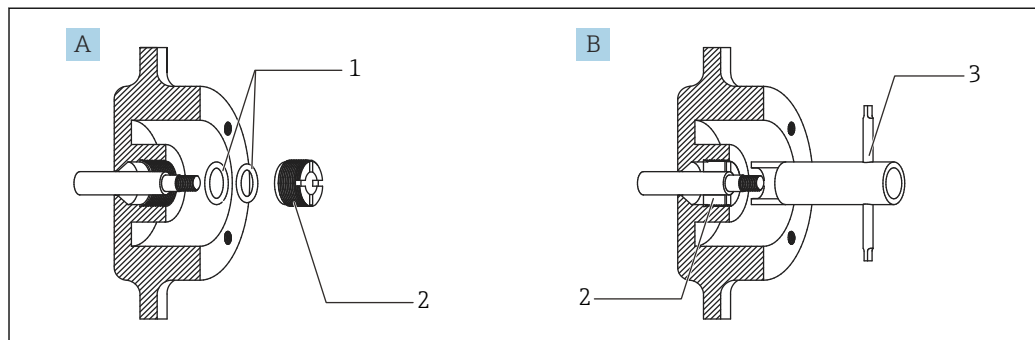
### 9.3 Replacement of o-rings for transmitters (LT5-4/LT5-6)

If there is gas leakage from the LT's main body side, the sealing o-rings must be replaced. The following steps must be performed carefully due to the tank being under pressure from within.

#### Replacement procedure

1. Close the gate valve at the top of the tank.
2. Gradually release the remaining pressure inside the LT and pipes until the pressure is completely released.
3. Remove all attached disks.
4. Remove the transmitter if attached.
5. Remove the coupling on the LT side. Remove the gland using the included gland fixing tool and remove the two o-rings.
6. While replacing the o-rings, replace any other worn parts as well.
7. Replace the o-rings and then tighten the gland. Reassemble the unit by following the above instructions in reverse order.
8. Slowly open the gate valve.
  - ↳ Opening the gate valve abruptly will generate high-speed airflow that may damage the measuring tape.

This completes the replacement procedure.



65 Replacement of o-rings

- A Before tightening  
 B After tightening  
 1 O-ring  
 2 Gland  
 3 Gland fixing tool

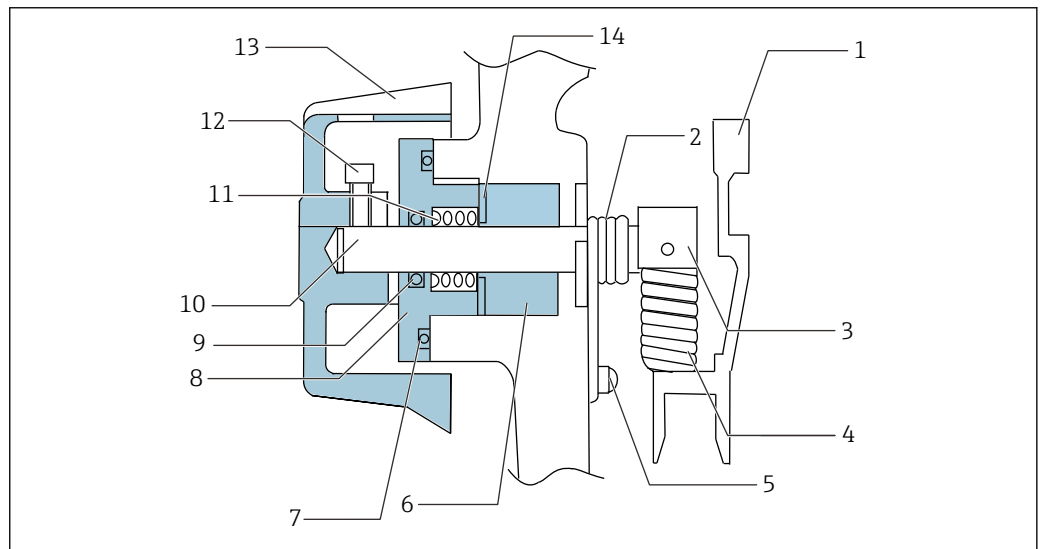
## 9.4 Replacement of the check handle unit (LT5-4/LT5-6)

The check handle unit is an important mechanism for checking the LT's operation status, and it is prone to wear and tear as it is used frequently. It is designed so that each part can be replaced easily if it becomes worn.

### Replacement procedure

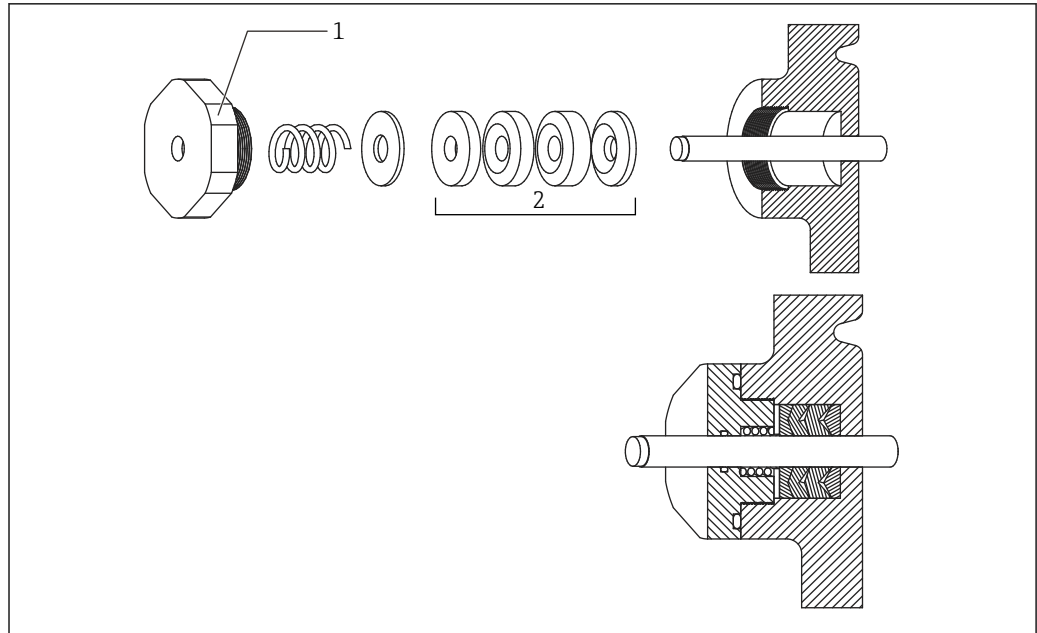
1. Remove the LT rear cover and the tape drum.
2. Loosen the socket head screw on the check handle and remove the check handle.
3. Remove the gland clamp with a No. 46 spanner or a monkey wrench.
4. Remove the gland spring, collar and seal metal.
5. Pull out the check shaft towards the tape drum.
6. Once the part has been replaced, reassemble by following the above instructions in reverse order.

This completes the replacement procedure.



66 Naming on the check handle unit

- 1 Tape drum
- 2 Check spring
- 3 Check boss
- 4 Spring
- 5 Spring holding thread
- 6 Seal metal
- 7 O-ring
- 8 Gland clamp
- 9 O-ring
- 10 Check shaft
- 11 Gland spring
- 12 Socket head screw
- 13 Check handle
- 14 Collar



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67 Check handle unit

- 1 Gland clamp
- 2 Seal metal

## 10 Repair

### 10.1 General information on repairs

#### 10.1.1 Repair concept

The Endress+Hauser repair concept assumes that the devices have a modular design and that repairs can be done by the Endress+Hauser Service Department or specially trained customers.

Spare parts are contained in suitable kits. They also come with relevant replacement instructions.

For more information on service and spare parts, contact the Service Department at Endress+Hauser.

#### 10.1.2 Repairs to Ex-approved devices

When carrying out repairs to Ex-approved devices, note the following:

- Repairs to Ex-approved devices may only be carried out by trained personnel or by the Endress+Hauser Service.
- Comply with the prevailing standards, national Ex-area regulations, Safety Instructions (XA) and certificates.
- Only use original spare parts from Endress+Hauser.
- When ordering a spare part, note the device designation on the nameplate. Only replace parts with identical parts.
- Carry out repairs according to the instructions. On completion of repairs, carry out the specified routine test on the device.
- Only Endress+Hauser Service may convert a certified device into a different certified variant.
- Document all repair work and conversions.

### 10.2 Spare parts


Some interchangeable device components are listed on an overview sign in the connection compartment cover.

The spare part overview sign contains the following information:

- A list of the most important spare parts for the device, including their ordering information
- The URL for the *W@M Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)):  
All the spare parts for the device, along with the order code, are listed here and can be ordered. If available, users can also download the associated Installation Instructions.

### 10.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

 Your Endress+Hauser Sales Center can provide detailed information on the services.

## 10.4 Return

The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the website for more information:  
<http://www.endress.com/support/return-material>
2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

## 10.5 Disposal

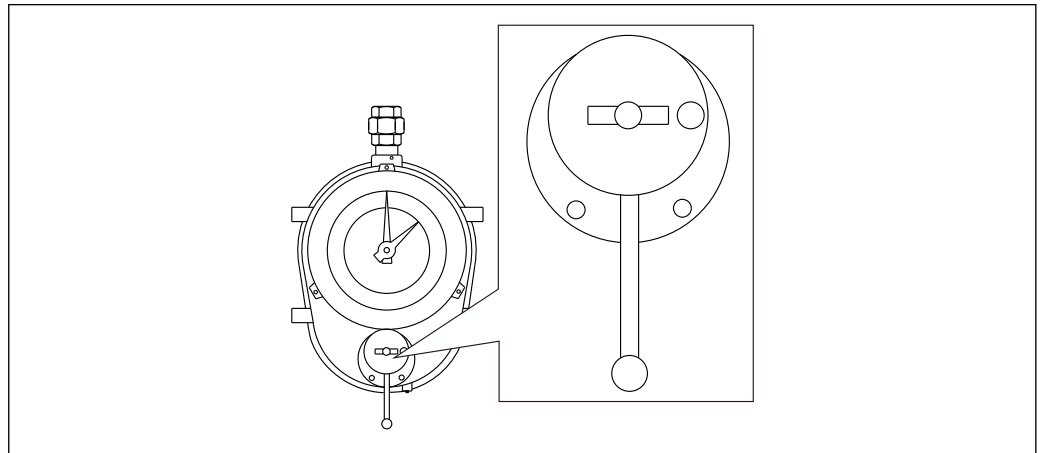
Observe the following notes during disposal:

- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

## 11 Accessories

### 11.1 Hoist handle

A hoist handle is mounted on the gauge head, and it can hoist up and lower the float manually. This prevents the float and measuring tape from becoming damaged in areas with poor measuring conditions, such as a tank with a stirrer, by hoisting the float in advance.



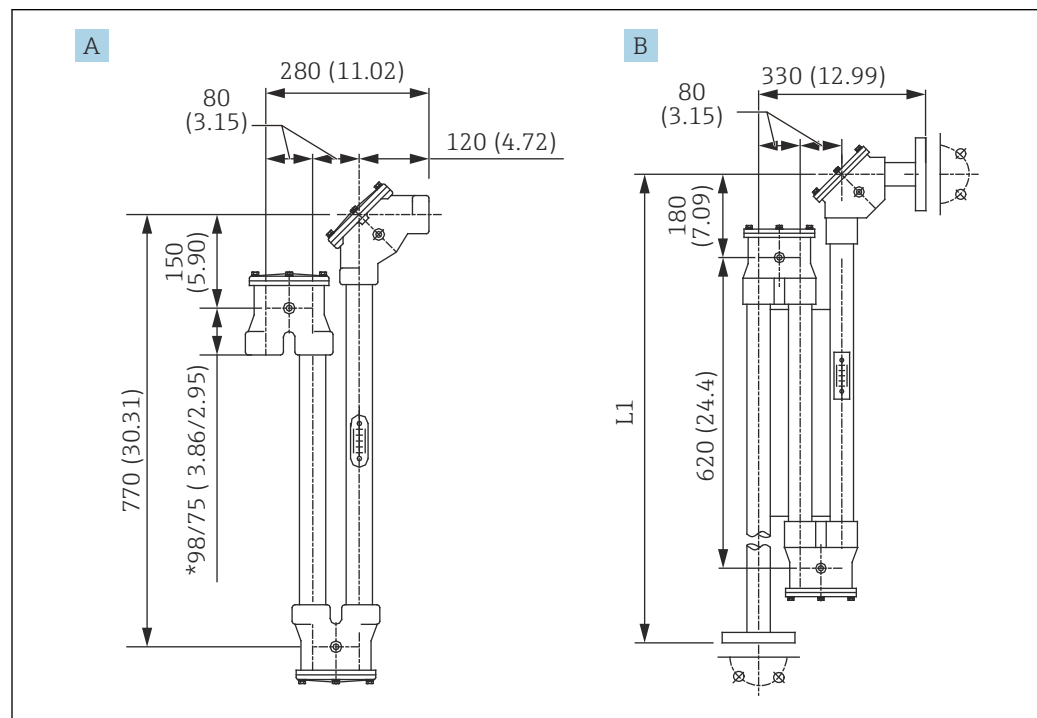
68 Hoist handle

A0041258

## 11.2 Seal pot

A seal pot is filled with liquid sealant to lock out vapors inside the tank.

<b>Liquid sealant</b>	Liquid paraffin (spindle oil): 1 150 cc
<b>Maximum sealing pressure</b>	400 mm H <sub>2</sub> O
<b>Shape</b>	U-shaped
<b>Connection standards</b>	Threaded type / flange type
<b>Material</b>	AC4A+SGP galvanized pipe / SUS316 / PVC



A0041259

69 Seal pot. Unit of measurement mm (in)

A Seal pot (SUS316/SGP/AC4A)

B Seal pot (PVC)

L1 Tape + wire: 1500 mm (59.06 in) / Tape only: 960 mm (37.8 in)

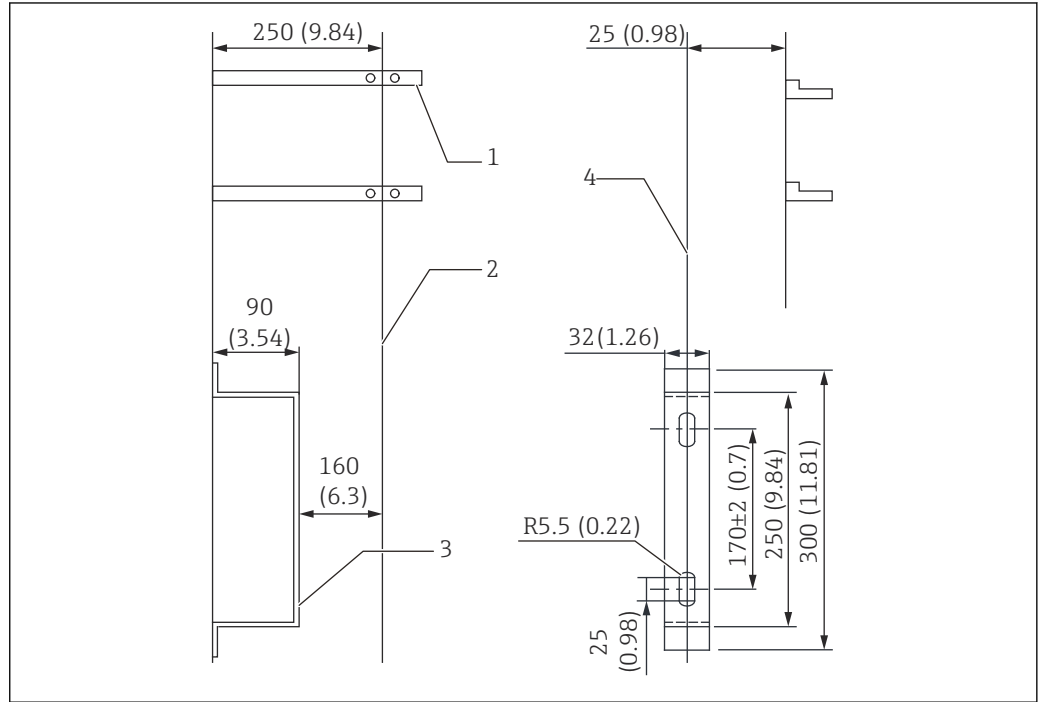
**i** The 75 mm (2.95 in) in seal pot 98/75 indicates the dimension of SUS316.



### 11.3 Gauge supporter

A gauge supporter is used for mounting the gauge on the external wall of a tank. Note that pipe supporters are not supplied.

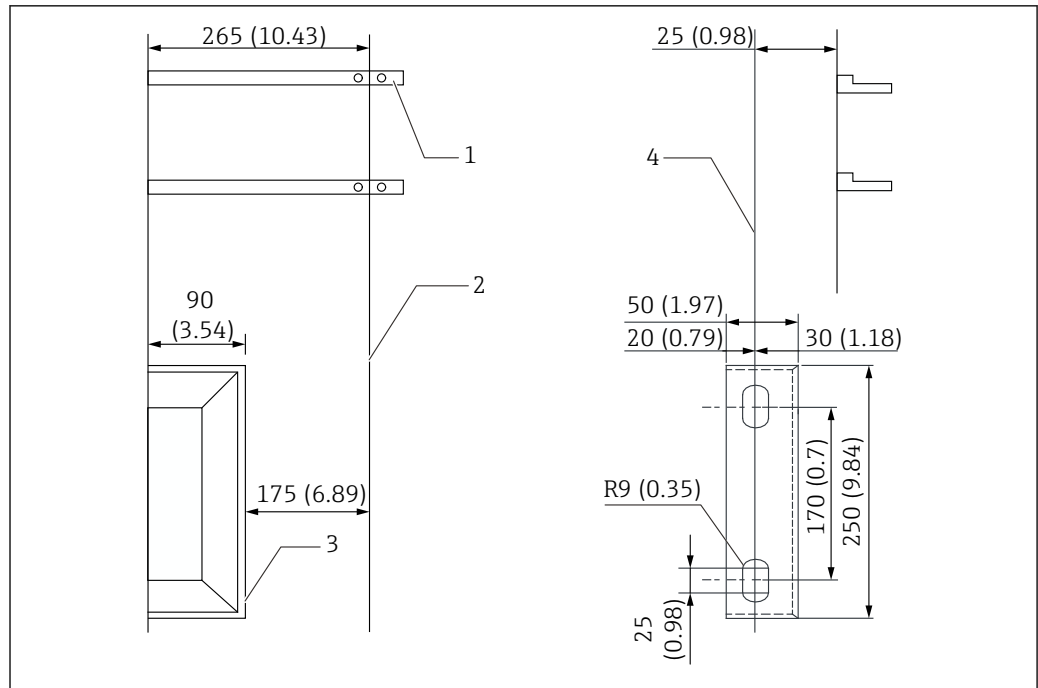
**i** In LT5-6 (high-pressure gauge head), the distance between the tank's external wall and the center of the gauge head is 15 mm (0.59 in) longer compared to that of LT5-1 (low-pressure gauge head) / LT5-4 (medium-pressure gauge head).



A0041179

**70** Gauge supporter (low/medium pressure). Unit of measurement mm (in)

- 1 Pipe supporter (not supplied)
- 2 Center line of the mounting position
- 3 Gauge supporter (based on the selected option SS400: t = 4.5 / SUS304: t = 4.0), mounting bolt
- 4 Center line of the gauge supporter



A0041180

71 Gauge supporter (high pressure). Unit of measurement mm (in)

- 1 Pipe supporter (not supplied)
- 2 Center line of the mounting position
- 3 Gauge supporter (based on the selected option SS400: t = 4.0 / SUS304: t = 4.0), mounting bolt
- 4 Center line of the gauge supporter

## 11.4 Guide pipes

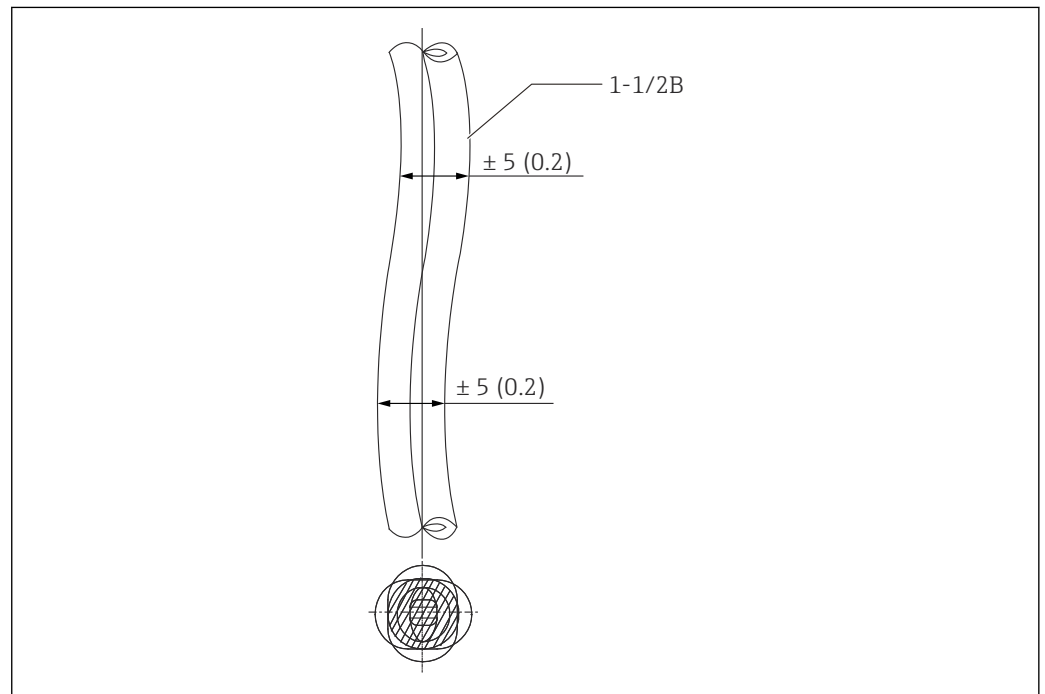
### 11.4.1 Selecting and mounting guide pipes

Guide pipes are required for most installations, except for tank top and underground applications. Guide pipes are usually used in three locations:

- Gauge head to sheave elbow
- Sheave elbow to sheave elbow
- Sheave elbow to tank roof

#### Precautions regarding installation

- Note that guide pipes and pipe supporters are not supplied by Endress+Hauser.
- Ensure that any bends in guide pipes are 5 mm (0.17 in) or smaller.
- The space (piping distance) between a sheave elbow and a sheave elbow must be no more than 2.5 m (8.2 ft).



72 Mounting guide pipes. Unit of measurement mm (in)


#### NOTICE

##### Recommended materials for guide pipes

- ▶ Always use a galvanized carbon steel pipe ("white gas pipe") for guide pipes. If the application is for extremely corrosive gas, a stainless steel or hard PVC pipe with a resin inner lining is recommended.

## 11.5 Mounting / enclosed accessories

Ordering information: 610 mounting accessories

NA	Copper-free gear	<p>If copper materials are used in the gear mechanism for whatever reason, the material is switched to something else, such as aluminum or stainless steel. The sealing material for the magnetic coupling and drain plug will be switched from NBR to CR. This is useful for applications with ammonium.</p> <p> As a general rule, copper materials cannot be used for the gear mechanism.</p>
NB	Custody transfer seal	In this option, holes are created in bolts that are used for the main body's rear cover and the display cover. Subsequent to bonded approval, a displacer wire for sealing may be inserted.
NC	Fixed tape guide	This option is for holding down the tape inside so that the tape does not become dislodged. It is useful for applications in which hunting may occur with the float. It is included as a standard item for LT5-4 and LT5-6.
ND	Dust protector	This is an internal component that prevents dust that is generated from using iron pipes from entering inside the gear head. It is included as a standard item for LT5-4 and LT5-6.
NE	Conster winding drum, aluminum	This is an aluminum conster winding drum. It is useful when the standard Bakelite conster winding drum cannot be used. For LT5-4 and LT5-6, the standard conster winding drum is aluminum.


Ordering information: 620 enclosed accessories

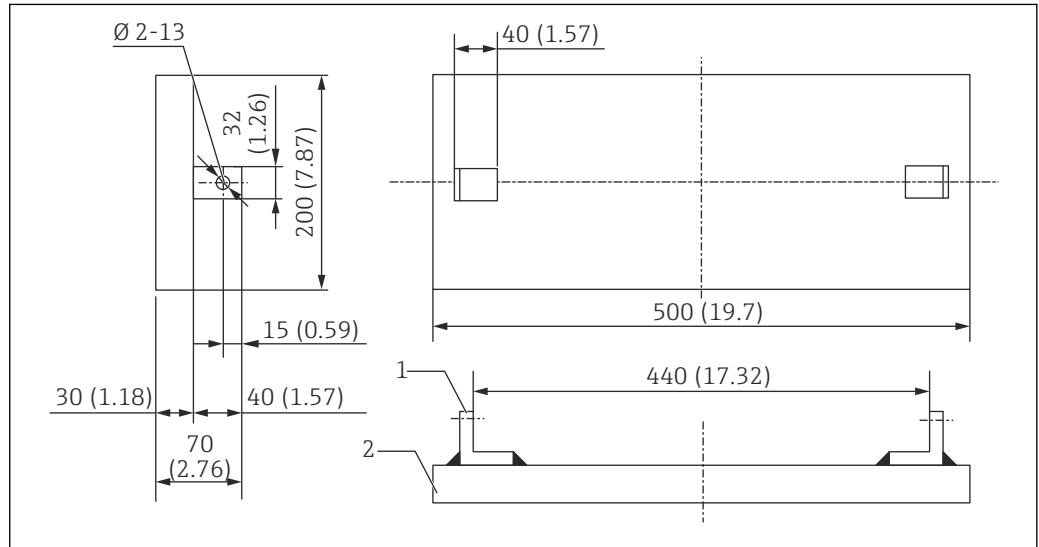
PE	FRT wire guide metal	This wire guide is installed on the floating roof. It prevents the measuring wire from wear due to contact with the roof.
PF	Wire guide socket Rc1-1/2	This socket is installed on the pipes of a floating roof tank or a gas holder tank. It prevents the measuring wire from wear due to contact with the pipes.
PG	Wire guide socket NPT1-1/2	
PH	Gas holder wire hook	This hook is welded onto a gas holder tank and connected to a measuring wire.

### 11.6 Anchor weight


If an anchor hook cannot be secured at the bottom of a tank (such as when there is liquid inside the tank), an anchor weight is used in order to keep the guide wire taut.

<b>Material</b>	SS400/SUS316
<b>Weight</b>	Approx. 23 kg (50.71 lb)

 Special specifications are required for using this anchor weight.

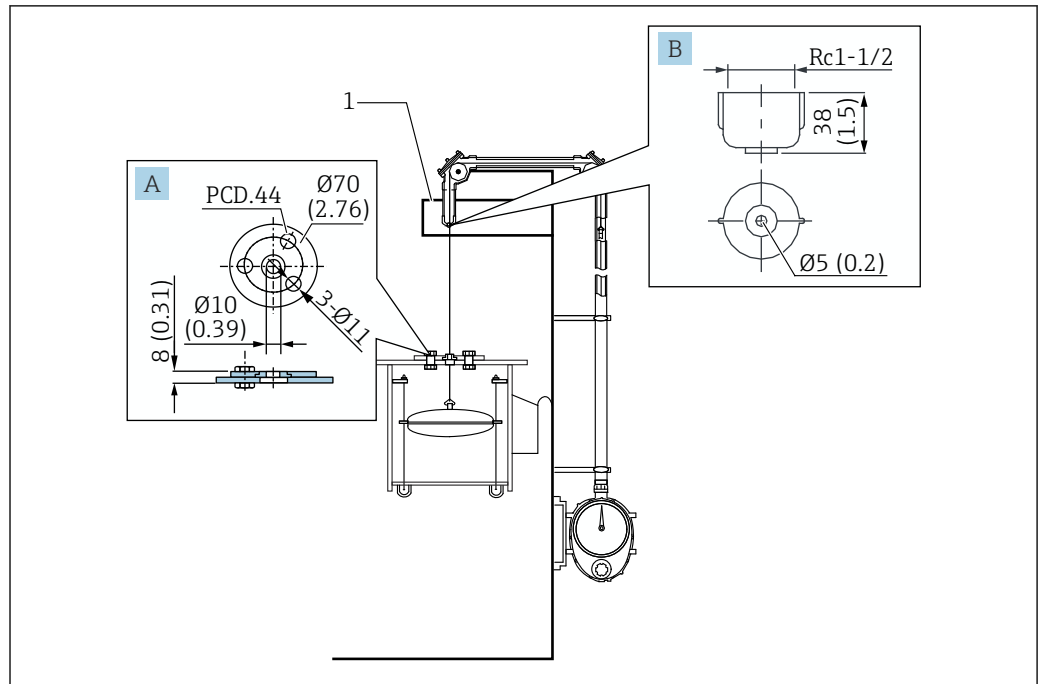


A0041260

 73 Anchor weight. Unit of measurement mm (in)

- 1 Anchor hook
- 2 Anchor weight

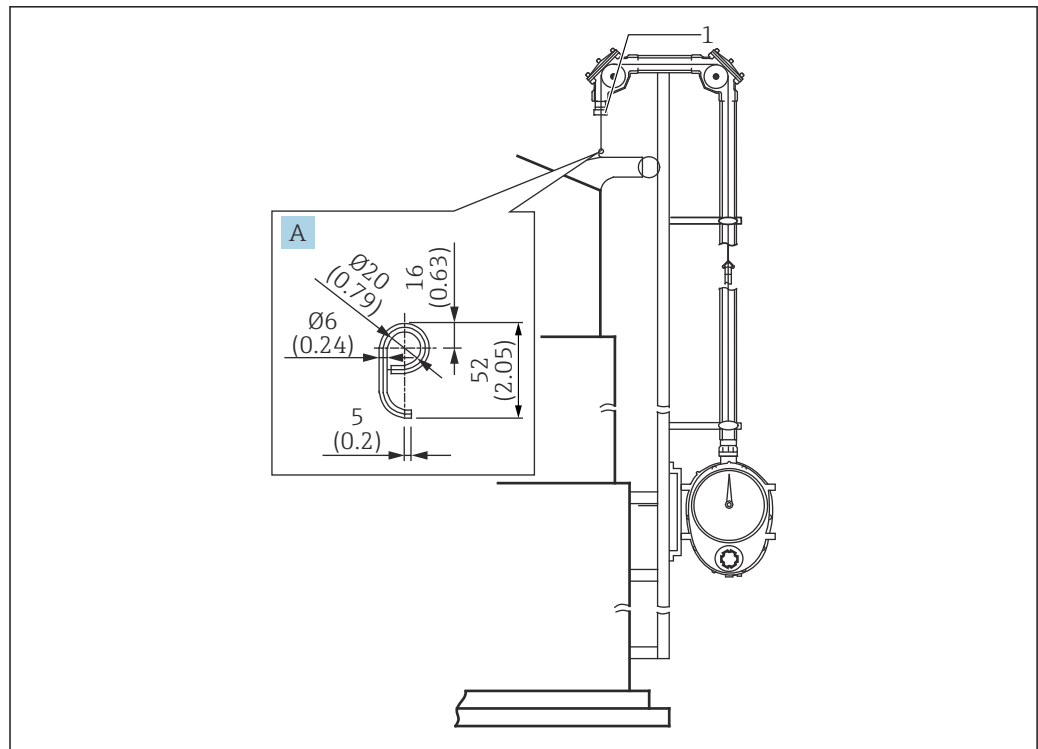
### 11.7 Wire guide metal, wire guide socket



A0041261

74 Wire guide metal, wire guide socket. Unit of measurement mm (in)

- A Wire guide metal
- B Wire guide socket
- 1 Roof stand



A0041262

75 Wire hook / wire guide socket. Unit of measurement mm (in)

- A Wire hook
- 1 Wire guide socket

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