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71672944
2024-09-30

Operating Instructions
Float level gauge LT5

Mechanical tank gauge for measuring liquid level

Endress+Hauser
People for Process Automation

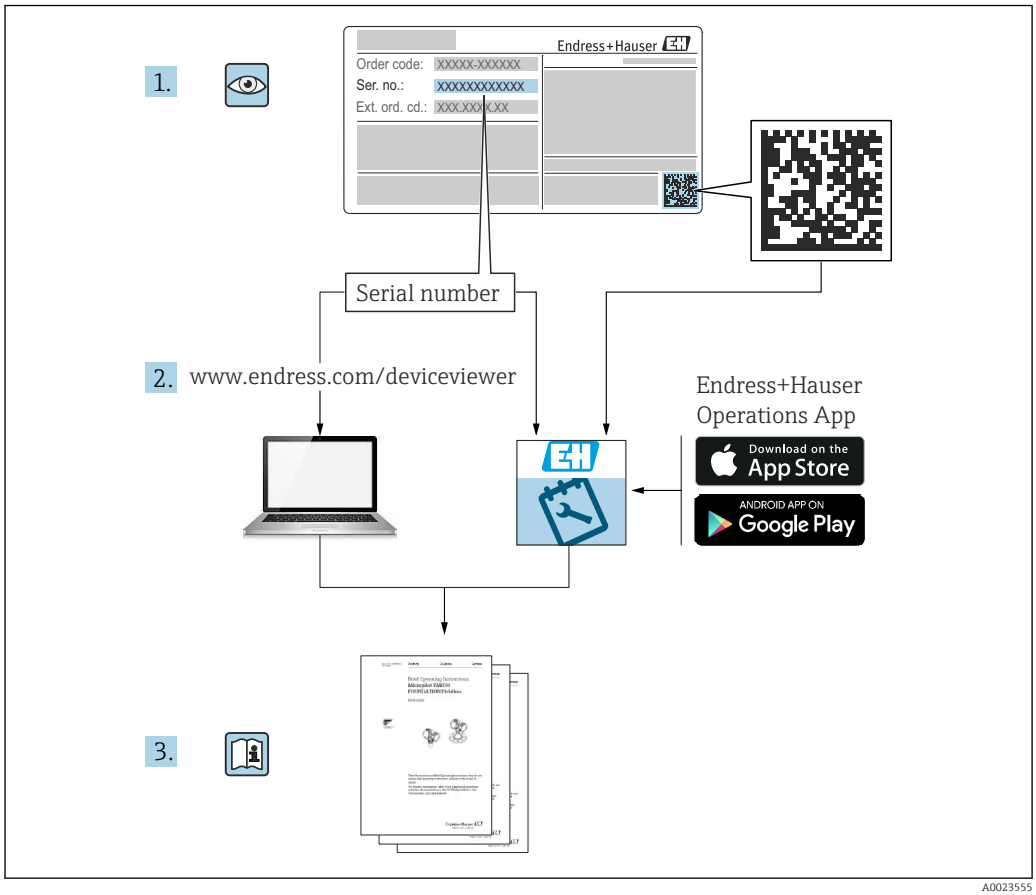

1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX XXX XX XX
Serial number
2. www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.
A0023555

Table of contents

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

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

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

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

NOTICE
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

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 documentation types are available in the Downloads area of the Endress +Hauser website (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): Enter the serial number on the 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 first 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.

2 Safety-related basic instructions

2.1 Basic safety instructions

2.1.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before starting work, read and understand the instructions in the manual 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:
- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in this manual.

2.2 Intended use

Applications and measured materials
Equipment intended for use in hazardous locations, sanitary applications, or high-risk applications due to process pressure have the corresponding label attached to 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 ensure that the ordered equipment has the correct specifications for the certification-related area (example: explosion proof, safety of pressure vessels).
- 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.
- Provide permanent protection for the equipment against corrosion caused by environmental effects.
- Do not exceed the limit values in "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 only if it is in proper technical condition, free from errors and faults.
- The 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, consult with the manufacturer.

Repair

To ensure continued operational safety and reliability:
- Carry out repairs on the device only if they are expressly permitted.
- Observe federal/national regulations pertaining to the repair of an electrical device.
- Use only original spare parts and accessories from the manufacturer.

Hazardous area

To eliminate danger to persons or the facility when the device is used in the hazardous area (e.g. explosion protection):
- Check the nameplate to verify if the device ordered can be put to its intended use in the hazardous area.
- Observe the specifications in the separate supplementary documentation that is an integral part of 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.

2.5.1 CE mark

This measuring system meets the legal requirements of the applicable EU Directive. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.

Endress+Hauser affixes the CE mark to this equipment as a sign of guarantee that this equipment has successfully passed testing.

3 Product description

3.1 Intended use

Float level gauge LT5 is an important measuring instrument in the process industry. With its mechanical construction that does not require a power supply, 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 task control
- Safe tank operation

3.2 Technical data

Item		Description	
Measuring 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 measurement liquid density is 1 g/cm^3 and measurement range is 10 m (32.8 ft))
		φ140 mm (5.51 in) float	± 30 mm (1.18 in) (when the measurement liquid density is 1 g/cm^3 and 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 (stainless steel): −200 to 200 °C (−328 to 392 °F) Wetted parts (PVC): −20 to 60 °C (68 to 140 °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 method		LT5	Two-pointer dial type / counter type (min. readable scale: 1 mm) Only counter display is available for 30 m and 100 ft
Gauge connection		LT5-1 (screw-in, low-pressure type)	Rp 1-1/2, w/o union nut, screw JIS B0203 Rc 1-1/2, union nut, SUS316, screw JIS B0203 NPT 1-1/2, union nut, SUS316, screw ANSI
		LT5-1 (flange, low-pressure type) Flange spec./materials	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 materials	10K 40A RF, aluminum (AC4C-T6), flange JIS B2220 NPS 1-1/2" Cl.150 RF, aluminum (AC4C-T6) flange ASME B16.5 40A 150 lbs RF, aluminum (AC4C-T6), flange JPI 7S-15
		LT5-6 (flange, high-pressure type) Flange spec. / gauge materials / bolt materials	10K 40A RF, iron (SCPL1), flange JIS B2220 NPS 1-1/2" Cl.150 RF, iron (SCPL1) flange ASME B16.5 40A 150 lbs RF, iron (SCPL1), flange JPI 7S-15 20K 40A RF, iron (SCPL1), flange JIS B2220 NPS 1-1/2" Cl.300 RF, iron (SCPL1) flange ASME B16.5 40A 300 lbs RF, iron (SCPL1), flange JPI 7S-15
Float φ400	Low-pressure type	Weight: 4.2 kg	ρ: Liquid density (g/cm^3): 0.5 ≤ ρ < 0.65

Item		Description	
	Low-pressure type	Weight: 5.0 kg	ρ: Liquid density (g/cm³) 0.65 ≤ ρ < 1.05
	Low-pressure type	Weight: 8.0 kg	ρ: Liquid density (g/cm³): 1.05 ≤ ρ ≤ 2.0
	Medium/high-pressure type	Weight: 8.3 kg	ρ: Liquid density (g/cm³): 0.5 ≤ ρ ≤ 0.7

Item		Description	
Float φ140	Low-pressure type	Weight: 2.1 kg	ρ: Liquid density (g/cm³): 0.5 ≤ ρ < 0.94
	Low-pressure type	Weight: 2.4 kg	ρ: Liquid density (g/cm³): 0.94 ≤ ρ ≤ 2.0
Display coupling (coupling between the internal parts of the gauge head and the display)		LT5-1 (screw-in, 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	Screw-in/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
Paint color		Gauge head	E+H Blue
		Other components	Silver

For the low-pressure type, PVC can be selected as a material for certain parts, such as the float. For more information, contact your Endress+Hauser Sales Center or distributor.

3.3 List of material specifications

Aluminum

Code	Description
ADC12	Aluminum die-casting alloy (SI-Si-Cu)
AC4C-T6	Aluminum alloy cast metal (Si7Mg)
AC4A	Aluminum alloy cast metal (Si10Mg)

Stainless steel

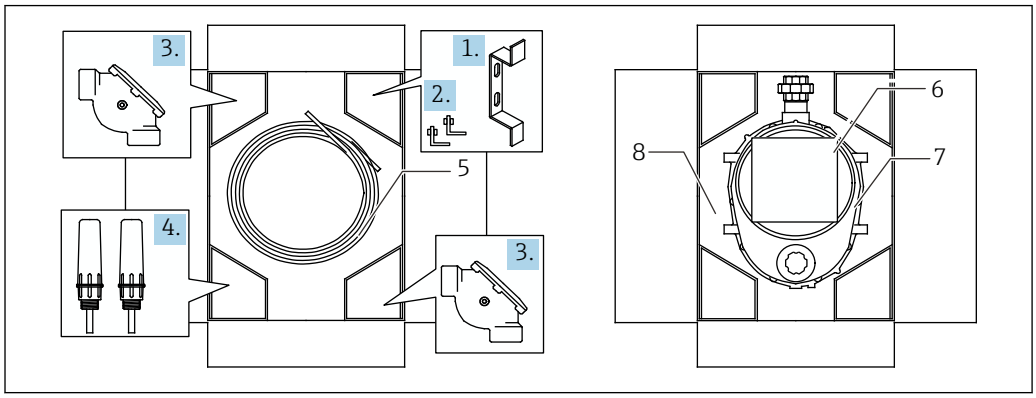
Code	Description
SUS304	Stainless steel (18Cr-8Ni)
SUS316	Stainless steel (18Cr-12Mi-2.5Mo)
SCS13	Cast stainless steel equivalent to SUS304
SCS14	Cast stainless steel equivalent to SUS316

Others

Code	Description
SCPL1	Cast carbon steel
SGP (white gas pipe)	Carbon steel pipe
PVC	Polyvinyl chloride

3.4 Delivery examples

Packing method will vary depending on the order code, etc. For the flange type, sheave elbows will be packed in a separate box.



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?

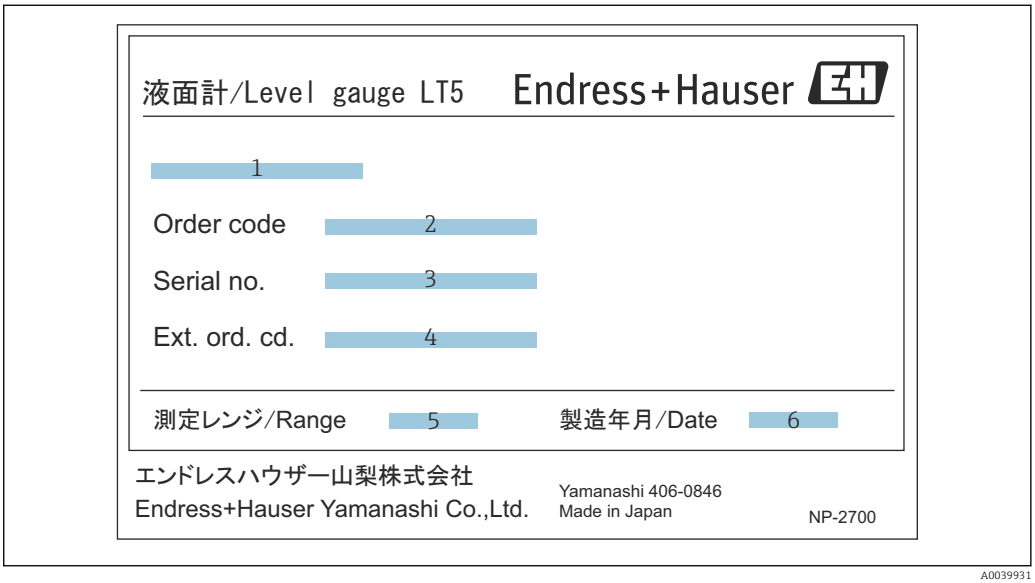
If one or more of these conditions are not satisfied, contact your Endress+Hauser Sales Center or distributor.

4.2 Product identification

The following options are available for identification of the device:
- Nameplate specifications
- Extended order code on the delivery note (including details of the device specification codes)
- Entering the serial number from the nameplate in *W@M Device Viewer* (www.endress.com/deviceviewer) will display all the information about the device.

Note that the information on a nameplate may be changed without notice when credentials and certificates are updated.

4.2.1 Nameplate



2 *LT5 nameplate*

1 *Instrument code (optional)*
2 *Order code*
3 *Serial number*
4 *Extended order code*
5 *Measurement range*
6 *Manufacturing year and month*

4.3 Manufacturer 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

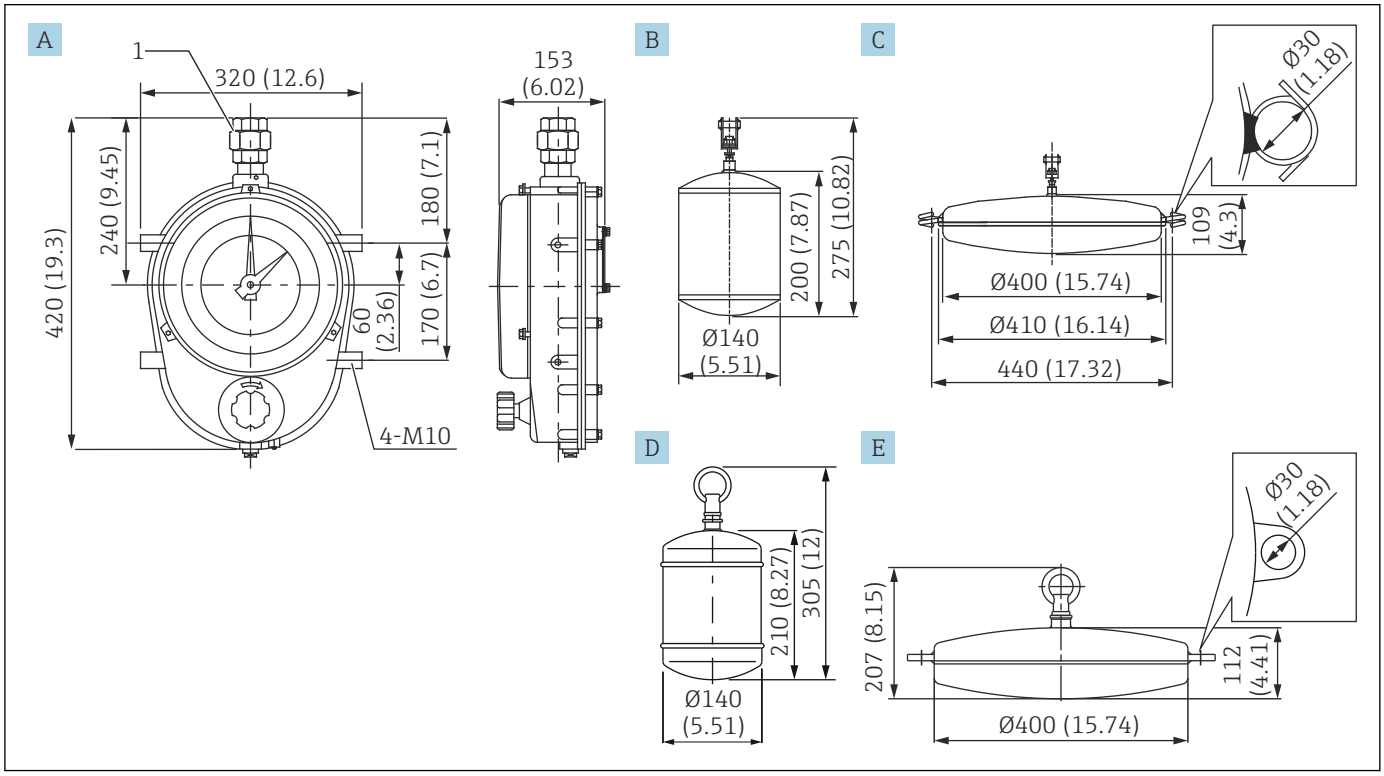
- ▶ When transporting the device to the measuring point, either use the device's original packaging or hold by the process connector.
- ▶ Secure a hoisting device (such as a hoisting ring or a lifting eye bolt) to the process connector, not to the housing. Pay attention to the device's center of gravity 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

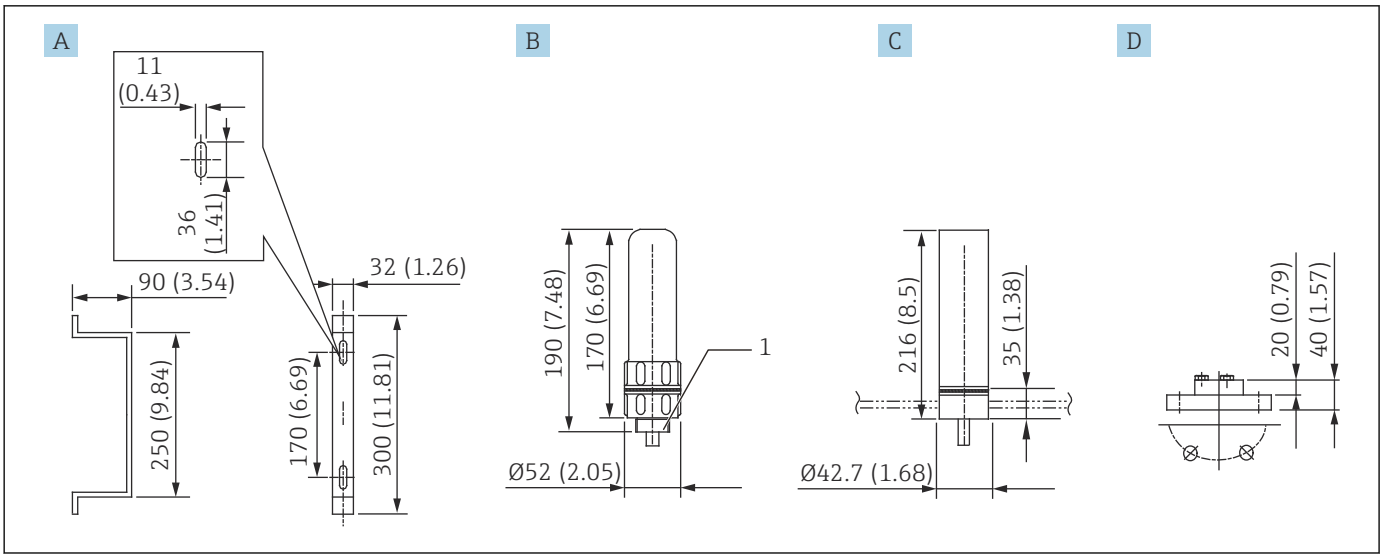
Dimensions of common components are listed for the installation conditions. For other components, contact your Endress+Hauser Sales Center or distributor.

5.1.1 Dimensions of LT5-1 (screw-in, low-pressure type)



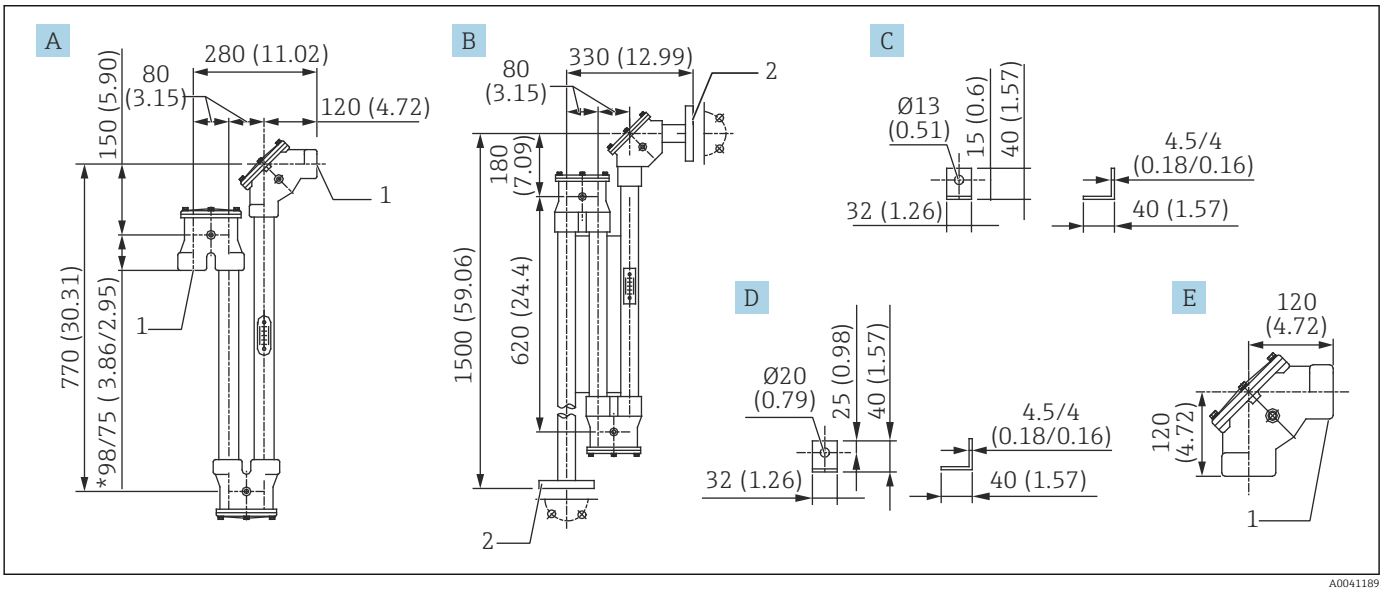
3 *LT5-1 / float dimensions. Unit of measurement mm (in)*

A Gauge head (ADC12)
B Float φ140 (SUS316)
C Float φ400 (SUS316)
D Float φ140 (PVC)
E Float φ400 (PVC)
1 Union nut (select from JIS Rc 1-1/2 /ANSI NPT 1-1/2; select Rp 1-1/2 if there is no union nut)



4 *Accessory 1. Unit of measurement mm (in)*

A Gauge supporter (select from iron (SCPL1) / SUS304)
B Top anchor (ADC6)
C Top anchor (SUS316 with socket welding)
D Top anchor (PVC) (PVC is only available for flange type)
1 Select from JIS R1 / ANSI NPT 1

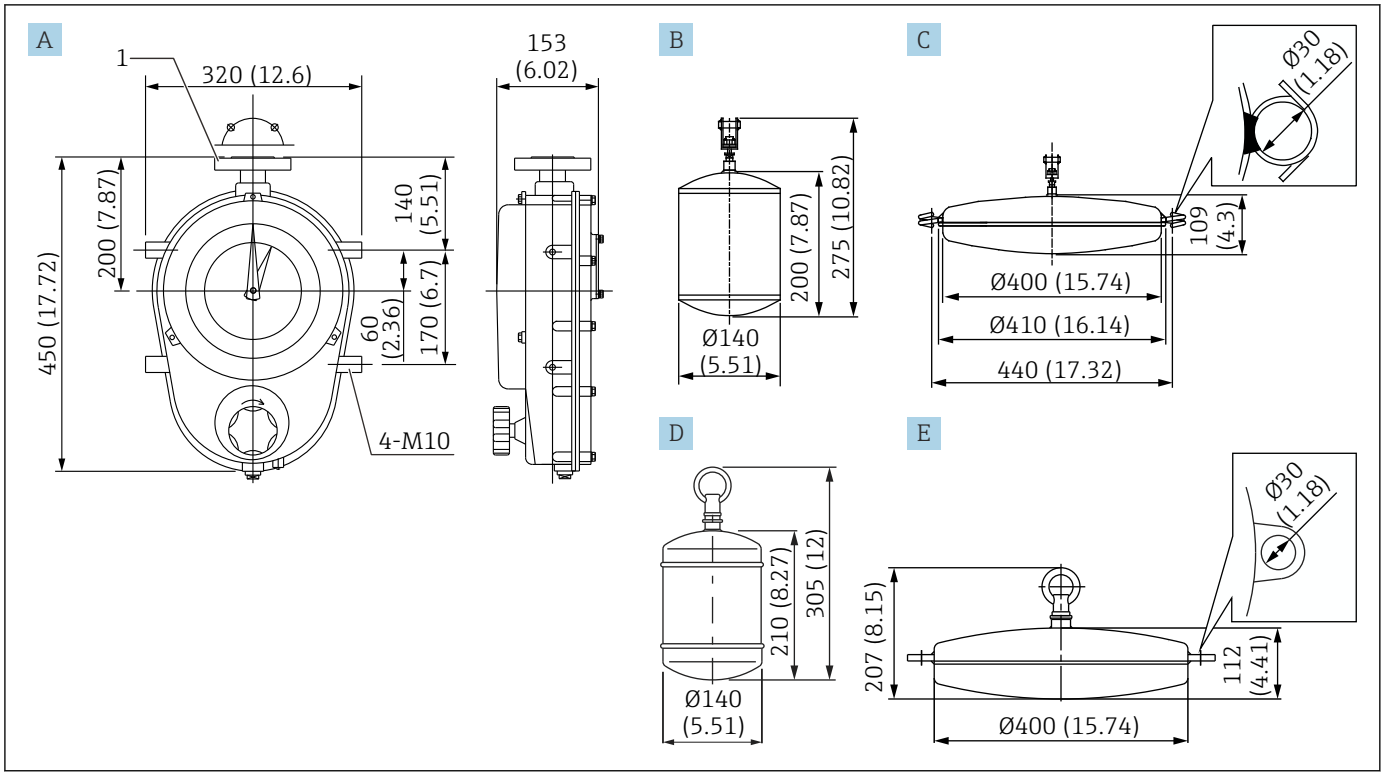


5 *Accessory 2. Unit of measurement mm (in)*

A Seal pot (select from aluminum / SUS316)
B Seal pot (PVC) (PVC is only available for flange type)
C Anchor hook (select from iron (SCPL1) / SUS316)
D Anchor hook (PVC bolt)
E 90 ° sheave elbow (select from ADC6 / SCS14)
1 Screw-in type (select from Rp 1-1/2 / NPT 1-1/2 as options)
2 Flange (select from JIS 10K 40A FF / ASME NPS 1-1/2" Cl.150 FF / JPI 40A 150 lbs FF)

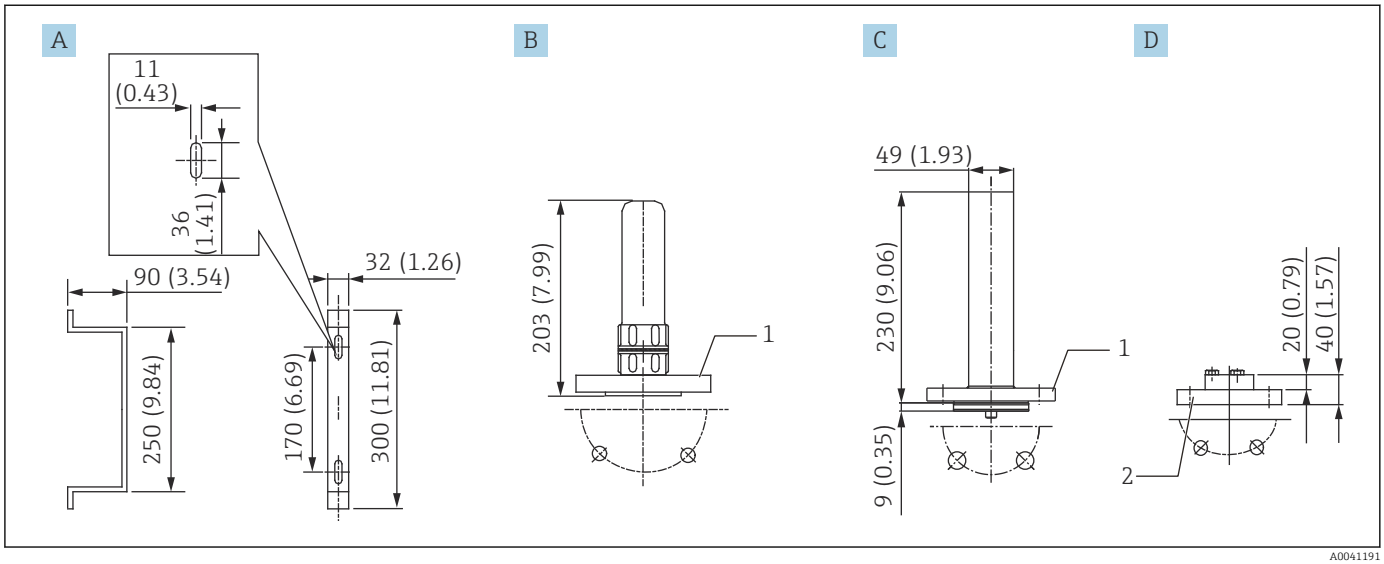
The 75 mm of seal pot 98/75 indicates the dimension for SUS316 specifications.

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



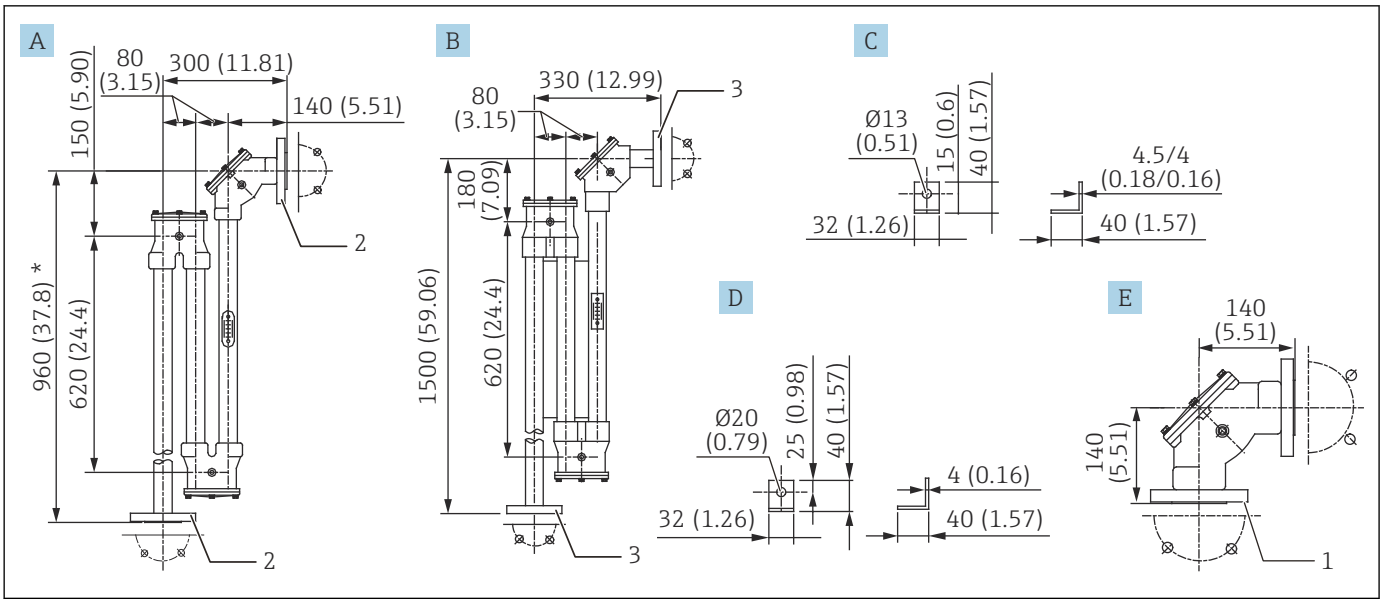
6 *Dimensions of LT5-1. Unit of measurement mm (in)*

A Gauge head (ADC12)
B Float φ140 (SUS316)
C Float φ400 (SUS316)
D Float φ140 (PVC)
E Float φ400 (PVC)
1 Flange (select from JIS 10K 40A RF / ASME NPS 1-1/2" Cl.150 RF / JPI 40A 150 lbs RF)



7 *Accessory 1 . Unit of measurement mm (in)*

A Gauge supporter (select from iron (SCPL1) / 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)

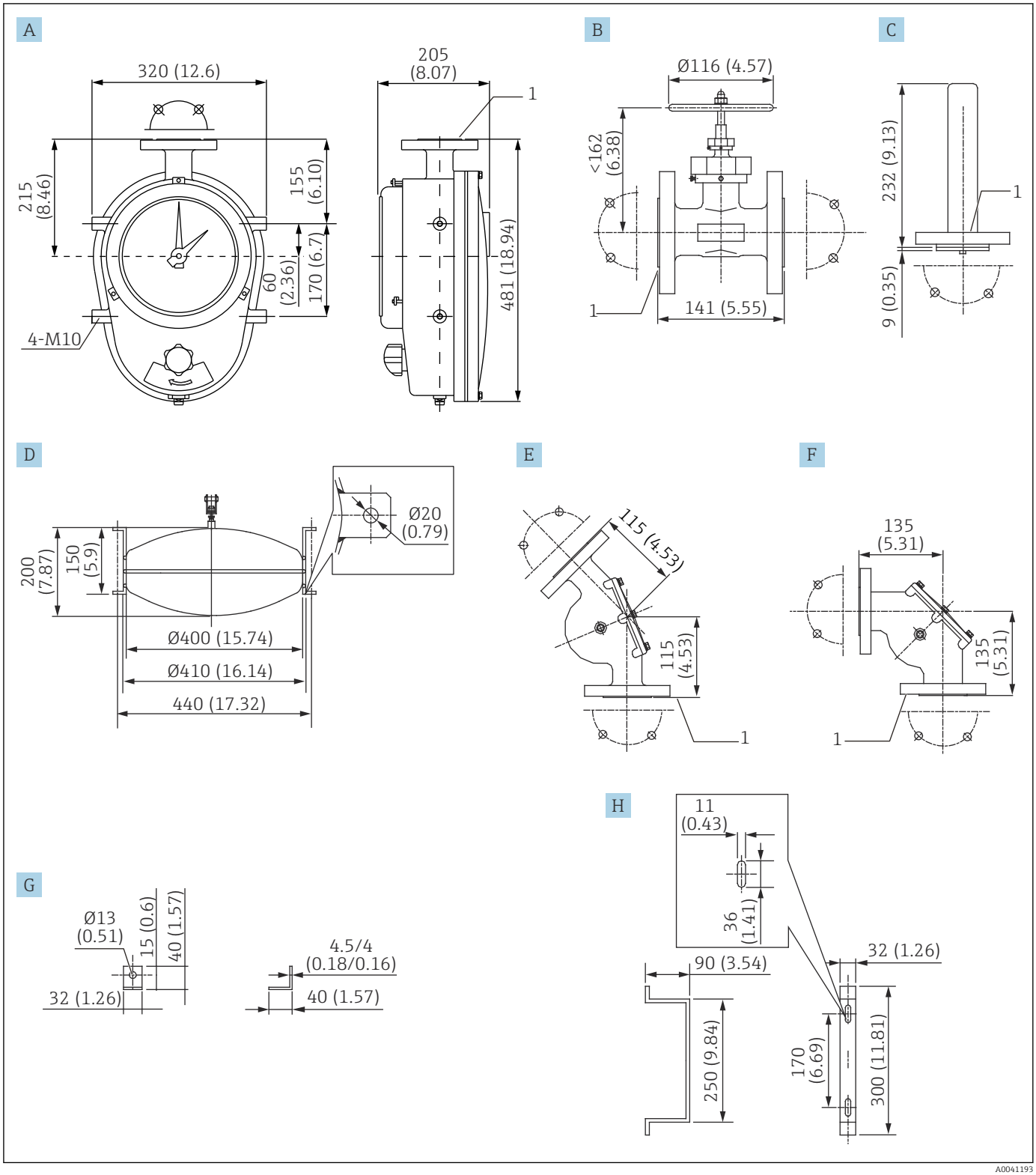


8 *Accessory 2. Unit of measurement mm (in)*

A Seal pot (select from aluminum + iron (SCPL1) / SCS14+SUS316; see notes below)
B Seal pot (PVC)
C Anchor hook (select from iron (SCPL1) / 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)

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

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

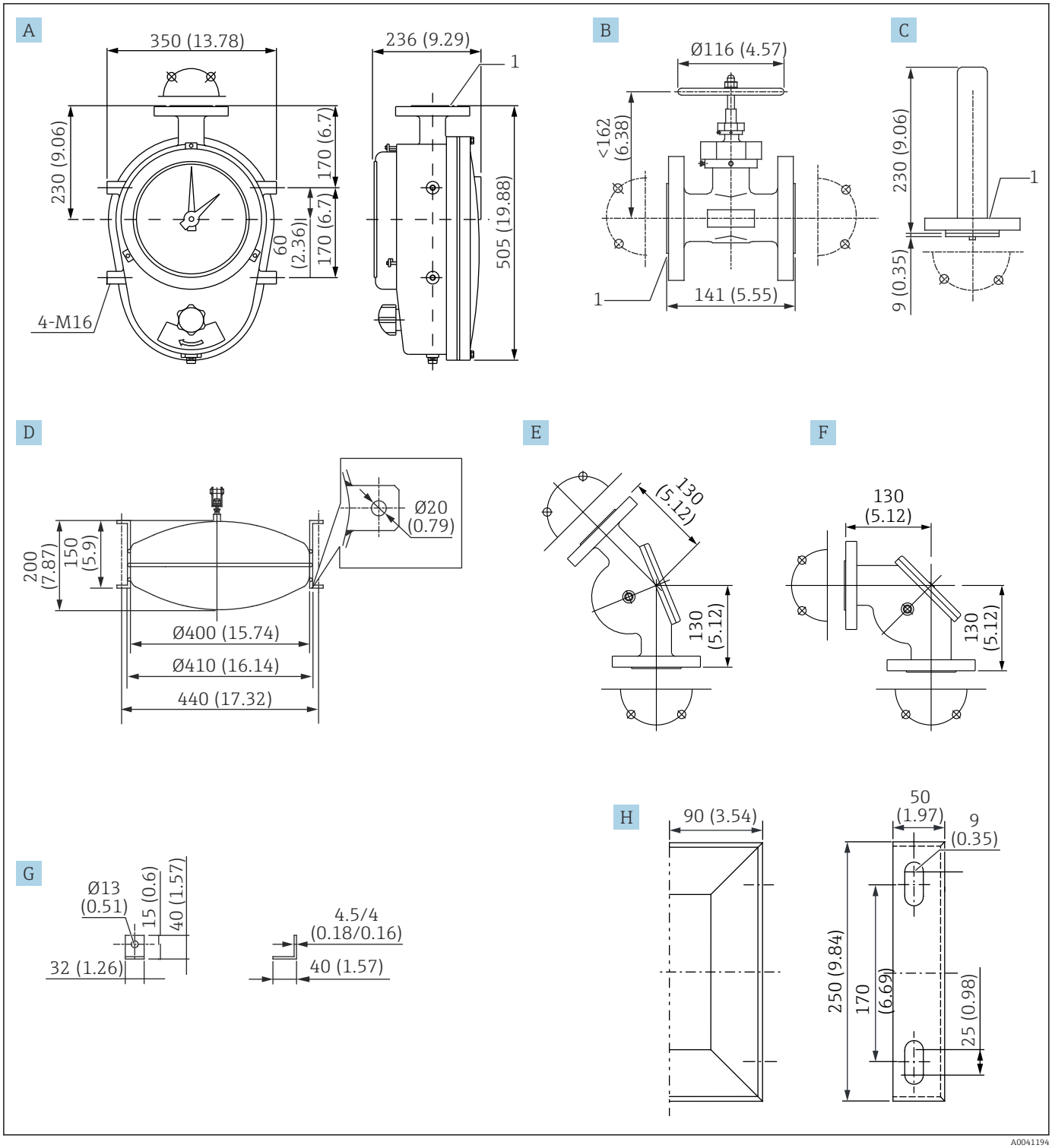


9 *Dimensions of LT5-4. Unit of measurement mm (in)*

A Gauge head (AC4C-T6)
B Gate valve (SCS13)
C Top anchor (AC4C-T6)
D Float φ400 (SUS316)
E 135 ° sheave elbow (AC4C-T6)
F 90 ° sheave elbow (AC4C-T6)

G Anchor hook (select from iron (SCPL1) / SUS316)
H Gauge supporter (select from iron (SCPL1) / 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)



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

- *A Gauge head (iron (SCPL1))*
- *B Gate valve (SCS13)*
- *C Top anchor (select from iron (SCPL1) / SUS316)*
- *D Float φ400 (SUS316)*
- *E 135 ° sheave elbow (iron (SCPL1))*
- *F 90 ° sheave elbow (iron (SCPL1))*
- *G Anchor hook (select from iron (SCPL1) / SUS316)*
- *H Gauge supporter (select from iron (SCPL1) / 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 Preparing for installation

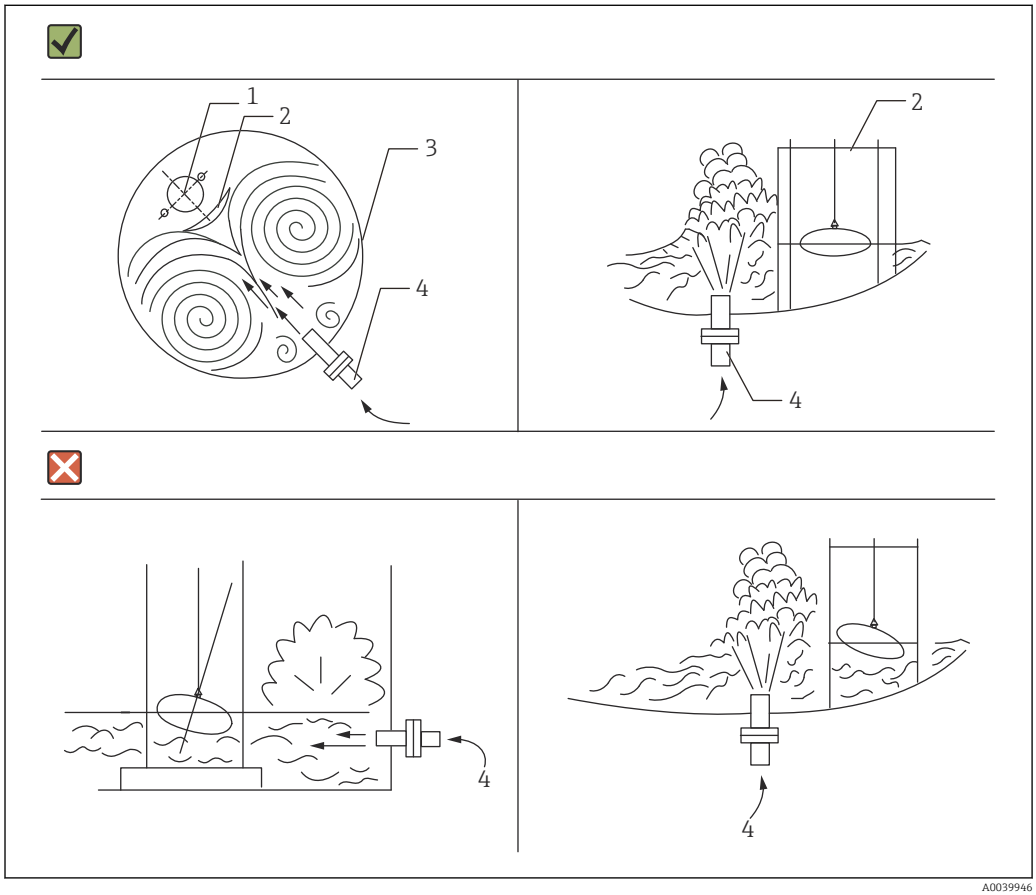
Follow the instructions below when installing LT.

- Select where to install the gauge head 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 come in direct contact with the float. If there is no choice but to install the float where there are waves or where liquid flows, install a wave guard to protect the float. Sudden inflow of liquid near the float may sever the tape.



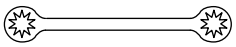
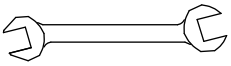
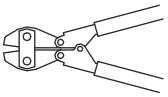
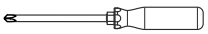
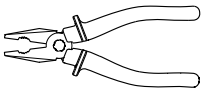
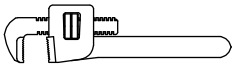
11 *Installation conditions*

1 *Float center*
2 *Wave guard installation*
3 *Tank*
4 *Liquid inlet*

5.3 Tools

Have the following tools ready to install LT5.

Items to prepare

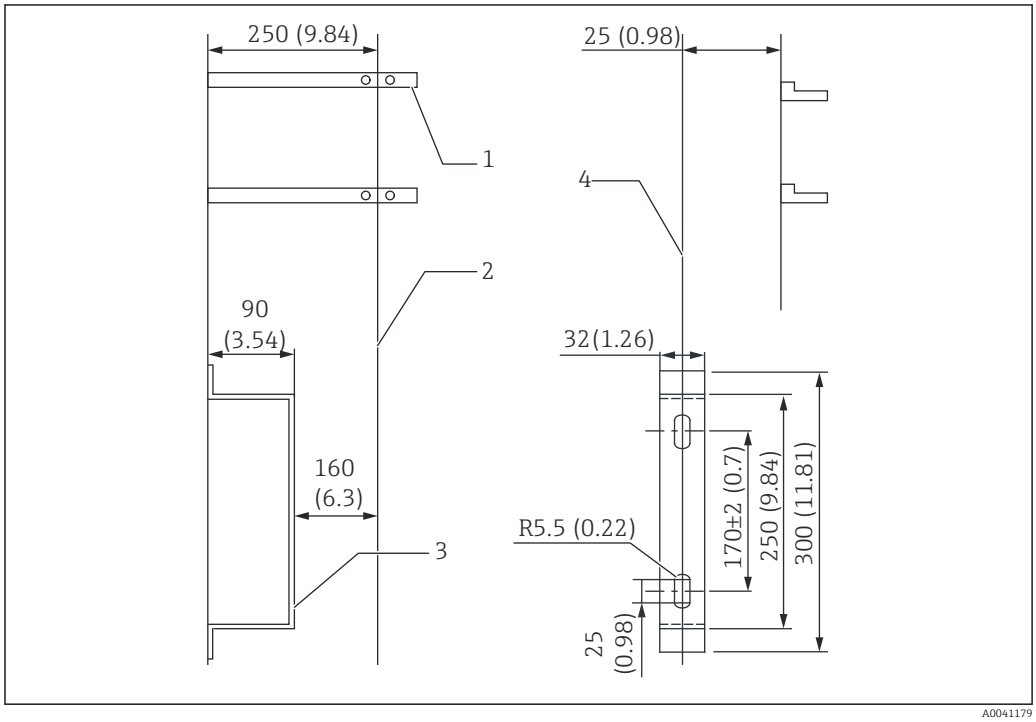
Tools	Intended use	LT5-1 (screw-in)	LT5-1 (flange)	LT5-4	LT5-6
 12 *Box-end wrench*	13 mm: For sheave elbow cover	●	●	●	-
	24 mm: For sheave elbow cover	-	-	-	●
	17 mm: For gauge head on device supporter	○	○	○	-
	24 mm: For gauge head on device supporter	-	-	-	●
	24 mm: JIS flange (M16 x 2)	-	◎	◎	◎
	21 mm: 150 lbs flange (1/2" x 2)				
	32 mm: 300 lbs flange (3/4" x 2)				
 13 *Open-end wrench*	19 mm: For securing guide wire and compressing springs	●	●	●	●
 14 *Water pump pliers*	25 mm or larger: For screw-in top anchors	●	-	-	-
 15 *Wire rope cutter*	For cutting off excess guide wire	●	●	●	●
 16 *Phillips screwdriver*	For tape clamps and adjusting the pointer on counter display	○	○	-	○
 17 *Nut driver*	5.5 mm: For tape clamps and dial display 8 mm: For indicator cover	○	○	○	○
 18 *Pliers*	For screws for mounting tape clamps	○	○	○	○
 19 *Sheet metal scissors*	For cutting off excess measuring tape	○	○	○	○
 20 *Pipe wrench*	600 mm or larger: For guide pipes of screw-in gauge head	○	-	-	-

●: Use on tank roof
○: Use at ground level
◎: Use on tank roof and at ground level
—: Do not use

5.4 Welding of gauge supporter

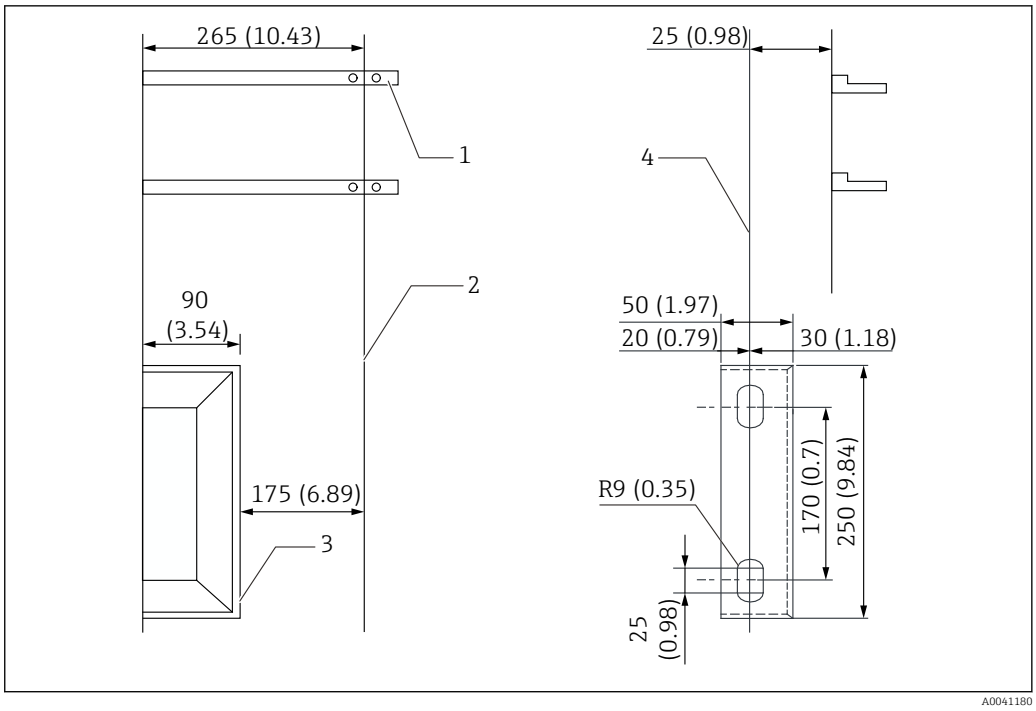
Refer to the diagram below when welding a gauge supporter. Note that pipe supporters are not supplied.

The distance from the outer tank wall to the gauge head center is 15 mm (0.59 in) longer for LT5-6 (high-pressure gauge head) compared to LT5-1 (low-pressure gauge head) and LT5-4 (medium-pressure gauge head).



21 Gauge supporter (for low and medium pressure). Unit of measurement mm (in)

1 *Pipe supporter (not supplied)*
2 *Center line for installation*
3 *Gauge supporter (depending on the selected option, SS400: t = 4.5 / SUS304: t = 4.0) with mounting bolts*
4 *Center line of the gauge supporter*



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

1 *Pipe supporter (not supplied)*
2 *Center line for installation*
3 *Gauge supporter (depending on the selected option, SS400: t = 4.0 / SUS304: t = 4.0) with mounting bolts*
4 *Center line of the gauge supporter*

5.5 Guide pipe

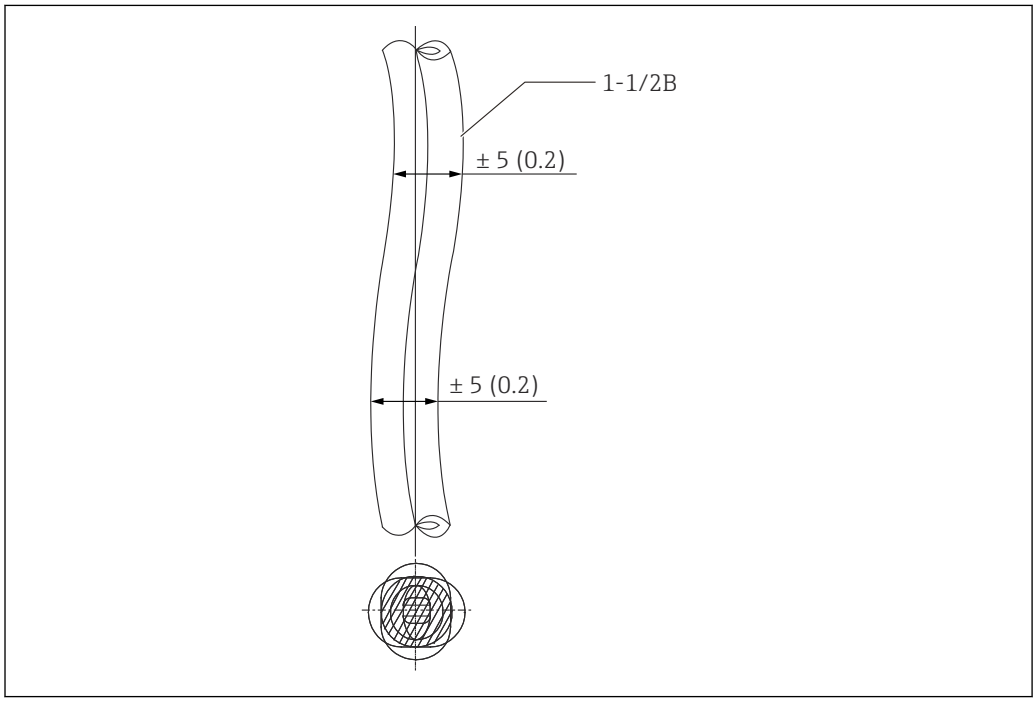
5.5.1 Selection and installation of guide pipe

Guide pipe installation is required for most applications, except for tank top and underground applications. Guide pipes are generally used in three areas:

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

Precautions regarding installation

- Guide pipes and pipe supporters are not supplied by Endress+Hauser.
- Keep the bend in guide pipe to 5 mm (0.17 in) or less.
- The space between two sheave elbows (piping distance) must not exceed 2.5 m (8.2 ft).



23 *Guide pipe installation. Unit of measurement mm (in)*

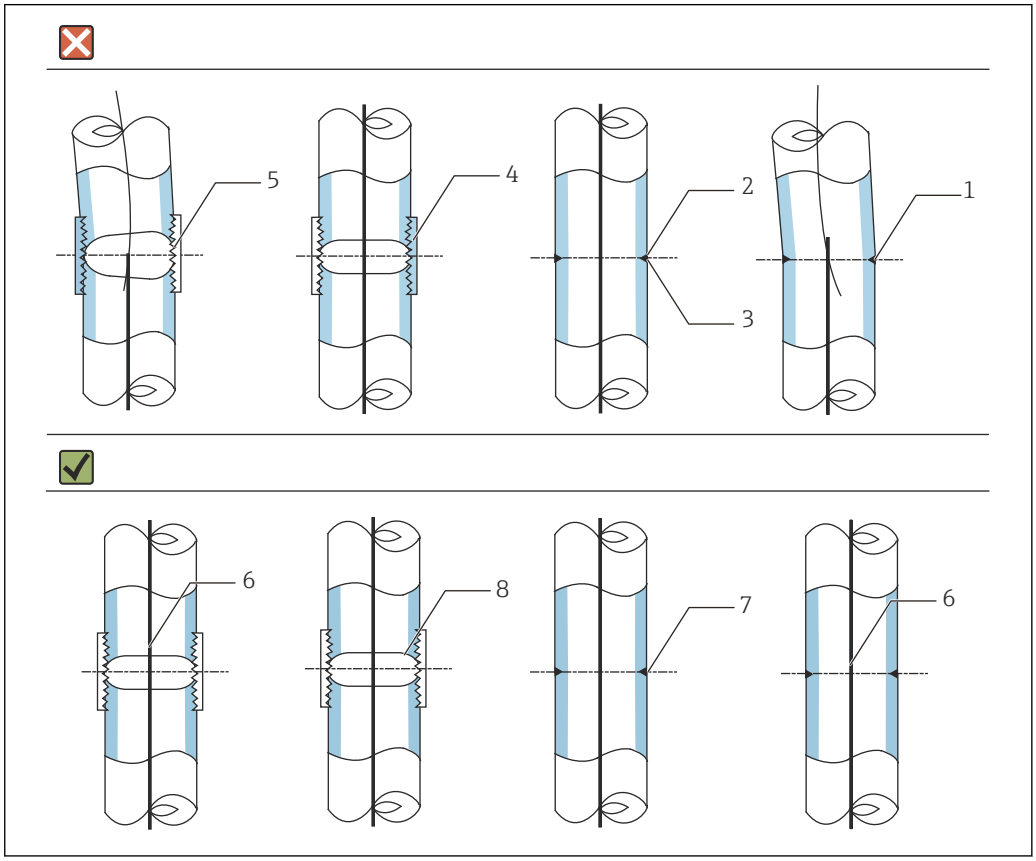
NOTICE

Recommended materials for guide pipes

▶ Always use galvanized carbon steel pipes (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 Guide pipe connection

- Use PTFE sealing tape and gaskets on the unions and flanges in order to maintain airtightness against gas and rain.
- Ensure that the connection between the guide pipe and the union is secure to prevent rain water from seeping into the gauge.
- When connecting the pipes, beware of nonlinearity caused by a bent screw 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.



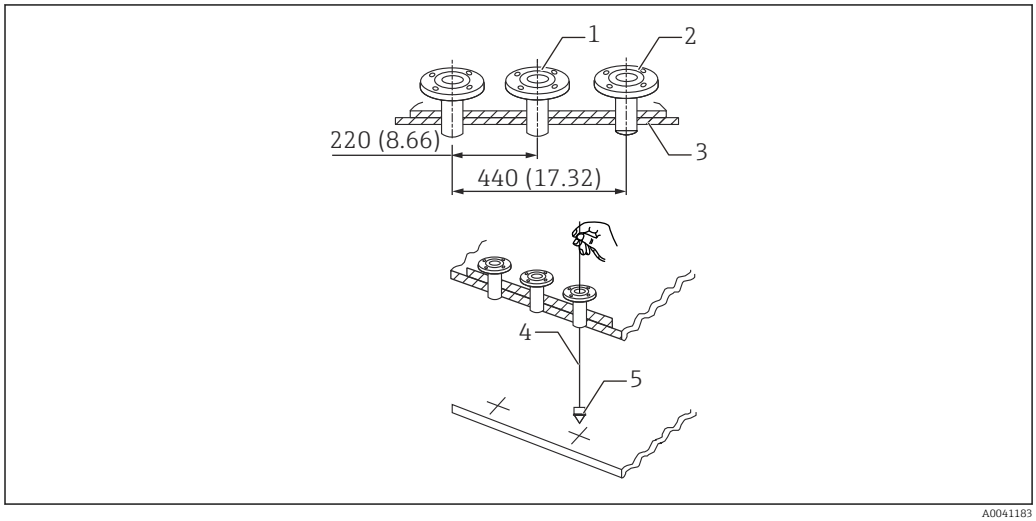
24 *Guide pipe connection*

1 *Bend due to welding*
2 *Welding part*
3 *Welding burr*
4 *Burr*
5 *Bent screw*
6 *Vertical line*
7 *No welding burr on the inside*
8 *Chamfering*

5.6 Top anchor and anchor hook

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

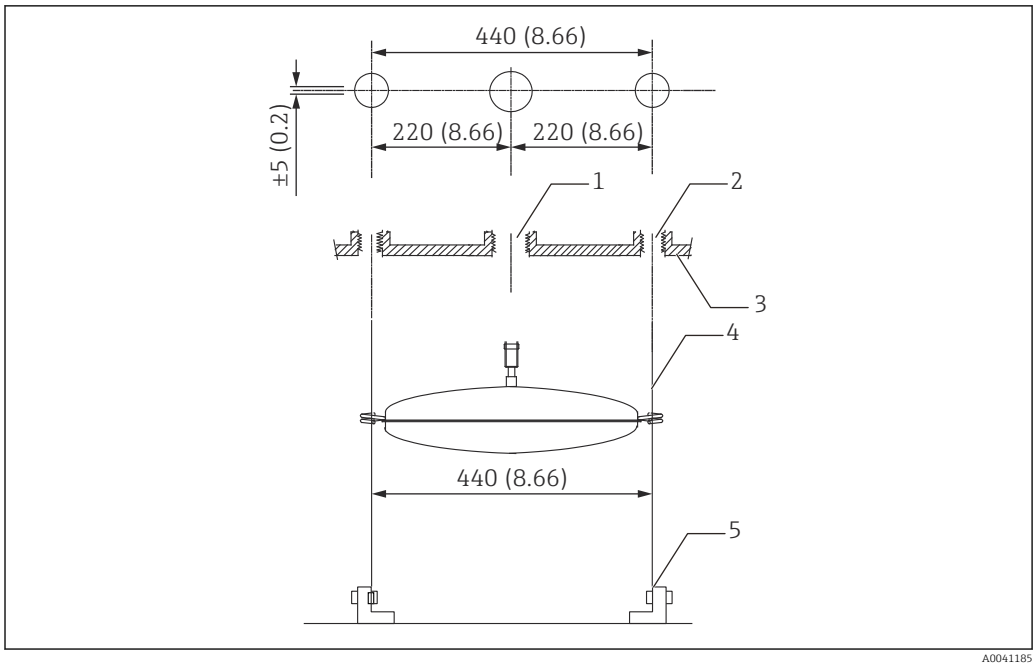
The flange will be a socket type depending on specifications.



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 line*
5 *Plumb bob*

Socket (screw-in) type



26 *Anchor hook installation. 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

For piping purposes, measuring tapes and wires are made slightly longer than their actual measurable lengths. The lengths of measuring tapes and wires will vary depending on the option. The tables below show actual lengths for 060 specification options for each 070 specification option. Note that the maximum display on the gauge head display simply corresponds to the measurement range. Refer to 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 installation

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

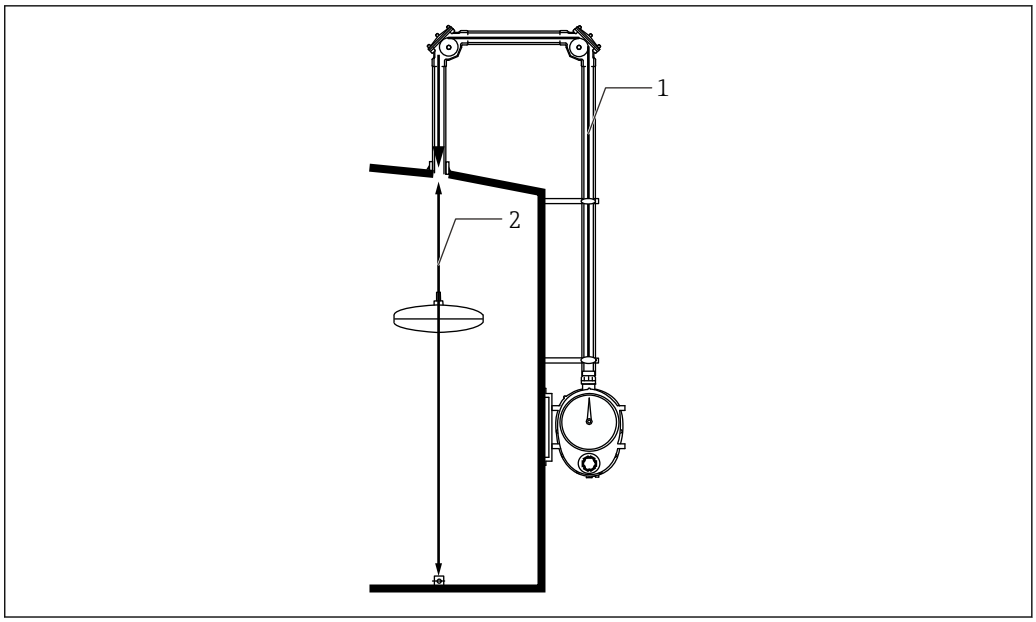
060 measurement range		Length (total length)	Perforated tape (measurement length)	Non-perforated tape	Spare parts
F	60 ft	167.31 ft	69.89 ft	98.42 ft	Contact Endress+Hauser
H	100 ft	249.33 ft	108.26 ft	141.07 ft	Contact Endress+Hauser

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



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

In the diagram above, the maximum measurement distance is 22 mm and the maximum excess is 23 m. For this reason, the total length of the measuring tape is 45 m.

5.8 Sealing materials for wetting liquid and gas parts

5.8.1 List of materials

Product name	Component name	Sealing material application site	Sealing material type	Packing/O-ring materials
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, screw-in type	Cover packing	V#6502
		Stainless steel, tank welding type		
	Top anchor	Aluminum, flange, screw-in type		
		Stainless steel, flange welding type	Spring retainer packing	
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 *ammonia specification CR
		Coupling	O-ring	PTFE
	Gate valve	Shaft	Shaft packing	PTFE
		Cap nut part	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 retainer packing	PTFE
		Stainless steel, 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 (SCPL1), flange welding type	Spring retainer packing	PTFE
		Stainless steel, flange welding type		

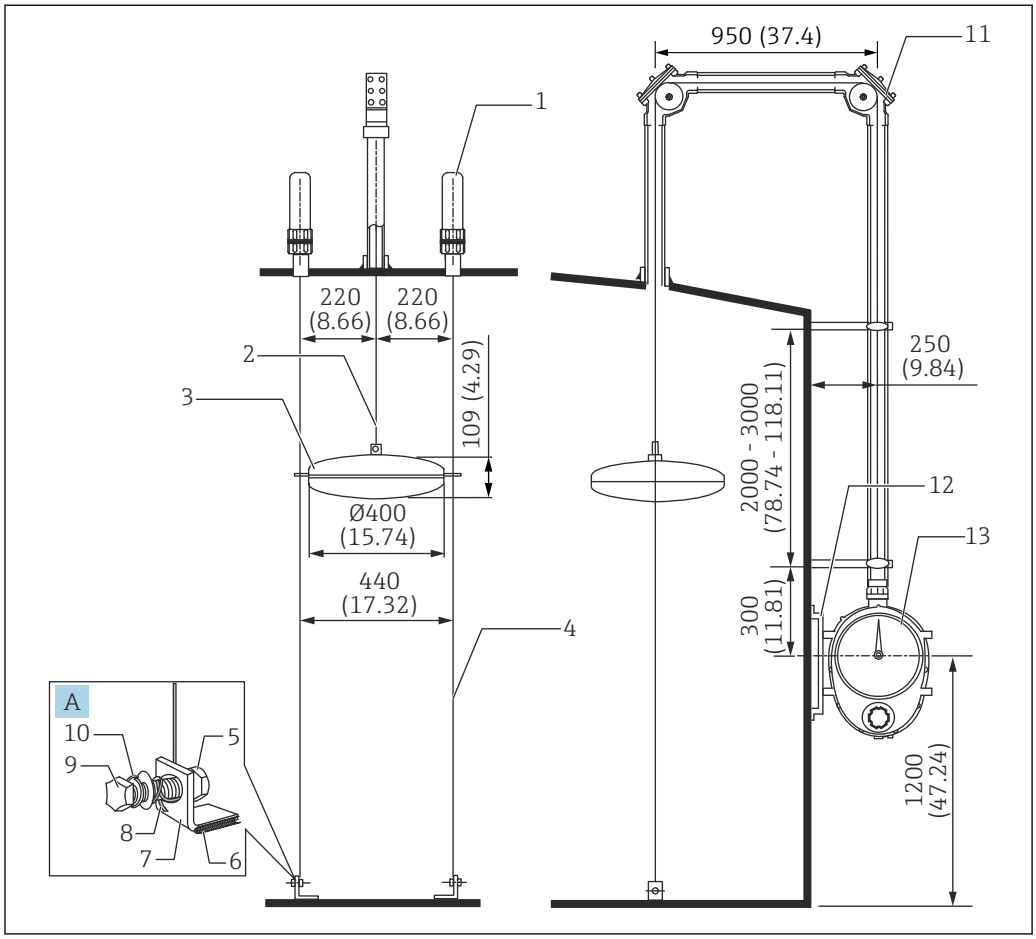
5.9 Material certificates

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

- High-pressure specification gauge head made of iron (the certificate for the flange is the same because it is an integrated type casting with the gauge head), cover, magnetic cover, check shaft (only for those without hoisting), plug
- Stainless steel measuring tapes and wires (excluding PFA-coated wires)
- Stainless steel float
- Stainless steel or iron high-pressure specification top anchor main unit, cover, flange
- Stainless steel guide wires (excluding PFA-coated wires)
- Stainless steel anchor hook
- Main unit of high-pressure specification sheave elbow made of iron (the certificate for the flange is the same because it is an integrated type casting with the main unit of the sheave elbow), cover
- Stainless steel gate valve

5.10 Reference diagrams and order codes for installation

5.10.1 For cone roof tanks (CRT)



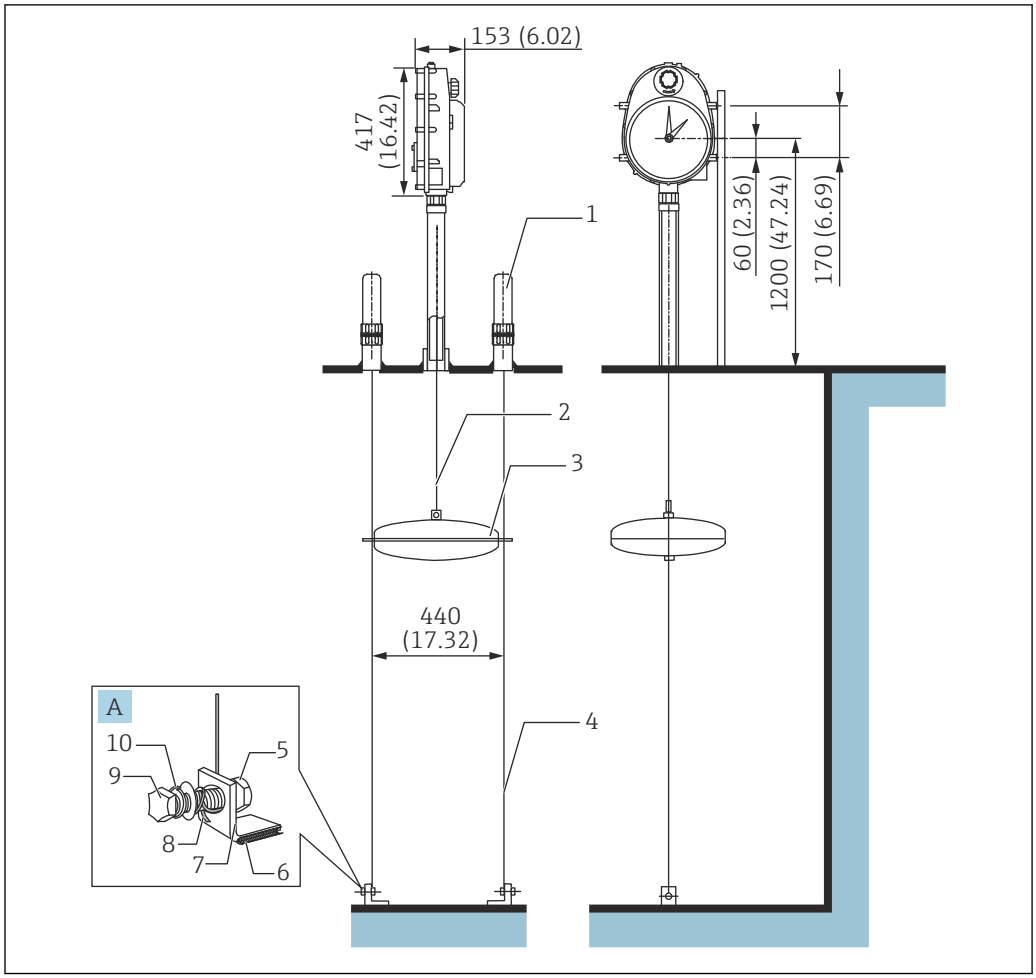
28 *Mounting on a cone roof tank. Unit of measurement mm (in)*

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

Example of target order code (LT5-111A031B11A111200000+PA)

Item	Target	Code	Specification	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, screw JIS B0203	
040	Display; cover	A	Dial display: acrylic	
050	Crank unit	0	None	
060	Measurement range	3	10 m	
070	Measuring tape	1	Measuring tape, CRT	
080	Float	B	D400 mm SUS316 tape connection 5.0 kg, 0.65 ≤ density 1.05, with ring	
090	Top anchor	11	2x R1, aluminum (ADC6), screw JIS B0203	2
100	Guide wire	A	Solid wire with a diameter of 3 mm x 2 wires	
110	Anchor hook; mounting bolt	1	Iron (SCPL1); SUS316	
120	90 ° sheave elbow	112	2x Rp1-1/2, aluminum (ADC6), screw JIS 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 Tank top mounting (for underground tank)



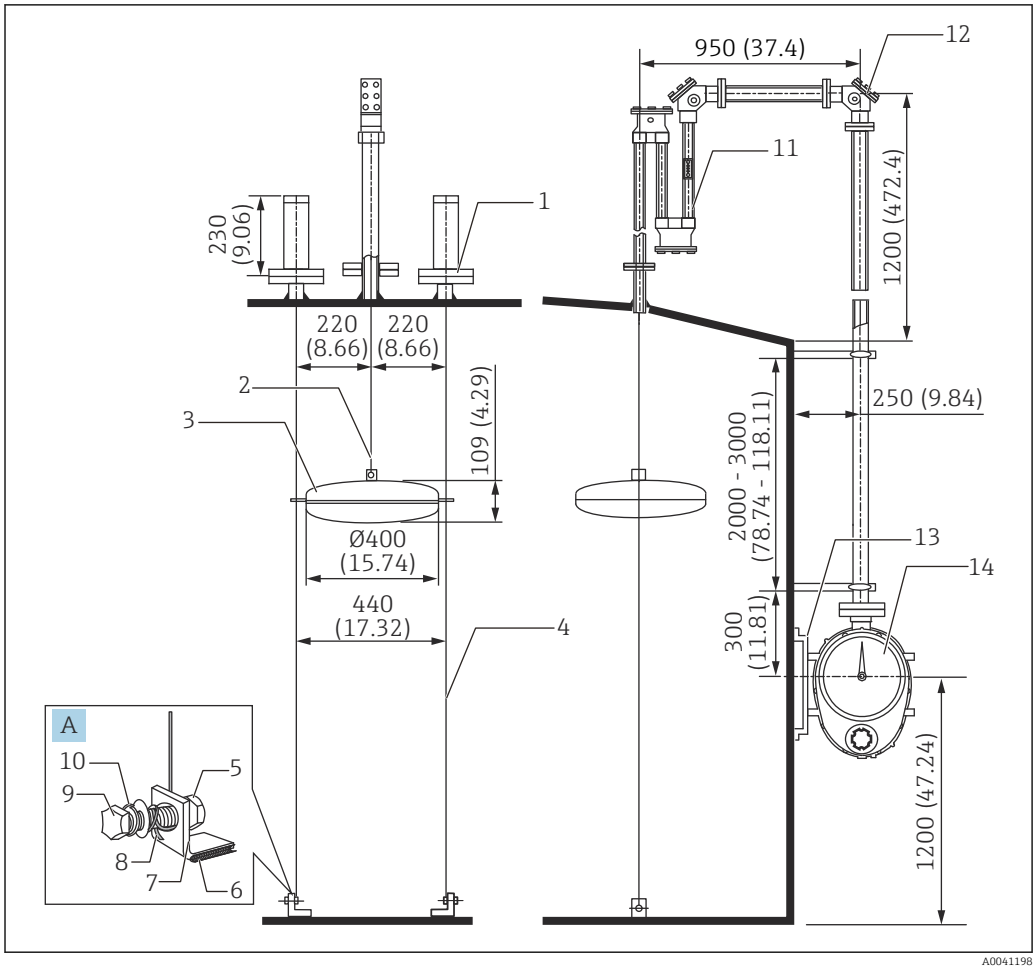
29 *Mounting on underground tank. Unit of measurement mm (in)*

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

Example of target order code (LT5-111C022B11A100000000)

Item	Target	Code	Specification	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, screw JIS B0203	
040	Display; cover	C	Reverse mounting, dial display, acrylic	
050	Crank unit	0	None	
060	Measurement range	2	5 m	
070	Measuring tape	2	Measuring tape, tank top mounting	
080	Float	B	D400 mm SUS316 tape connection 5.0 kg, 0.65 ≤ density 1.05, with ring	
090	Top anchor	11	2x R1, aluminum (ADC6), screw JIS B0203	2
100	Guide wire	A	Solid wire with a diameter of 3 mm x 2 wires	
110	Anchor hook; mounting bolt	1	Iron (SCPL1); 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)



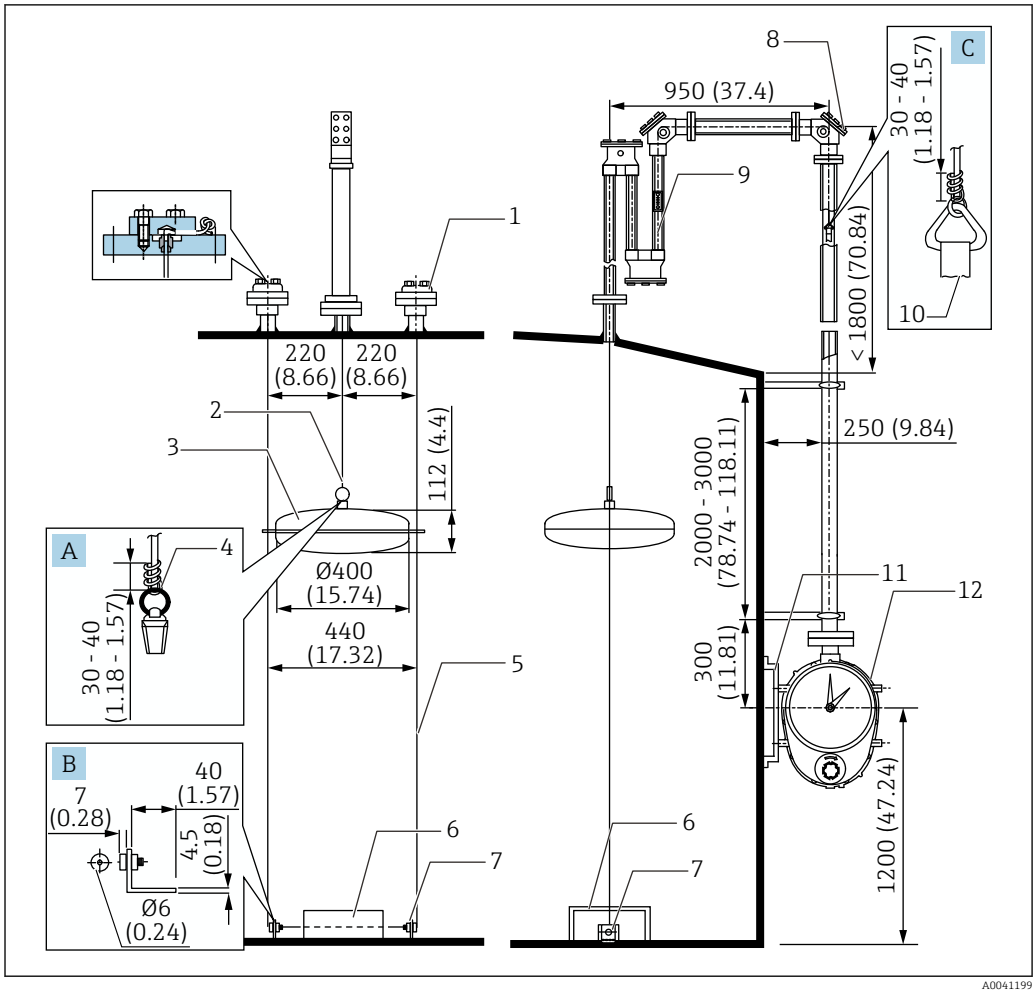
30 Mounting seal pot for CRT. Unit of measurement mm (in)

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

Example of target order code (LT5-11AA023B1BA21A1000F0+PA)

Item	Target	Code	Specification	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	Measurement range	2	5 m	
070	Measuring tape	3	Measuring tape, seal pot / BT	
080	Float	B	D400 mm SUS316 tape connection 5.0 kg, 0.65 ≤ density 1.05, with ring	
090	Top anchor	1B	2x 10K 40A RF, SUS316, flange JIS B2220	2
100	Guide wire	A	Solid wire with a diameter of 3 mm 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 PVC seal pot for CRT)



31 *Mounting PVC seal pot for CRT. Unit of measurement mm (in)*

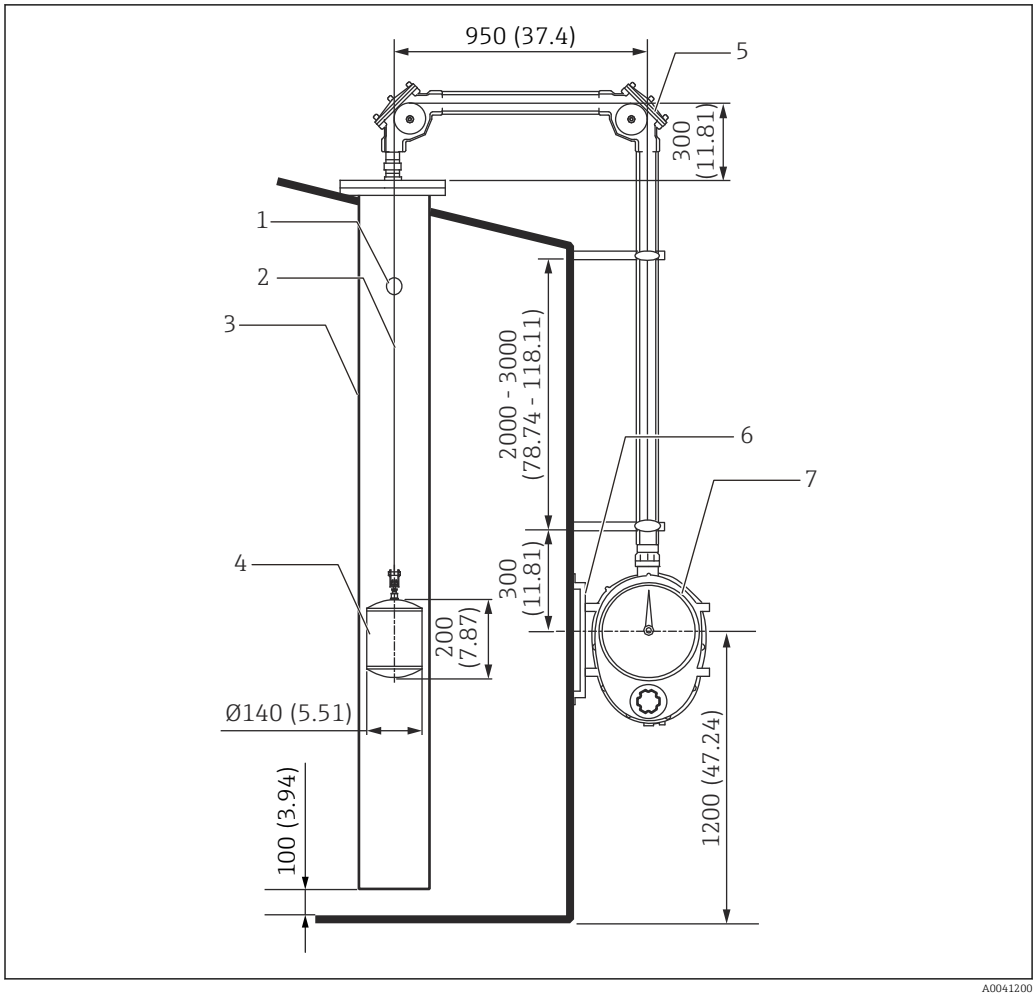
A Float tip
B Anchor hook details
C Triangle bracket for measuring wire
1 Top anchor
2 Measuring wire
3 Float
4 Teflon tube
5 Guide wire (PFA-coated wire)
6 Wire protection stand (not supplied)
7 Anchor hook
8 90 ° sheave elbow
9 Seal pot
10 Measuring tape
11 Gauge supporter
12 Gauge head

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

Example of target order code (LT5-11AA025H1NC41A1000N0+PA)

Item	Target	Code	Specification	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	Measurement range	2	5 m	
070	Measuring tape	5	Tape + PFA-coated wire, seal pot/CRT	
080	Float	H	D400 mm SUS316 tape connection 5.0 kg, 0.65 ≤ density 1.05, with ring	
090	Top anchor	1N	2x 10K 40A RF, PVC, flange JIS B2220	2
100	Guide wire	C	PFA-coated stranded wire with a diameter of 4.6 mm 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 type)



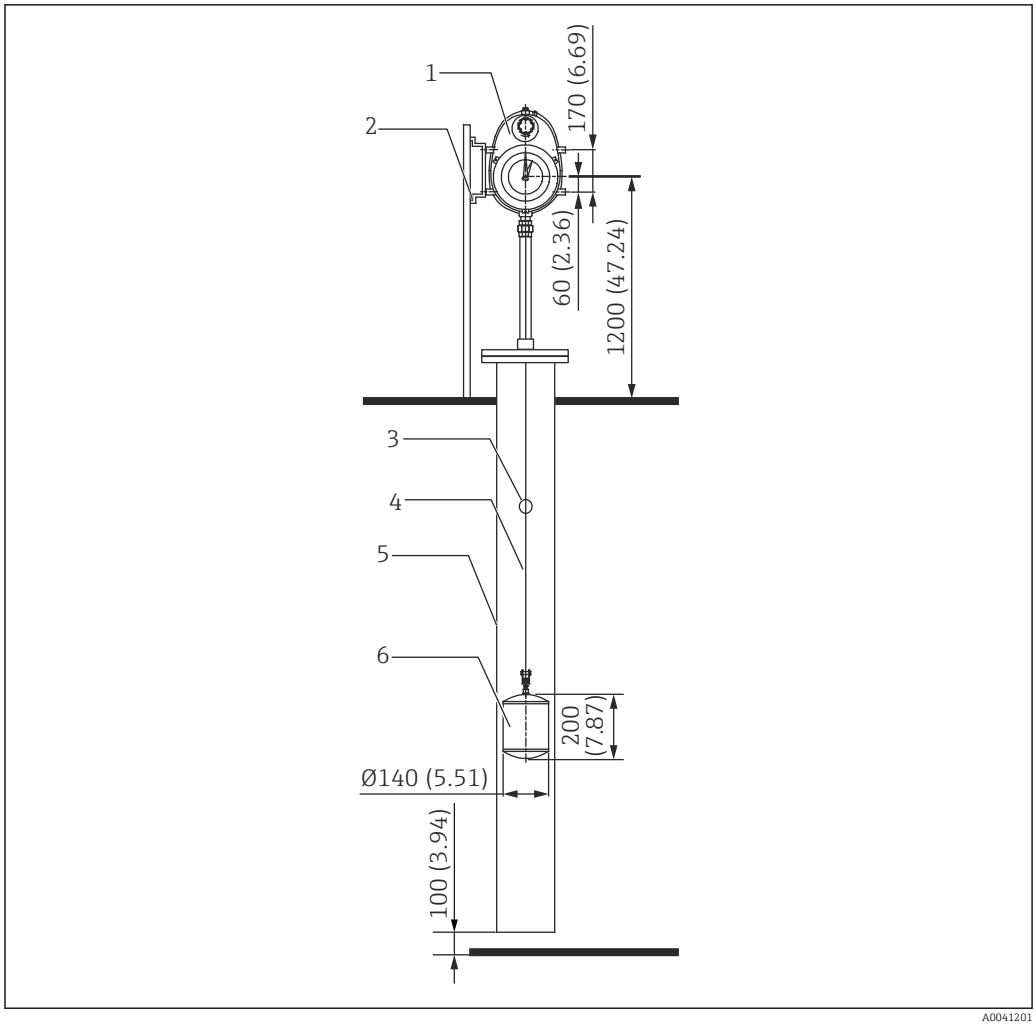
32 *Mounting on a compact cone roof tank. Unit of measurement mm (in)*

1 *Vent hole*
2 *Measuring tape*
3 *Guide pipe (stilling well)*
4 *Float*
5 *90 ° sheave elbow*
6 *Gauge supporter*
7 *Gauge head*

Example of target order code (LT5-111A021L000011200000+PA)

Item	Target	Code	Specification	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, screw JIS B0203	
040	Display; cover	A	Dial display: acrylic	
050	Crank unit	0	None	
060	Measurement range	2	5 m	
070	Measuring tape	1	Measuring tape, CRT	
080	Float	L	D140 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), screw 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 Tank top mounting (guide pipe type)



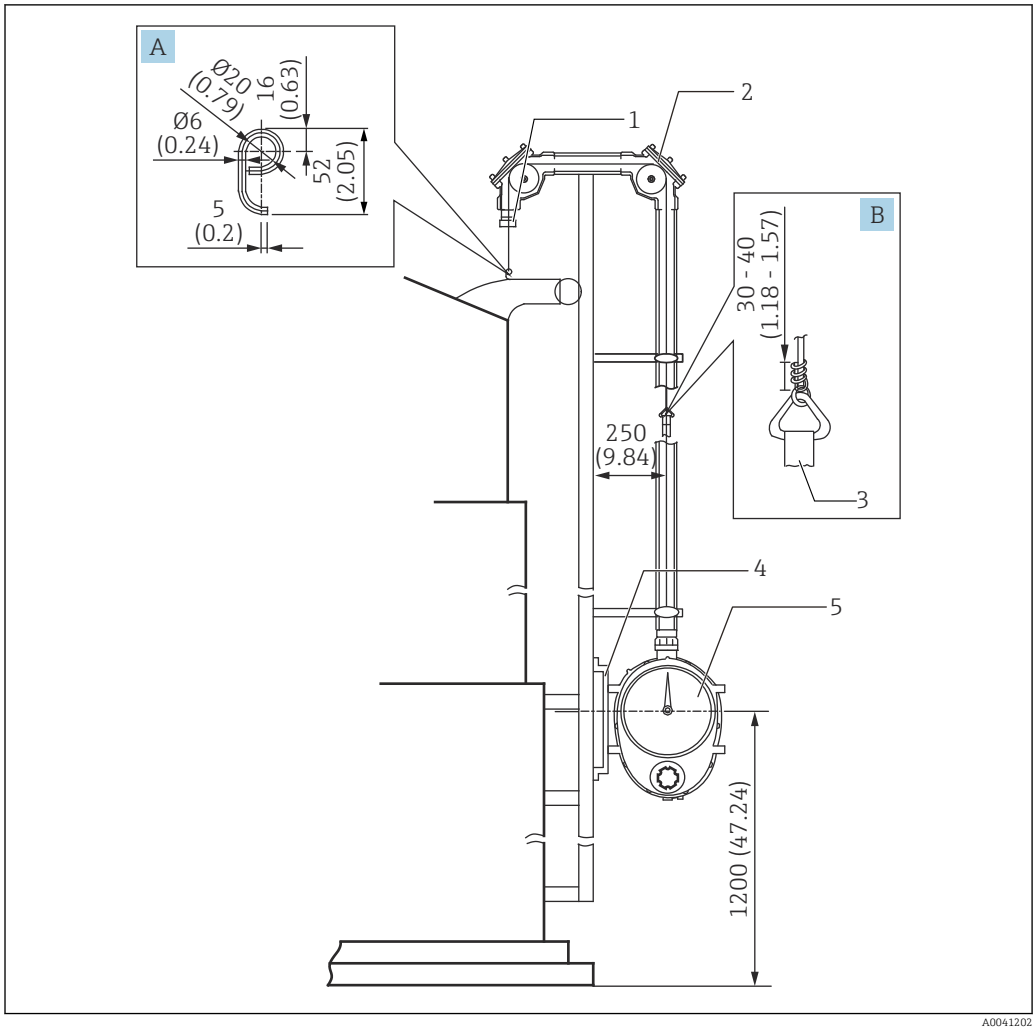
33 *Mounting on tank top, unit. Unit of measurement mm (in)*

1 *Gauge head*
2 *Gauge supporter*
3 *Vent hole*
4 *Measuring tape*
5 *Guide pipe (stilling well)*
6 *Float*

Example of target order code (LT5-111C022L000000000000+PA)

Item	Target	Code	Specification	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, screw JIS B0203	
040	Display; cover	C	Reverse mounting, dial display, acrylic	
050	Crank unit	0	None	
060	Measurement range	2	5 m	
070	Measuring tape	2	Measuring tape, tank top mounting	
080	Float	L	D140 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



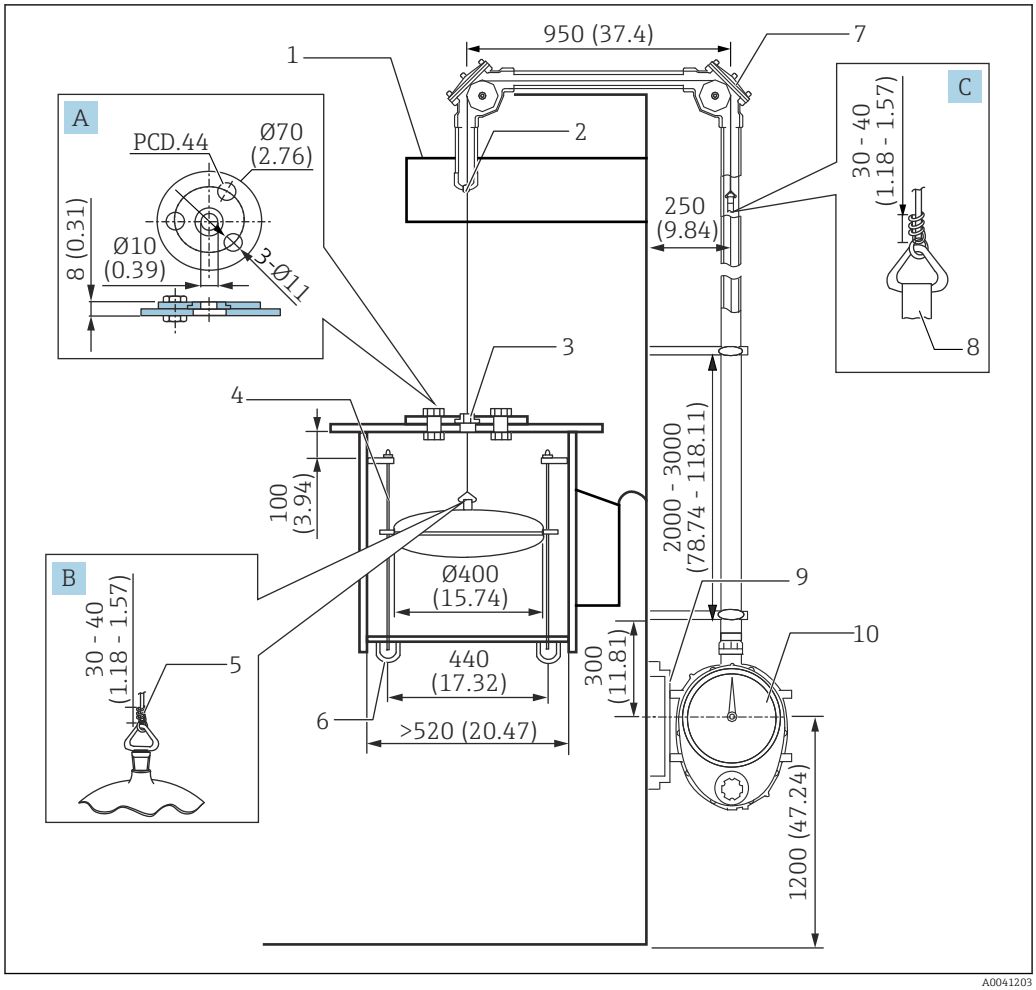
34 *Mounting a gas holder. Unit of measurement mm (in)*

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

Example of target order code (LT5-111A0340000011200000+PAPFPH)

Item	Target	Code	Specification	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, screw JIS B0203	
040	Display; cover	A	Dial display: acrylic	
050	Crank unit	0	None	
060	Measurement 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), screw 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, Rc 1-1/2	
620	>>Enclosed accessories	PH	Gas holder wire hook	

5.10.8 For floating roof (FRT)



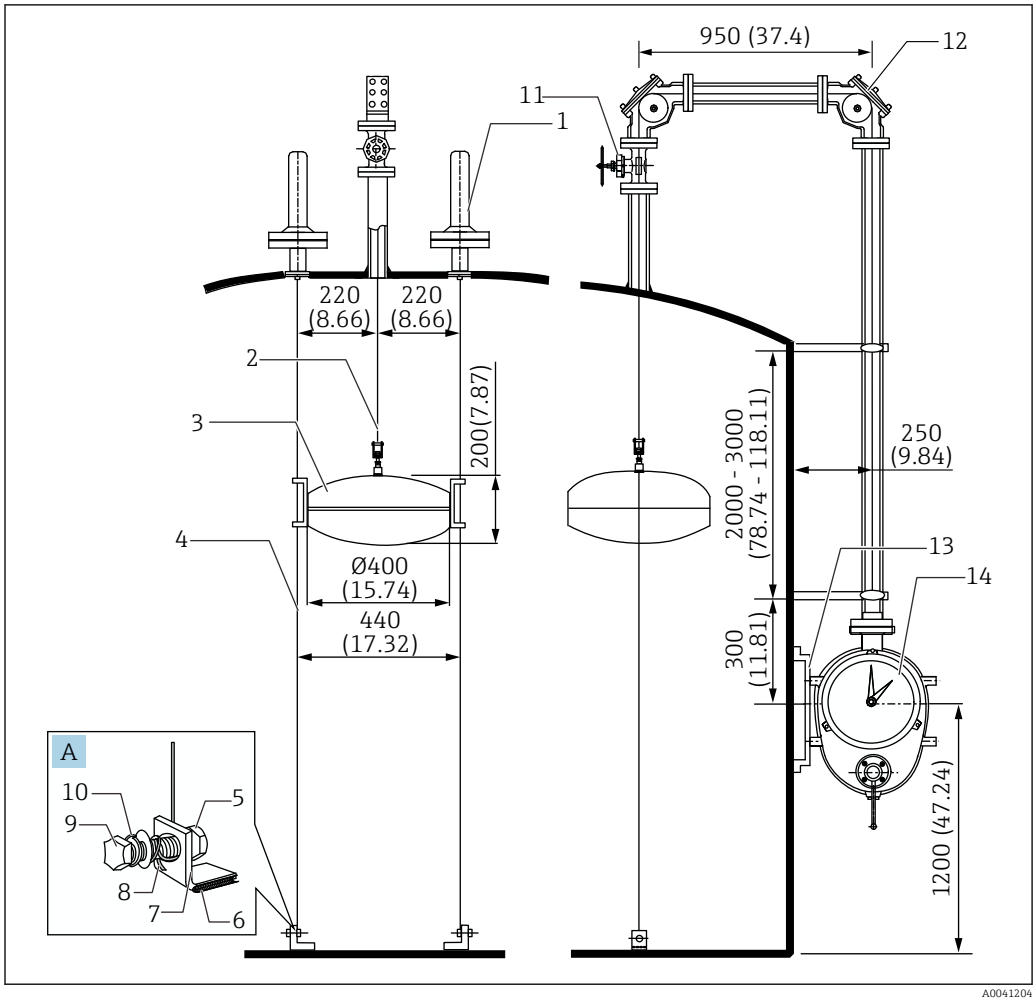
35 *Mounting on a floating roof tank. Unit of measurement mm (in)*

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: φ16 mm (0.63 in)
5 Stainless steel wire (accessory)
6 Pipe end: 1B Sch 40 to 80
7 90 ° sheave elbow
8 Measuring tape
9 Gauge supporter
10 Gauge head

Target order code (LT5-111A054E000011200000+PAPEPF)

Item	Target	Code	Specification	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, screw JIS B0203	
040	Display; cover	A	Dial display: acrylic	
050	Crank unit	0	None	
060	Measurement range	5	20 m	
070	Measuring tape	4	Tape + wire, FRT	
080	Float	E	D400 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), screw 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, Rc 1-1/2	

5.10.9 Dome roof tank for medium pressure



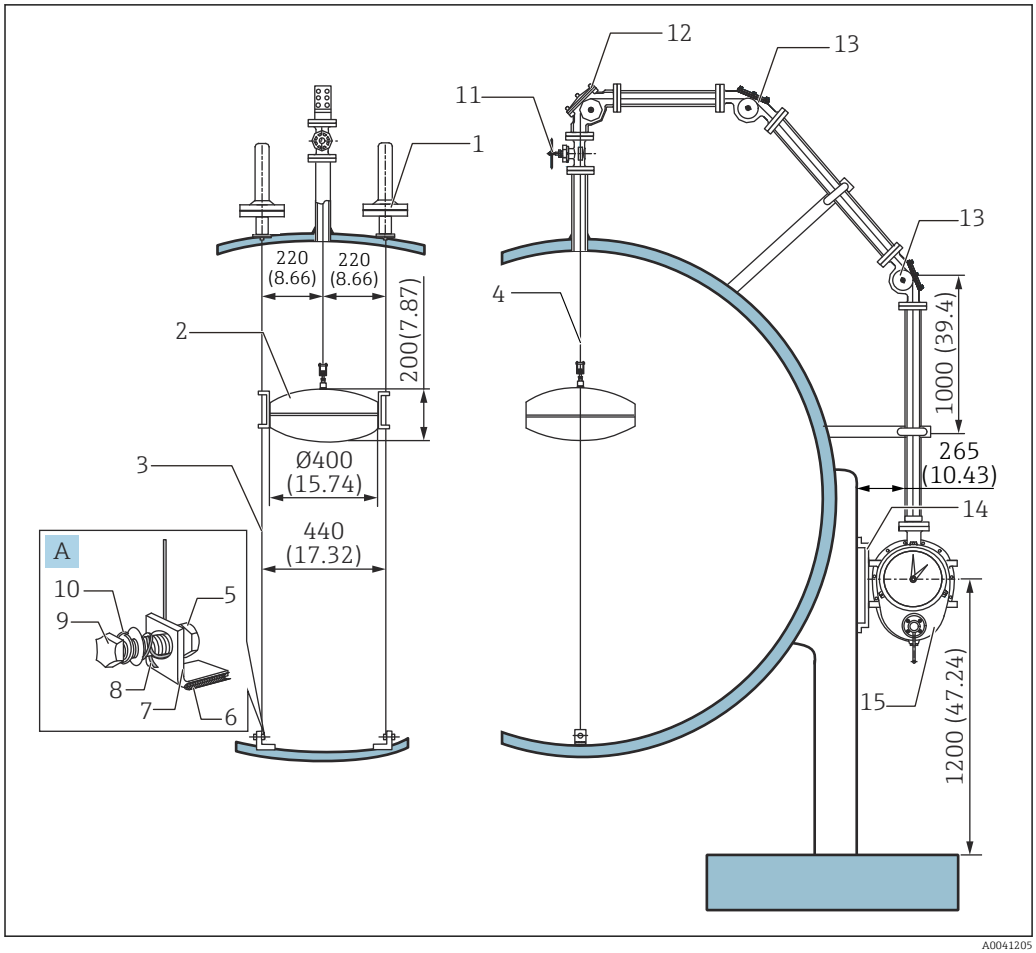
36 Mounting on a dome roof tank for medium pressure. Unit of measurement mm (in)

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

Example of target order code (LT5-44AB151R4AA24A200001+PA)

Item	Target	Code	Specification	Quantity
020	Gauge head	4	0.09807 MPa/14.22 psi, aluminum (AC4C-T6)	1
030	Gauge head process connection	4A	10K 40A RF, aluminum (AC4C-T6), flange JIS B2220	
040	Display; cover	B	Dial display; glass + iron (SCPL1)	
050	Crank unit	1	Selected	
060	Measurement range	5	20 m	
070	Measuring tape	1	Measuring tape, CRT	
080	Float	R	D400 mm SUS316 wire connection 8.3 kg, 0.5 ≤ density 0.7, with ring	
090	Top anchor	4A	2x 10K 40A RF, aluminum (AC4C-T6), flange JIS B2220	2
100	Guide wire	A	Solid wire with a diameter of 3 mm x 2 wires	
110	Anchor hook; mounting bolt	2	SUS316; SUS316	
120	90 ° sheave elbow	4A2	2x 10K 40A RF, aluminum (AC4C-T6), 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	1
620	>>Enclosed accessories	PA	Gauge supporter SS400 low/medium-pressure gauge head	

5.10.10 Spherical tank for high pressure



37 *Mounting on a spherical tank for high pressure. 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

Example of target order code (LT5-66GB153R6GA26G16G204+PC)

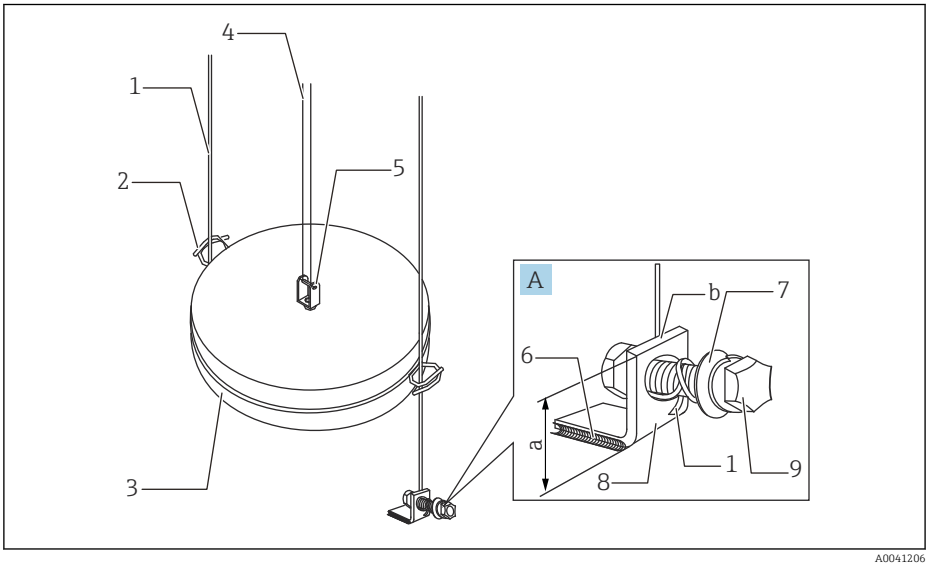
Item	Target	Code	Specification	Quantity
020	Gauge head	6	2.45 MPa/355.25 psi, iron (SCPL1)	1
030	Gauge head process connection	6G	20K 40A RF, iron (SCPL1), flange JIS B2220	
040	Display; cover	B	Dial display; glass + iron (SCPL1)	
050	Crank unit	1	Selected	
060	Measurement range	5	20 m	
070	Measuring tape	3	Measuring tape, seal pot / BT	
080	Float	R	D400 mm SUS316 wire connection 8.3 kg, 0.5 ≤ density 0.7, with ring	
090	Top anchor	6G	2x 20K 40A RF, iron (SCPL1), flange JIS B2220	2
100	Guide wire	A	Solid wire with a diameter of 3 mm x 2 wires	
110	Anchor hook; mounting bolt	2	SUS316; SUS316	
120	90 ° sheave elbow	6G1	1x 20K 40A RF, iron (SCPL1), flange JIS B2220	1
130	135 ° sheave elbow	6G2	2x 20K 40A RF, iron (SCPL1), 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

- Do not bend the guide wires.
- Pull one of the two guide wires vertically while pulling the other guide wire horizontally.
- Use two packings with a washer in between for the space between the top anchor and the mounting flange on the tank side. Check the packing before arranging the guide wires.
- Make sure that the anchor hook and the guide wire at the bottom of the tank are sufficiently strong as they will be difficult to repair once the tank is filled with liquid.

1. Open the cover of the top anchor located on the top of the tank.
2. Pass the guide wire through the guide ring on the float at the bottom of the tank, and secure it tightly on the anchor hook using a bolt and a nut.
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).
   Wrap the guide wire once or twice from the inside of the anchor hook, pass it through the hole, and then wrap it again once or twice on the outside. Adjust the number of coils as necessary.

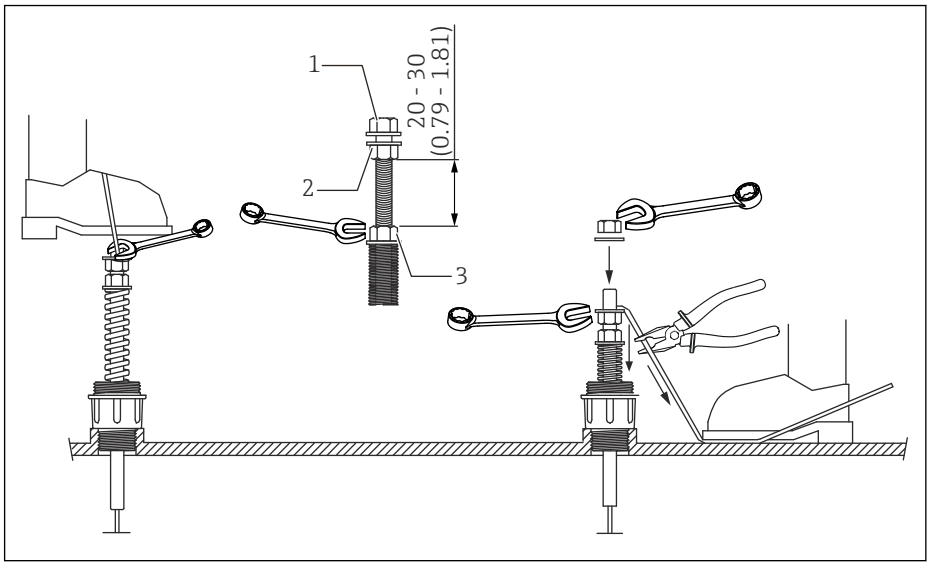


38 *Mounting guide wires 1*

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

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

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



39 Mounting guide wires 2. Unit of measurement mm (in)

1 Nut 1
2 Nut 2
3 Nut 3

This completes the installation procedure.

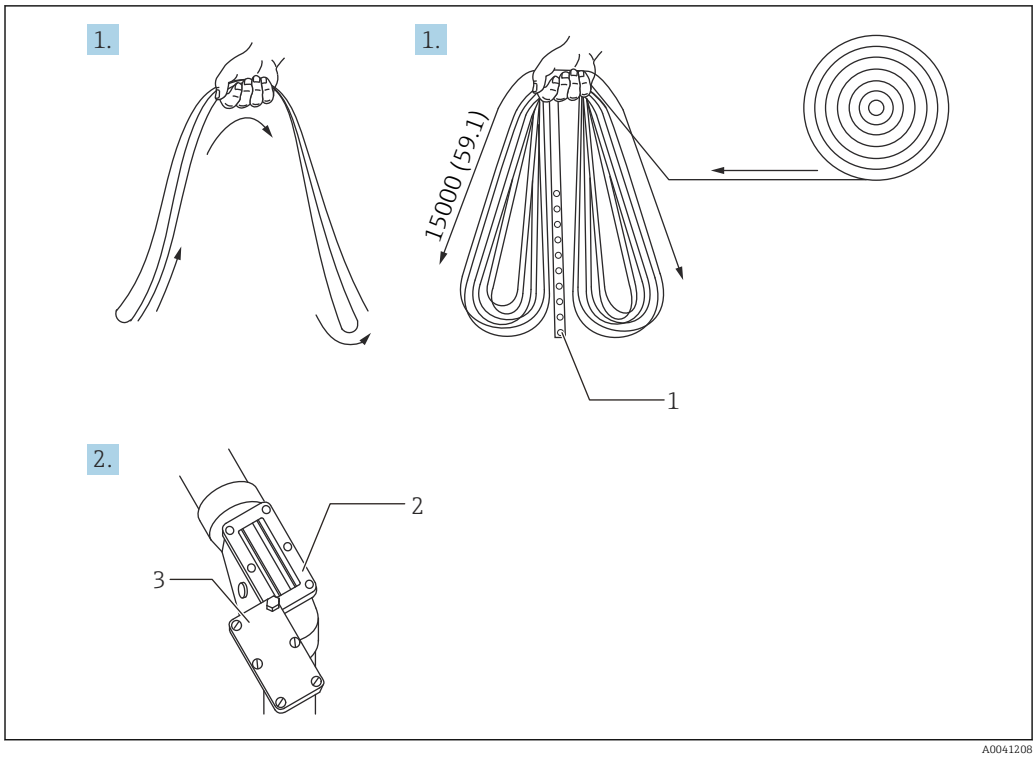
5.12 Mounting measuring tape and measuring wire

- 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.
- There are small holes at intervals of 20 mm (or 1 inch if using the imperial system) along half of the entire length of the measuring tape. Mount the measuring tape so that the perforated side is wound by the gauge.
- When mounting, check to make sure that the measuring tape and the measuring wires do not come off the sheave elbow roller. Always inspect them after they have been mounted.
- If it is necessary to pass the measuring tape through a 135 ° sheave elbow, ensure the safety of the work area as poor footing makes this an extremely dangerous mounting process.
- The joint between the float and the measuring tape cannot be repaired once the tank is filled. For this reason, inspect the joint thoroughly after the float and the measuring tape have been connected.

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 preparation for the mounting process.



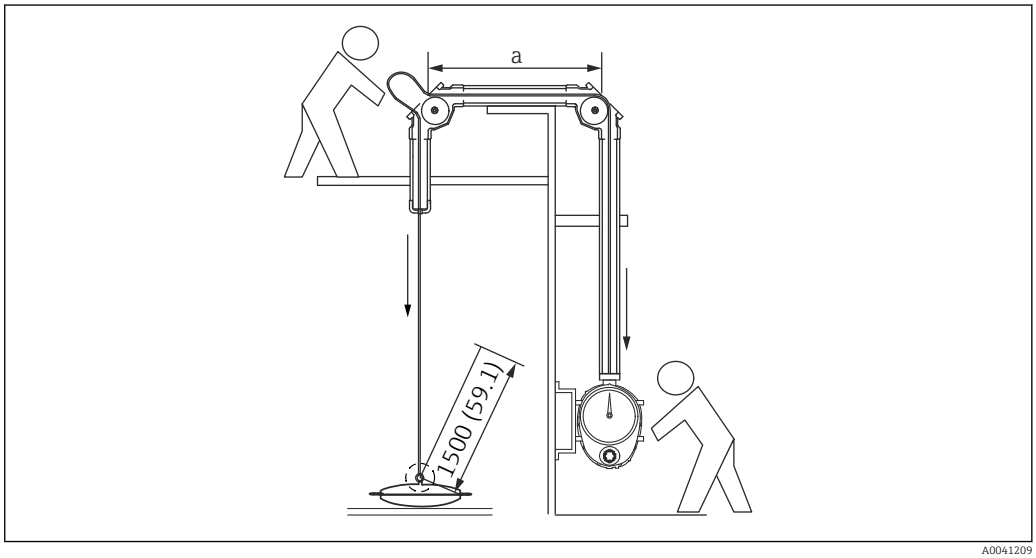
40 *Preparing the measuring tape. Unit of measurement mm (in)*

1 *Perforation*
2 *Sheave elbow*
3 *Cover*

5.12.1 For cone roof tank

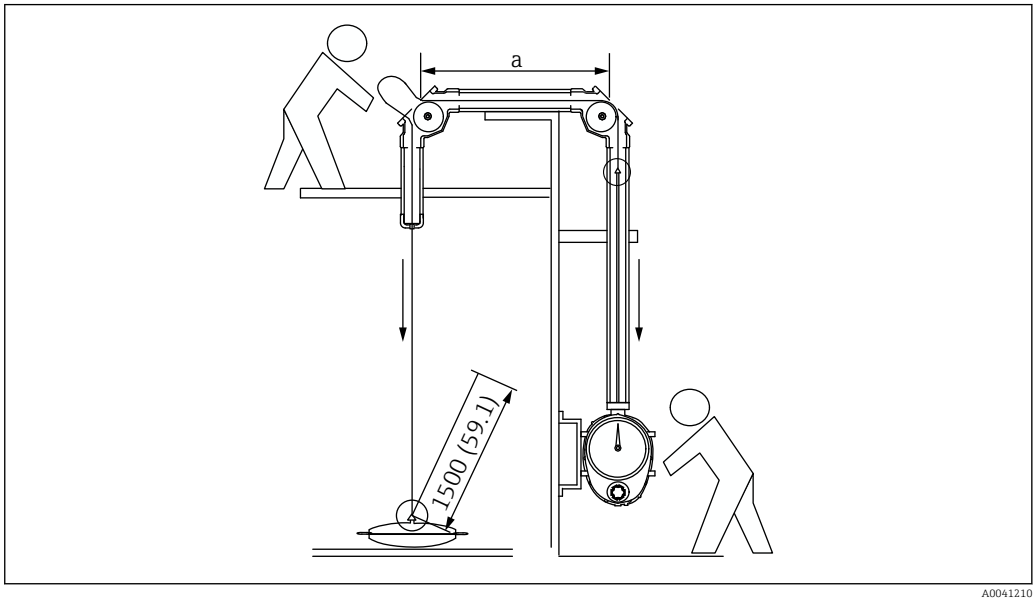
Mounting procedure

1. Feed one end of the measuring tape (non-perforated side) into the tank from the sheave elbow on the tank roof.
2. Pass the other end of the tape (perforated, looped side) through the sheave elbow on the gauge head and insert it into the gauge head.
3. Secure the end of the measuring tape on the tape drum. Wind the tape around the tape drum twice, and then pull the measuring tape inside the tank.
4. For the length of the measuring tape to the float, cut the measuring tape while leaving approximately 1.5 m in excess.
5. Connect the measuring tape to the float.
   ↳ For details on the connection procedure, refer to → 58.



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

a Guide pipe



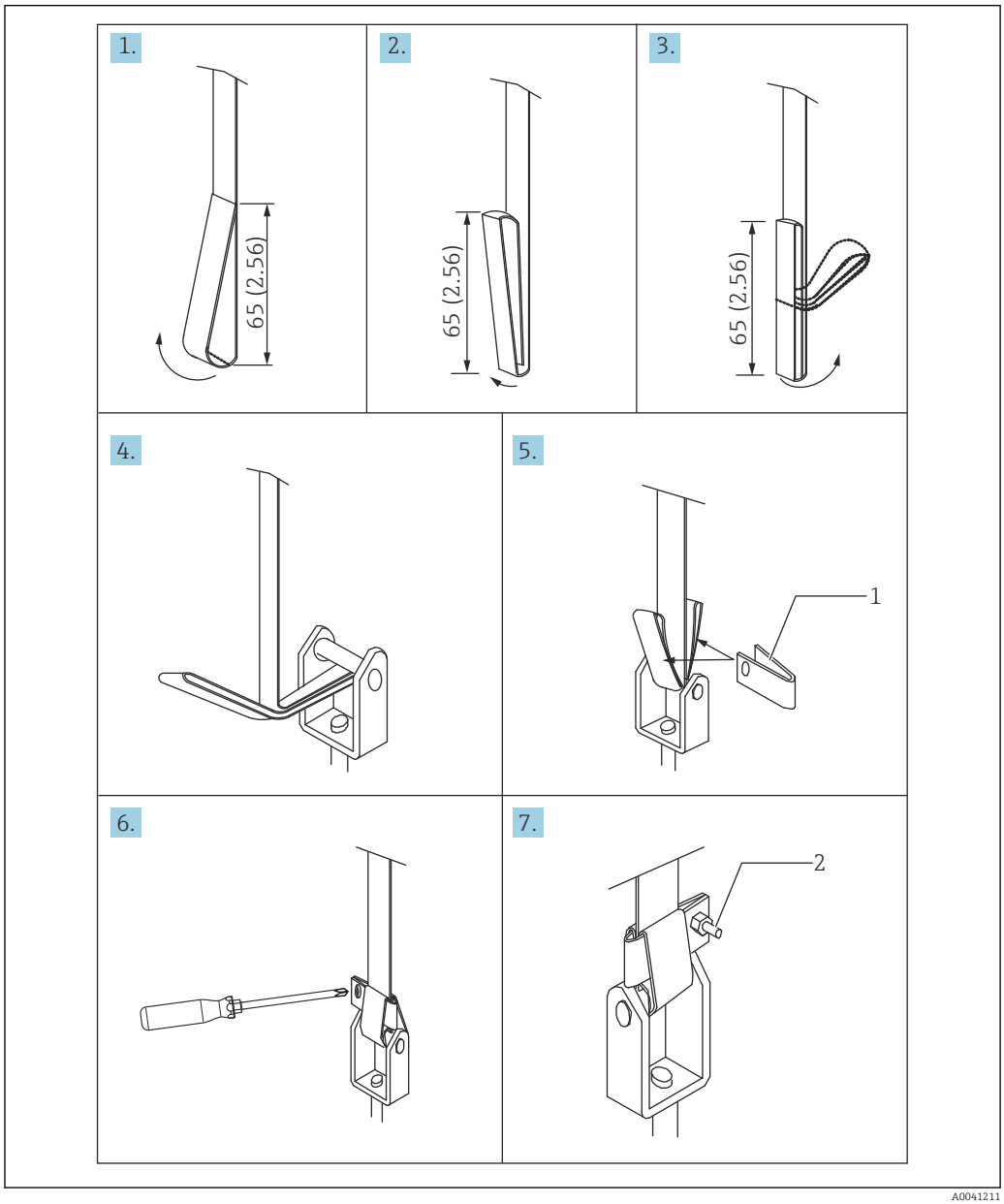
42 *Mounting the measuring tape and measurement wires: Measuring tape + measurement wires. Unit of measurement mm (in)*

a Guide pipe

5.12.2 Measuring tape and float connection procedure

1. Bend the measuring tape at a length of 65 mm (2.56 in).
2. Bend the measuring tape again at a 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.
6. Crush the protruding end of the bolt on the nut side with pliers to lock the nut.

This completes the connection procedure.



43 *Connecting the measuring tape and the float. Unit of measurement mm (in)*

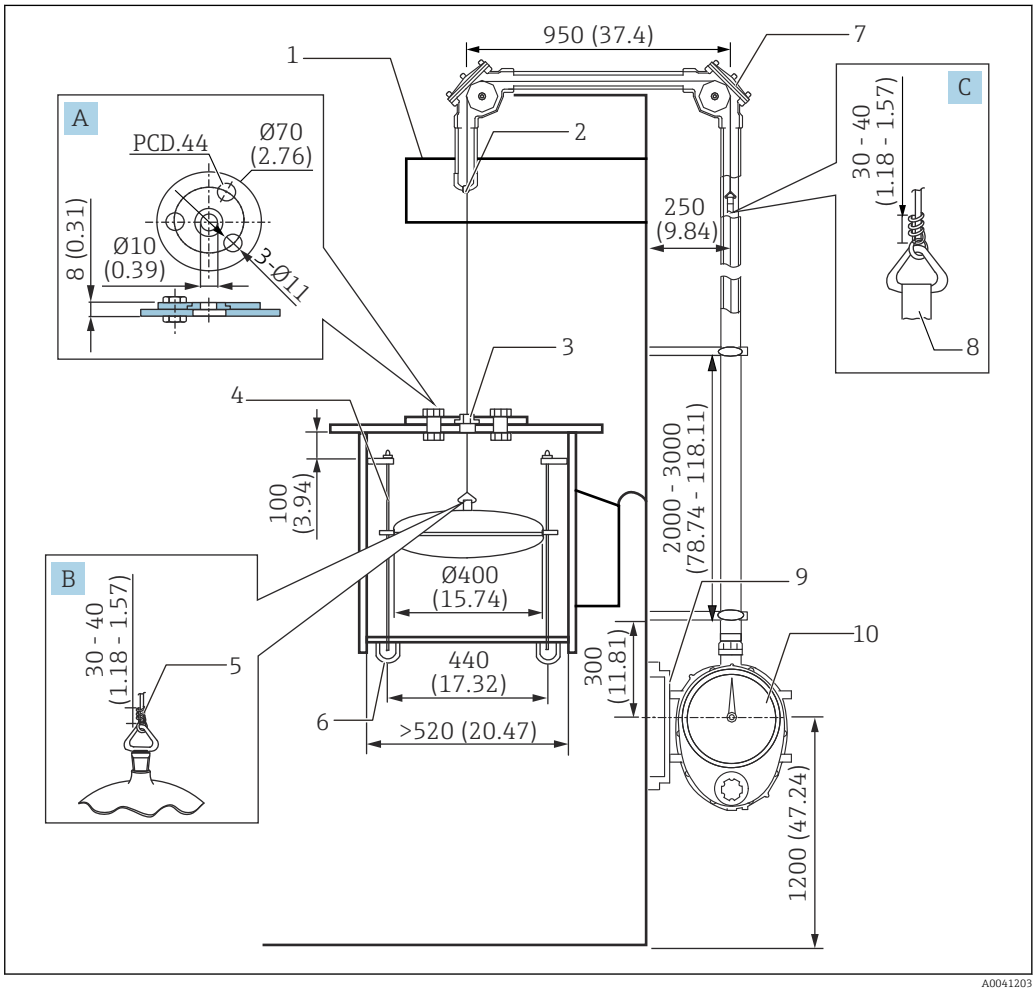
1 Measuring tape clamp
2 Screw thread

5.12.3 For floating roof tank

Mounting procedure

1. Insert one end of the measuring wire into the tank from the 90° sheave elbow on the gauge head through the sheave elbow on the tank roof.
2. Temporarily fix the other end in place.
3. Connect the measuring wire to the float inside the tank.
4. Connect the measuring wire to the measuring tape on top of the tank again and feed the measuring tape to the gauge head side.
5. Confirm that the measuring tape is not twisted.
6. Close the sheave elbow cover.

This completes the mounting procedure.



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: φ16 mm (0.63)
5 Stainless steel wire (accessory)
6 Pipe end : 1B Sch 40 to 80
7 90 ° sheave elbow
8 Measuring tape
9 Gauge supporter
10 Gauge head

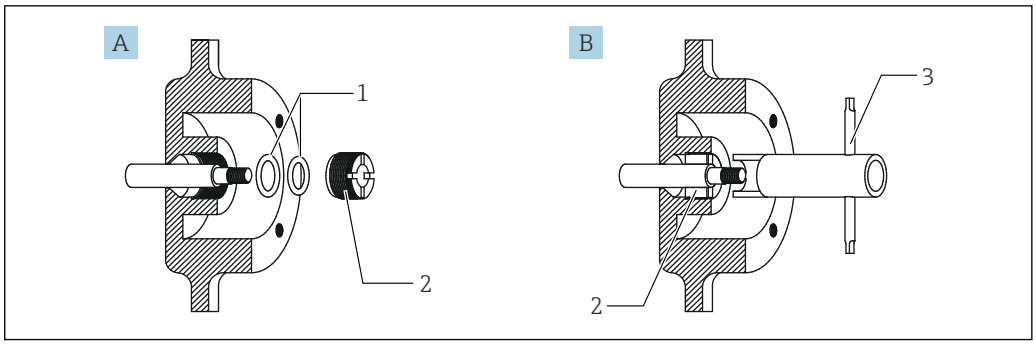
5.12.4 For medium/high pressure tank

- 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. Mount the measuring tape so that the perforated side is wound by the gauge.
- When mounting, check to make sure that the measuring tape and the measuring wires do not come off the sheave elbow roller. Always inspect them after they have been mounted.
- If it is necessary to pass the measuring tape through a 135 ° sheave elbow, ensure the safety of the work area as poor footing makes this an extremely dangerous mounting process.
- The joint between the float and the measuring tape cannot be repaired once the tank is filled. For this reason, inspect the joint thoroughly after the float and the measuring tape have been connected.

Mounting procedure

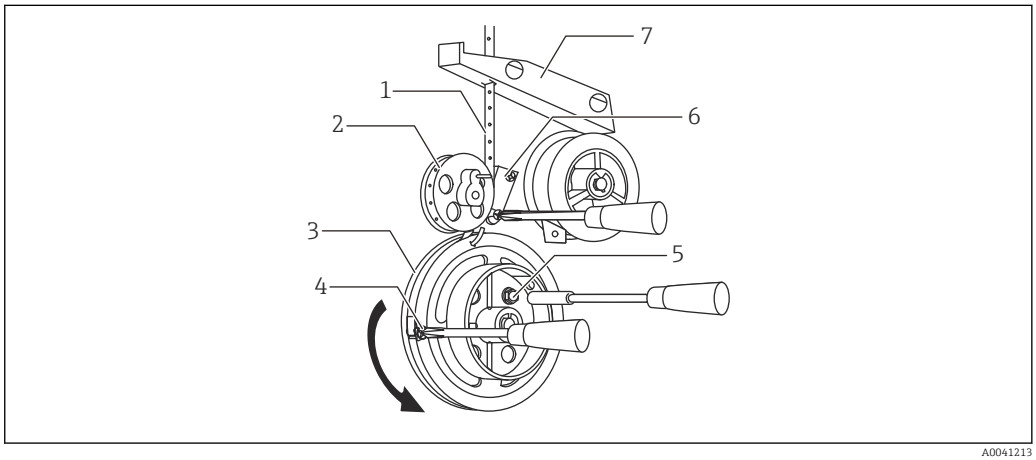
1. Rotate the gate valve counterclockwise and open the gate valve completely, and then remove the sheave elbow cover and the gauge rear cover.
   ↳ Using the attached gland tightening tool, remove the gland on the rear cover of the gauge head.
   Remove the O-rings (2 pcs.).
2. Remove the tape guide 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 side and insert it into the gauge.
5. Once the measuring tape is inserted into the gauge through the narrow opening in the dust cover, secure it to the tape drum with tape set screws, then wind the tape twice around the tape drum.
6. Loosen the mounting screws (2 pcs.) and adjust the position of the measuring tape so that it does not obstruct the narrow opening in the dust cover.
7. Pull the measuring tape inside the tank.
8. For the length of the measuring tape to the float, cut the measuring tape while leaving approximately 1.5 mm (0.06 in) in excess.
9. Connect the measuring tape to the float.
   ↳ For details on the connection procedure, refer to → 58.
10. Confirm 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.



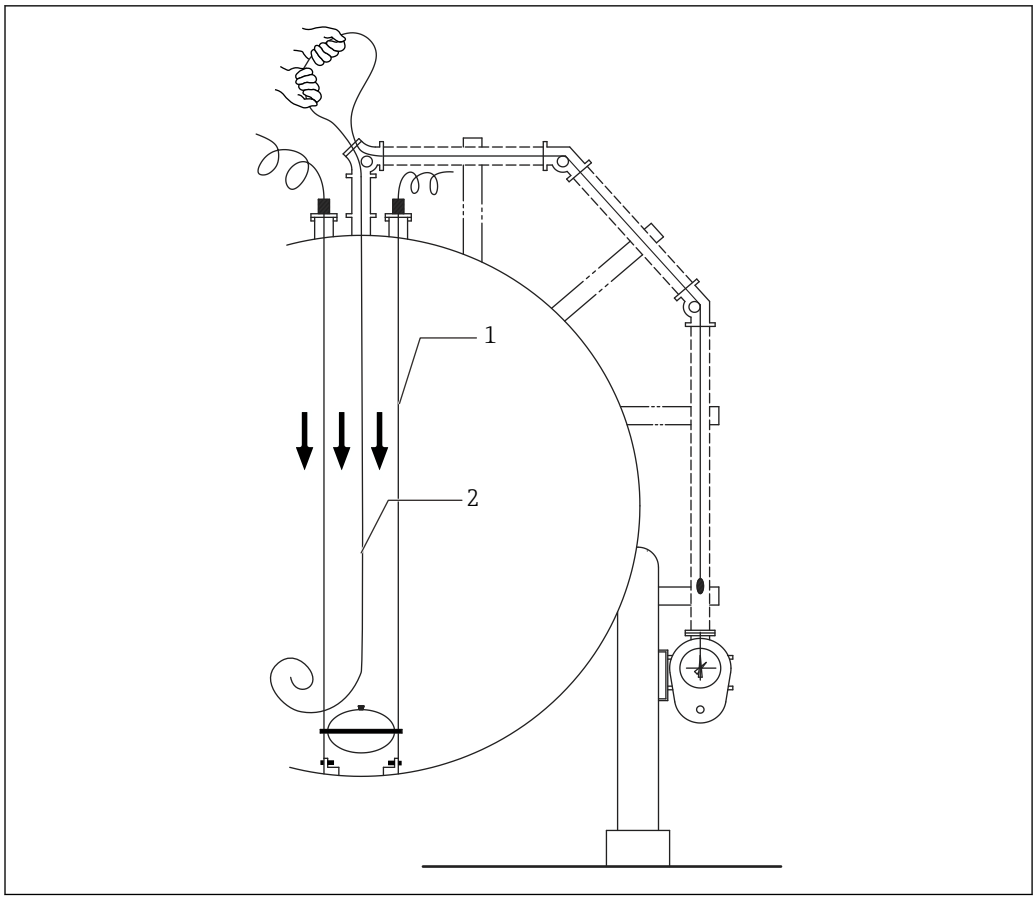
45 *Gland fixing tool*

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



46 *LT components*

1 Measuring tape
2 Sprocket
3 Tape drum
4 Tape set screw
5 Lock screw
6 Tape guide
7 Dust cover



47 *Mounting the measuring tape*

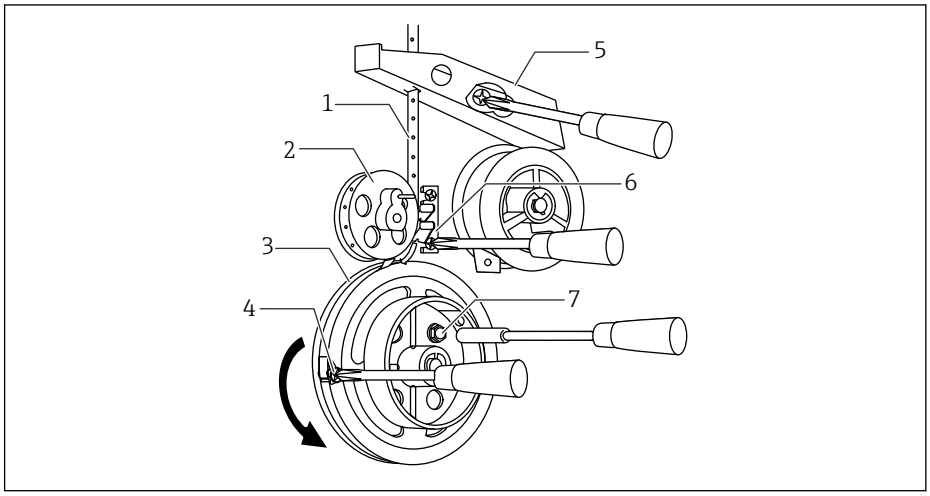
1 Guide wire
2 Measuring tape

Once the measuring tape has been connected to the gauge head, cut it off, leaving approximately 1.5 m (4.92 ft) from the connection to the float.

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.

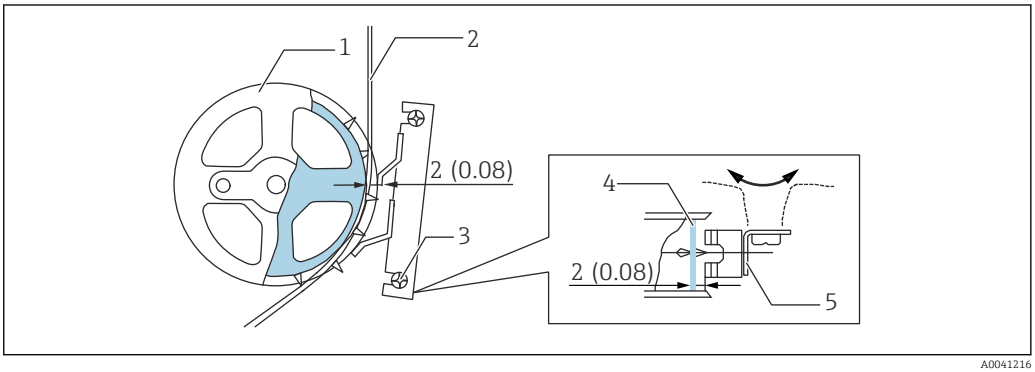


48 Tape drum

1 Measuring tape
2 Sprocket
3 Tape drum
4 Tape set screw
5 Dust cover
6 Tape guide
7 Lock screw

2. After the measuring tape has been properly set, adjust the ends of the tape guide as shown below so that the two ends are both approximately 2 mm (0.08 in) away from the measuring tape surface.
   ↳ The measuring tape may come off the sprocket pins due to abrupt movement caused by liquid waves, which may throw off the indicator. The tape guide prevents this.
3. If a dust cover is installed, loosen the mounting screws (2 pcs.) and adjust the position of the measuring tape so that it does not obstruct the narrow opening in the dust cover.

This completes the adjustment procedure.



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

1 Sprocket
2 Measuring tape
3 Mounting bolt
4 Measuring tape
5 Tape guide

5.12.6 Mounting a conster

Mounting procedure

Mount the conster after the measuring tape has been installed.

- Never remove your hand when winding the conster. The force of the spring may cause an injury.
- If the conster is removed from the large conster drum or excessive force is applied to it, the generated torque becomes uneven, resulting in inaccurate reading. Handle the conster with care.
- When winding the conster from the small conster drum to the large conster drum, do not let go of the large conster drum until the force has been transmitted to the measuring tape at the end.

1. Check to ensure that the lock screw has been removed before securing the tip 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 fixing the conster drum in place, rotate the tape drum counterclockwise to remove any slack before fixing it in place.
4. If the tank is empty, roll the tape twice around the small conster drum before securing it to the tape drum with a lock screw.
   ↳ If the tank contains liquid, measure the level of the liquid, calculate the number of windings using the equation below, and then wind the tape around the large conster drum the exact number of times required based on the calculation.
5. Close the gauge head cover.
6. For LT5-4/LT5-6, close the gland of the cover.

This completes the conster mounting procedure.

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

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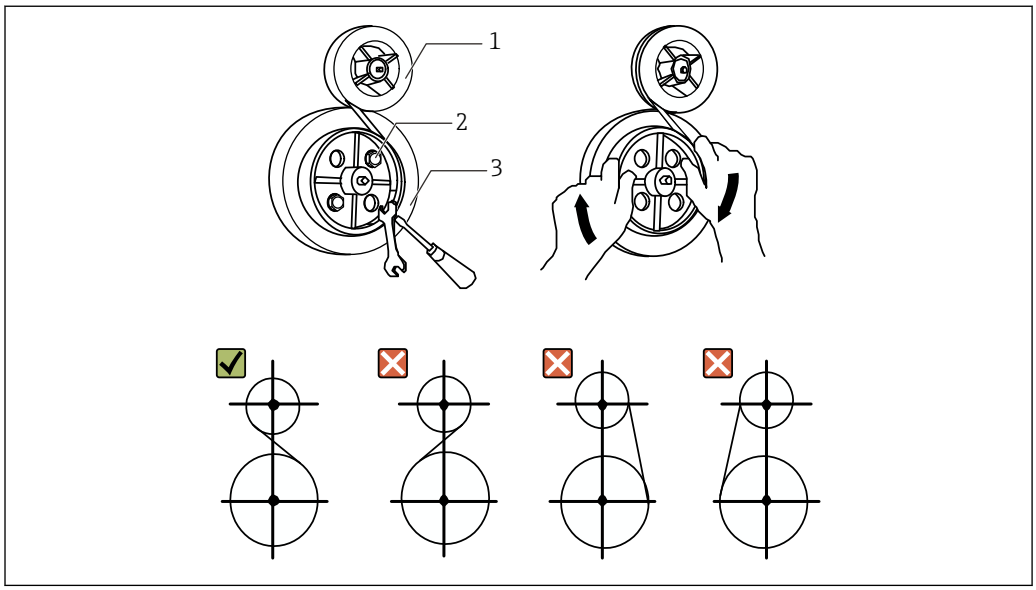


A0041218

50 Mounting a conster

1 Small conster drum
2 Lock screw
3 Large conster drum

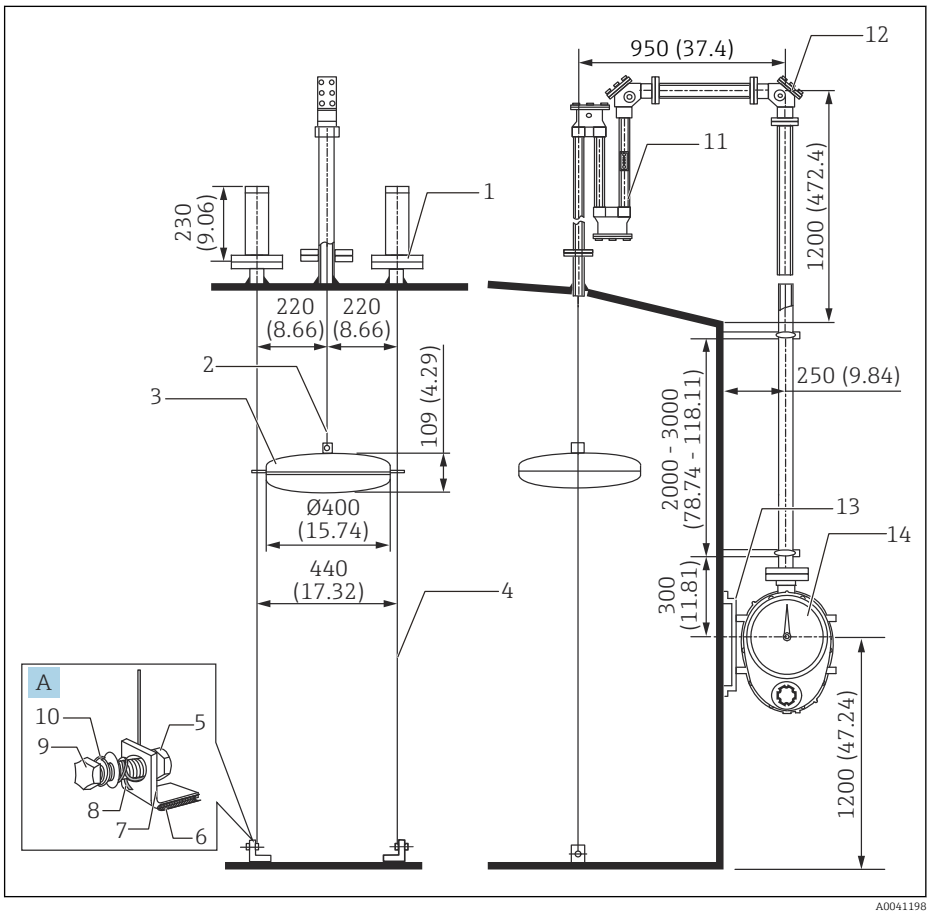
5.13 Liquid sealant for seal pot

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

Liquid sealant filling procedure

1. Install the entire LT unit, including the seal pot and float.
   ↳ Depending on the selected order code, parts may be different from those shown in the diagram below.
2. Hoist the float up and down manually to confirm that the dial (or counter) display changes accordingly.

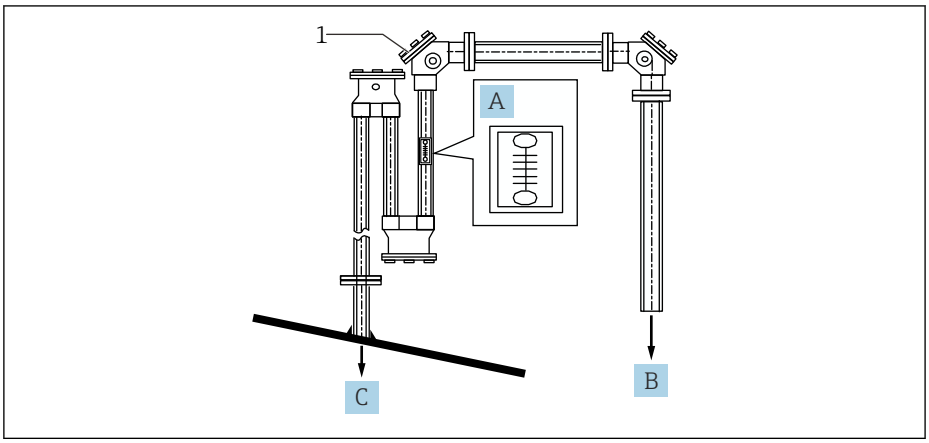
↳



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.



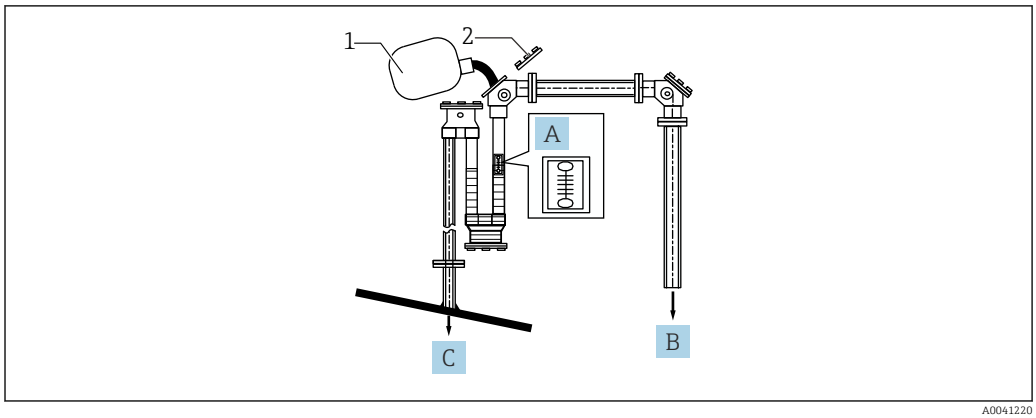
52 *Filling liquid sealant*

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

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

This completes the liquid sealant filling.

The kit contains approximately 2 L (liters) of liquid sealant. This means that when the proper amount of liquid sealant has been injected, there will be a small amount of liquid sealant left. Do not discard this leftover sealant as it is used to refill the sealant as necessary after running the tank.



53 *Amount of liquid sealant*

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

Running the tank without filling with liquid sealant may lead to malfunction as LT and sheave elbow packings and O-rings may be eroded by the gas components inside the tank. To prevent this, always fill with liquid sealant.

5.13.2 Filling seal pot with liquid sealant (for an existing gauge)

Liquid sealant filling procedure

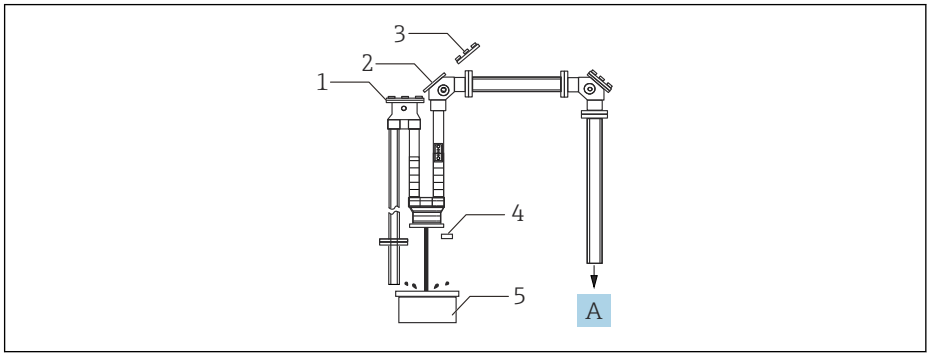
CAUTION

Used liquid sealant may have turned into a hazardous substance as a result of mixing with the liquid inside the tank.

- ▶ Never touch used liquid sealant with your bare hands.

Carefully select the materials for containers that will hold the liquid sealant.

1. Place a container with a capacity of at least 2 L (liters) under the drain.
2. Check the safety of the vicinity of the tank and then remove the drain plug of the seal pot.
3. Drain the liquid sealant from the seal pot.
4. Open the 90 ° sheave elbow cover.



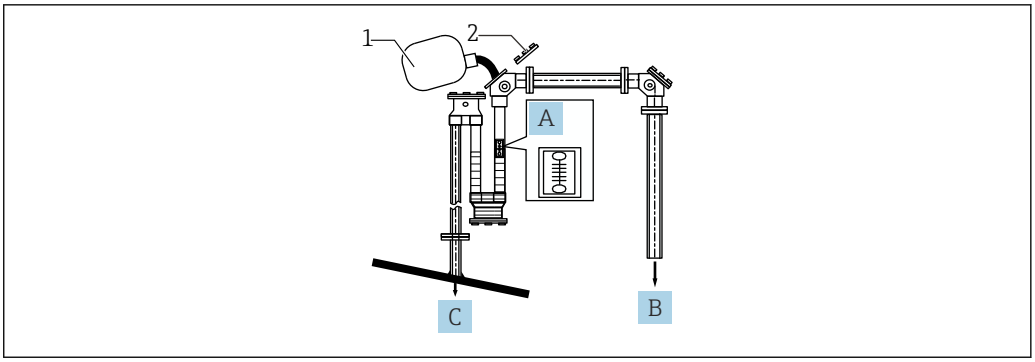
A0041230

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 with a capacity of 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 liquid sealant*

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

6 Commissioning

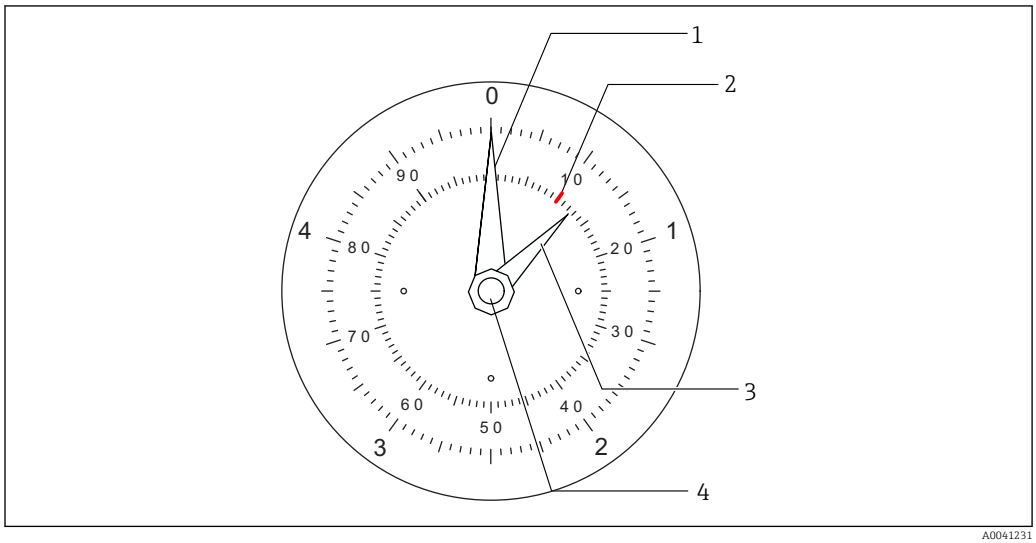
6.1 Dial display

Pointer setting and scale reading procedure

When calibrating (pointer setting) to a value that has been determined as a calculated value or a measured value, the calibration procedure will be different for a dial display and a counter display. If the tank height is under 20 m or 60 ft, select a dial display; for taller tanks, select a counter display.

1. Remove the indicator cover and loosen the cap nut.
   ↳ The long needle (white) can move freely and the short needle (yellow-green) can be freed by pulling it forward. Align the short needle with the inner scale (1 mm (0.04 in) increments) so that it corresponds to the last two digits of the liquid level.
2. Align the long needle with the outer scale.
   ↳ Since each increment of the outer scale corresponds to 100 mm (3.94 in) of liquid level, visually align the needle based on the last two digits of the liquid level.
3. After aligning the needles, tighten the cap nut firmly.
   ↳ Read the indicator by using the outer scale and the long needle to determine the 10 000 mm (393.7 in), 1 000 mm (39.37 in), and 100 mm (3.94 in) digits while using the inner scale and the short needle to determine 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 procedure.



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

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

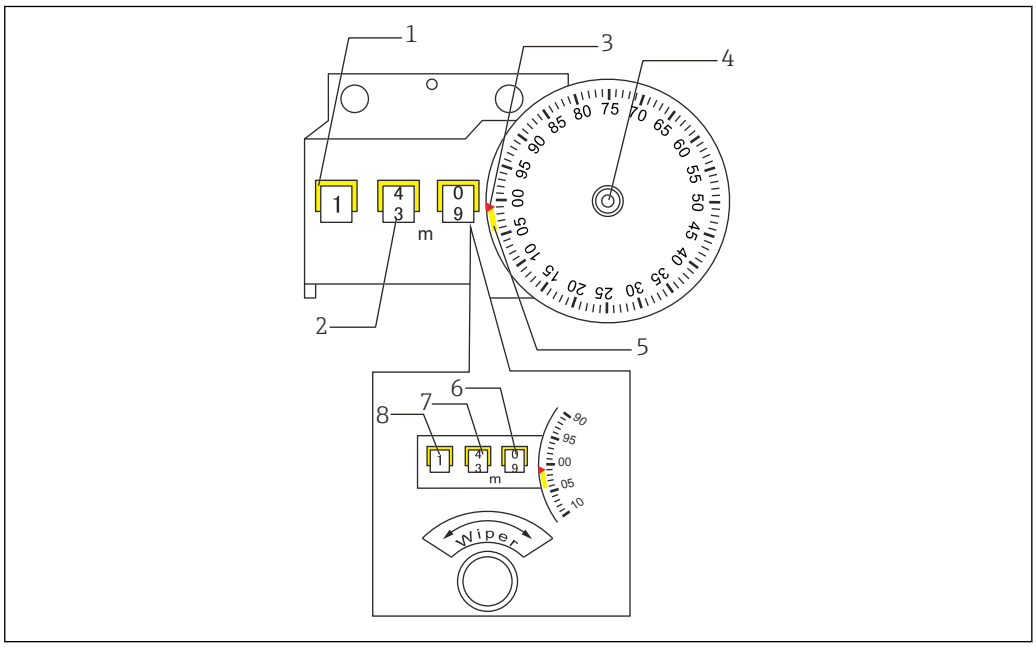
6.2 Counter display

Counter display procedure

- The scale plate (1 mm (0.04 in) increments) can rotate freely.
- On the counter drum, the number on the No. 1 drum changes each time the scale plate makes one full rotation (100 mm (3.94 in)).

1. Remove the indicator cover.
2. Loosen the screw at the center of the scale plate.
3. Turn the scale plate so that the number on the counter drum corresponds to the first three digits of the liquid level.
4. Align the scale plate so that the pointer corresponds to the last two digits of the liquid level, and tighten the scale plate screw.
   ↳ If the pointer is between 97 and 03 on the scale plate, the number on the counter drum will not change instantly. It will change gradually while maintaining a constant relationship with the rotation of the scale plate. This will result in the counter indicating half values. In order to eliminate reading errors, the counter window and parts of the scale plate are color coded.

This completes the display procedure.



57 *Counter display*

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

When the pointer (red) is pointing towards the yellow section, read the value on the yellow side of the counter, and when it is pointing towards the black section, 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 adjustment

There are three ways to adjust the indicator on a liquid level gauge as described below, but operation of the indicator unit is handled using the same procedure.

- Fill the tank with actual liquid and calibrate the indicator based on the measured value
- Calibrate the indicator based on a calculation when the tank is empty
- Fill the tank with water and calibrate the indicator based on the measured value

6.3.1 Indicator adjustment procedure using actual liquid

In order to obtain accurate data, measure the liquid level two to three times using a measuring tape which has been officially tested to have a tolerance equivalent to ±0.3 mm (0.01 in) (however ±1.2 mm (0.05 in)/10 m (32.81 ft)), and then use the data for calibration.

6.3.2 Indicator adjustment procedure using an empty tank

- Determine Lf from the equation below when the tank is empty and set the indicator to that value.
- When the liquid level reaches Lf, the float will gain buoyancy and the gauge will begin to operate, continuing to indicate an accurate liquid level.

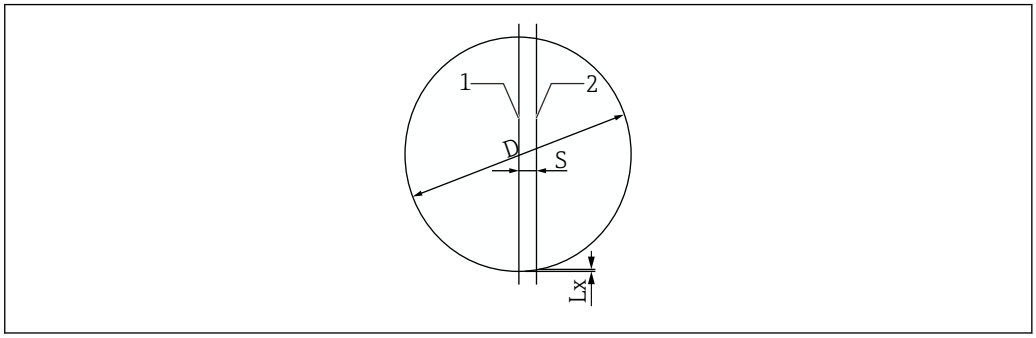
1.	**Liquid level at which float gains buoyancy (in water)**	
$Lf = \left(\frac{h}{2} + \frac{\frac{W - T}{\rho} - \frac{V}{2}}{S} \right)$ x 10 mm (0.39 in)		
Tape tension	T	1200 g (2.65 lb)

Specification	Float (D)	Materials	Weight (W)	Cross-sectional area (S)	Height (h)	Volume (V)	Liquid density (g/cm³)
Low pressure	400 mm (15.75 in)	SUS316	4200 g (9.26 lb)	1257 cm²	10.9 cm (4.29 in)	10520 cm³	0.5 ≤ ρ < 0.65
			5000 g (11.02 lb)				0.65 ≤ ρ < 1.05
			8000 g (17.64 lb)				1.05 ≤ ρ ≤ 2.0
		PVC	4200 g (9.26 lb)	1257 cm²	11.2 cm (4.41 in)	10870 cm³	0.5 ≤ ρ < 0.65
			5000 g (11.02 lb)				0.65 ≤ ρ < 1.05
			8000 g (17.64 lb)				1.05 ≤ ρ ≤ 2.0
	140 mm (5.51 in)	SUS316	2100 g (4.63 lb)	154 cm²	20.0 cm (7.87 in)	2661 cm³	0.5 ≤ ρ < 0.94
			2400 g (5.29 lb)				0.94 ≤ ρ ≤ 2.0
		PVC	2100 g (4.63 lb)	154 cm²	21.0 cm (8.27 in)	2946 cm³	0.5 ≤ ρ < 0.94
			2400 g (5.29 lb)				0.94 ≤ ρ ≤ 2.0
Medium/ high pressure	400 mm (15.75 in)	SUS316	8300 g (18.3 lb)	1257 cm²	20.0 cm (7.87 in)	19200 cm³	0.5 ≤ ρ ≤ 0.7

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 center line, add Lx, which can be determined from the following equation, to Lf in 2 above.

$Lx = \frac{D}{2} - \sqrt{\frac{D^2}{4} - S^2}$	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)



58 *Indicator adjustment on a spherical tank*

1 Center of the tank
2 Center of float installation

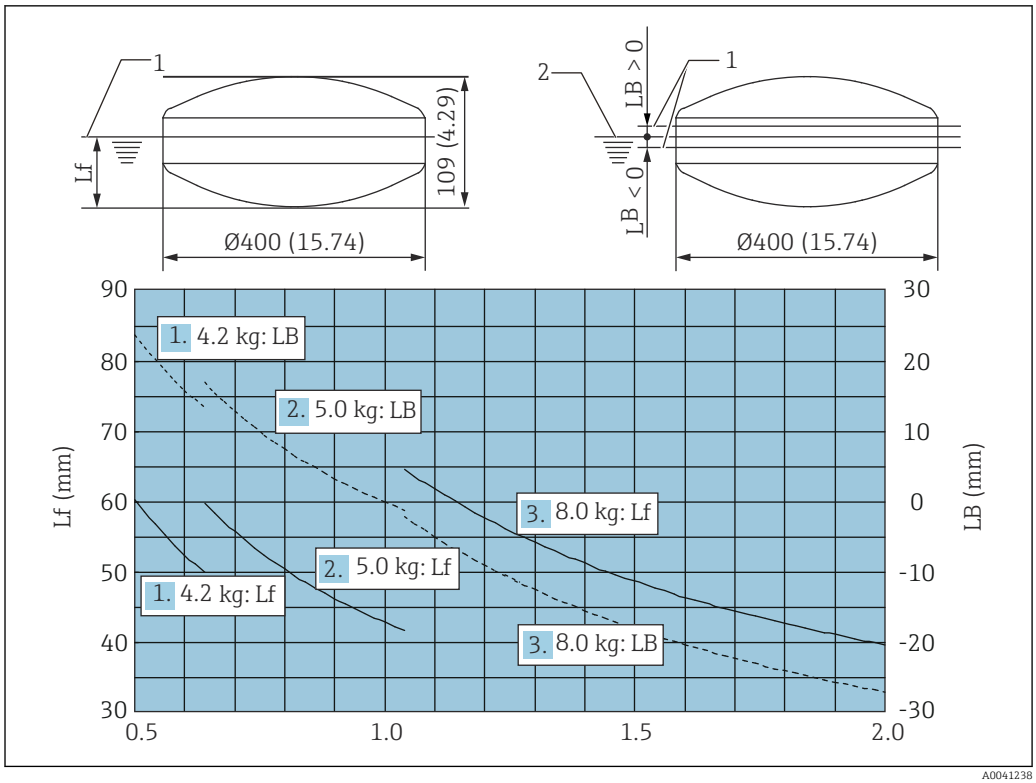
6.3.3 Indicator adjustment procedure with a water-filled tank

When a tank is completed, a water-filling test is generally performed. Since it is difficult to take measurements once the tank has been filled with actual liquid, the indicator can be adjusted when the tank is filled with water and then re-adjusted once the tank has been 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.

After calibrating the gauge indicator to the measured value with water, determine Lb from the following equation. If Lb is a positive value, it is added to the measured indicator value; if it is a negative value, the subtracted value becomes the final indicator value.

Equation: SUS316 φ400 mm (15.75 in), 5 000 g (11.02 lb) float

1.	**Draft surface Lf (the height of the liquid level from the bottom of the float when the float gains buoyancy)**				
$Lf = \left(\frac{h}{2} + \frac{\frac{W - T}{\rho} - \frac{V}{2}}{S} \right)$ x 10 mm (0.39 in)					
Float diameter	D	400 mm (15.75 in)	Float height	h	10.9 cm (4.29 in)
Float mass	W	5 000 g (11.02 lb)	Float volume	V	10 520 cm^3
Waterline cross section	$S = \pi D^2/4$	1 256.64 cm^2	Tape tension	T	1 200 g (2.65 lb)
Density of measurement liquid	ρ (water)	1 g (0.002 lb)/ cm^3	Calculated draft surface value	Lf (water)	42.9 mm (1.69 in)
	ρ (with actual liquid)	0.8 g (0.002 lb)/ cm^3		Lf (actual liquid)	50.4 mm (1.98 in)
2.	Correction of indicated value with simulated actual liquid		Lb = Lf (water) - Lf (actual liquid)		−7.5 mm (−0.3 in)



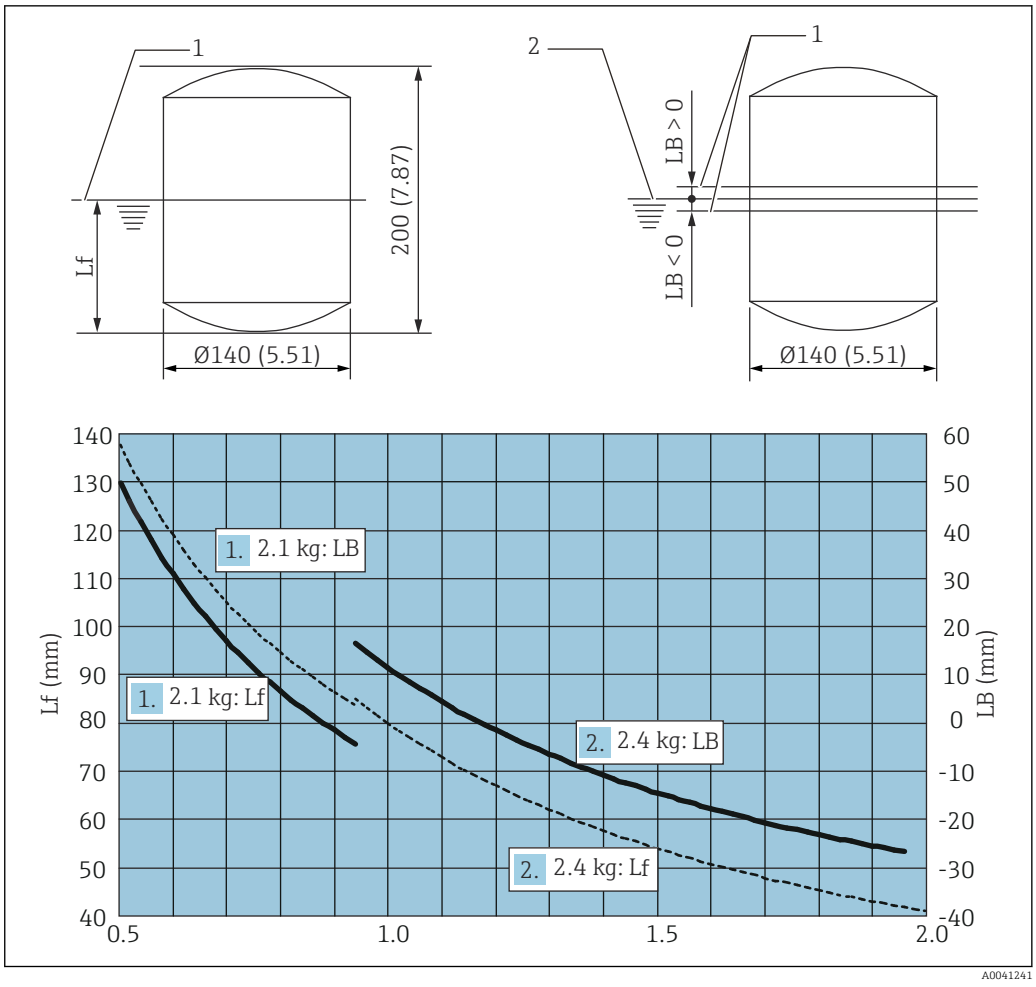
59 *Graph of LT5-1 φ400 mm (15.75 in) float: Density of measurement liquid ρ (g/cm3). Measurement unit mm (in)*

1 *Draft surface at density ρ*
2 *Water (draft surface at a density of 1.0 g (0.002 lb)/cm³)*

Equation: SUS316 φ140 mm (5.51 in), 2 100 g (4.63 lb) float

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

1.	**Liquid level at which float gains buoyancy (in water)**				
$Lf = \left(\frac{h}{2} + \frac{\frac{W - T}{\rho} - \frac{V}{2}}{S} \right)$ x 10 mm (0.39 in)					
Float diameter	D	140 mm (5.51 in)	Float height	h	20 cm (7.87 in)
Float mass	W	2 100 g (4.63 lb)	Float volume	V	2 661.2 cm^3
Waterline cross section	$S = \pi D^2/4$	153.94 cm^2	Tape tension	T	1 200 g (2.65 lb)
Density of measurement liquid	ρ	1 g (0.002 lb)/ cm^3	Calculated draft surface value	Lf	72 mm (2.83 in)
	ρ (with actual liquid)	0.8 g (0.001 lb)/ cm^3		Lf (actual liquid)	86.6 mm (3.41 in)
2.	Correction of indicated value with simulated actual liquid		Lb = Lf (water) - Lf (actual liquid)		−14.6 mm (−0.57 in)

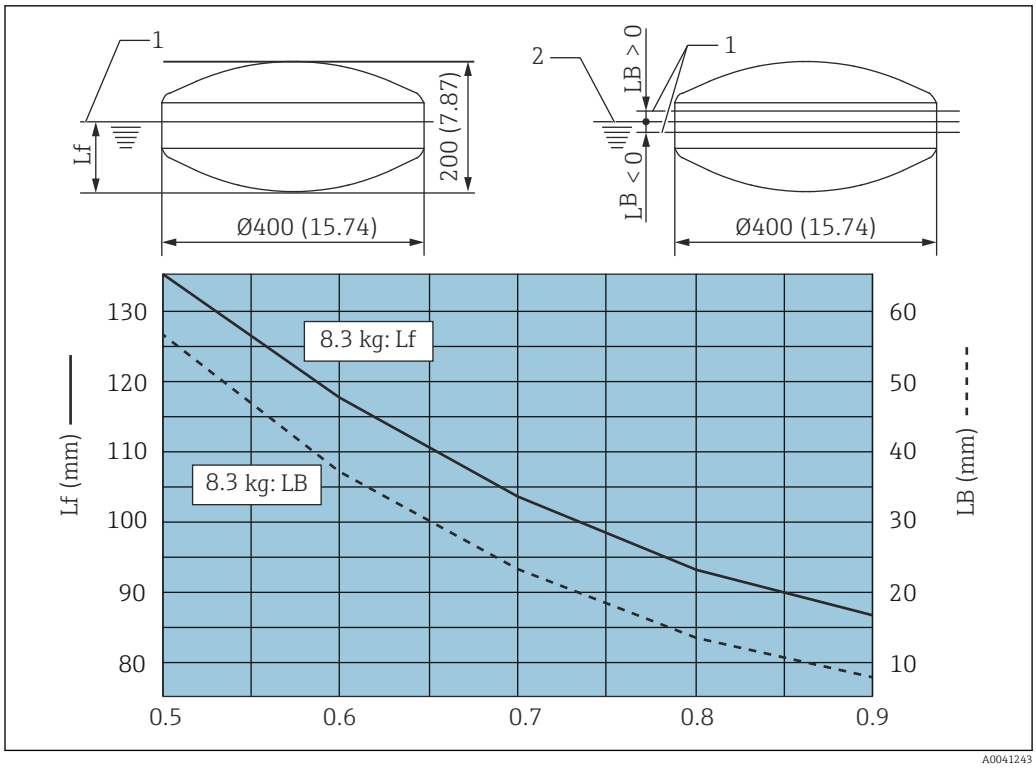


60 *Indicator value when the tank is filled with water. Measurement unit mm (in)*

1 *Draft surface at density ρ*
2 *Water (draft surface at a density of 1.0 g (0.002 lb)/cm³)*

Equation: SUS316 φ400 mm (15.75 in), 8300 g (18.30 lb) float

1.	**Liquid level at which float gains buoyancy (in water)**				
$Lf = \left(\frac{h}{2} + \frac{\frac{W - T}{\rho} - \frac{V}{2}}{S} \right)$ x 10 mm (0.39 in)					
Float diameter	D	400 mm (15.75 in)	Float height	h	20 cm (7.87 in)
Float mass	W	8300 g (18.30 lb)	Float volume	V	19200 cm^3
Waterline cross section	$S = \pi D^2/4$	1256.64 cm^2	Tape tension	T	1200 g (2.65 lb)
Density of measurement liquid	ρ (water)	1 g (0.002 lb)/ cm^3	Calculated draft surface value	Lf	80.1 mm (3.15 in)
	ρ (with actual liquid)	0.5 g (0.001 lb)/ cm^3		Lf (actual liquid)	136.6 mm (5.38 in)
2.	Correction of indicated value with simulated actual liquid		Lb = Lf (water) - Lf (actual liquid)		−56.5 mm (−2.22 in)



61 *Graph of LT5-4/LT5-6 φ400 mm (15.75 in) float: Density of measurement liquid ρ (g/cm³). Measurement unit mm (in)*

1 *Draft surface at density ρ*
2 *Water (draft surface at a density of 1.0 g (0.002 lb)/cm³)*

6.4 Precautions for water-filling and airtightness tests and handling of gauge at startup

In high-pressure tanks, such as liquid gas tanks, damage to the measuring tape and other such accidents have a significant impact on the operation of the tank, and the recovery cost can be extensive. It has been our experience that all issues involving damaged measuring tapes arise during the testing phase or the initial operation of the tank. To prevent such incidents, be sure to implement the following measures. These measures will prevent incidents that occur during the initial operation of the tank.

- For high-pressure tanks, always open the gate valve when performing a water-filling test of the tank and set the LT to measurement mode. Failure to perform this step may result in damage to the measuring tape.
  If you notice that the gate valve has not been opened after you have 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.
- In the water-filling test, partially open the water-feeding valve and fill it with water slowly until a depth of approximately 500 to 1 000 mm (19.69 to 39.37 in) is reached.
- When a large amount of water is injected, the measuring tape may become damaged. If the float is near the water inlet, install a wave guard to protect the float from being affected directly by the water surface.
- If performing an airtightness test of LT with the gate valve open, check to ensure that the following LT components have been firmly tightened before performing the test. Failure to tighten the following components will lead to massive air release, which creates a super high-speed airflow near the gate valve that vibrates and damages the measuring tape.
  - Drain plug under the main unit of LT
  - Rear cover bolts
  - Gland on the gauge head rear cover
  - Covers for the elbows
- When opening the rear cover of LT after the airtightness test is complete, check to make sure that the internal pressure of the tank is atmospheric pressure or that the gate valve is closed before opening LT.
  Never open LT or the sheave elbow cover in an attempt to release the compressed air from the airtightness test in a hurry. This will damage the measuring tape.
- Always open the gate valve when injecting actual liquid, such as liquefied gas, into the tank.
  Only close the gate valve in case of an emergency or when the liquid surface is stopped.

7 Operation

7.1 Check handle (standard)

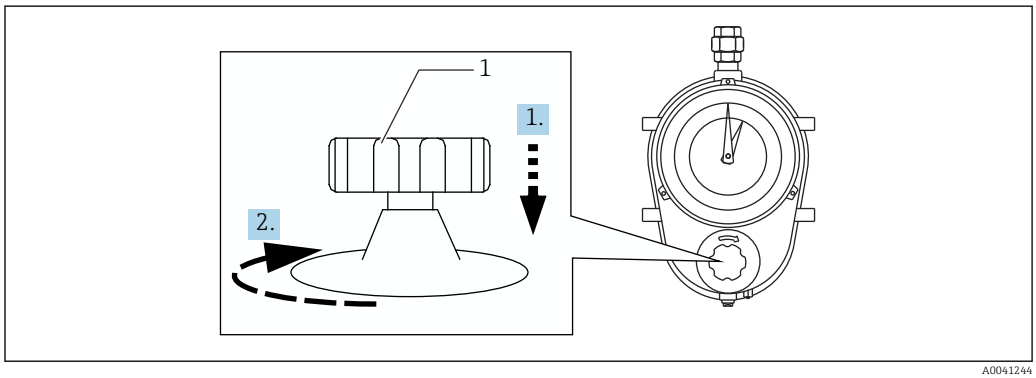
A check handle is used to confirm that LT is operating properly.

- When checking the operation using a check handle, make sure that the tank has been filled with liquid first.
- A check handle is not a float hoist handle. Do not forcibly hoist the float using the check handle.
- Handling a hoist handle → 76

Check handle operation procedure

1. Locate the check handle found at the bottom of the main unit of LT and push it inside the main unit of 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 scale plate indicator on the main unit of LT.

This completes the operation procedure.

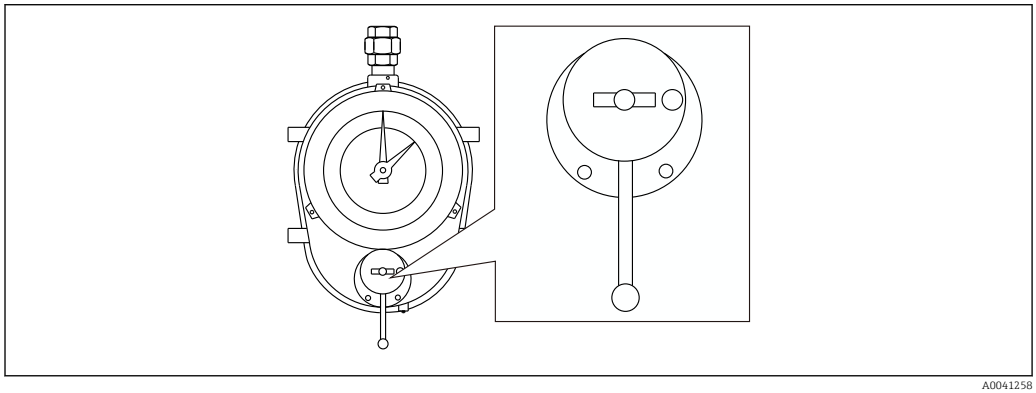


62 Check handle

1 Check handle

7.2 Hoist handle (optional)

A hoist handle is attached to the gauge head, and it allows the float to be raised and lowered manually for purposes other than measuring the liquid level. In locations with poor measurement conditions (such as tanks with mixers and tanks for corrosive liquids), hoisting the float and measuring tape in advance helps to prevent them from being damaged, thereby improving the service life of LT.



63 Hoist handle

7.2.1 Handling a hoist handle (for LT5-1)

- 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.
- Once the float has been lowered enough to reach the liquid level, stop cranking the handle.
- When the hoist handle reaches position A in the following diagram, the float will be freed from the handle. Remove the handle while taking measurements.

Hoisting procedure

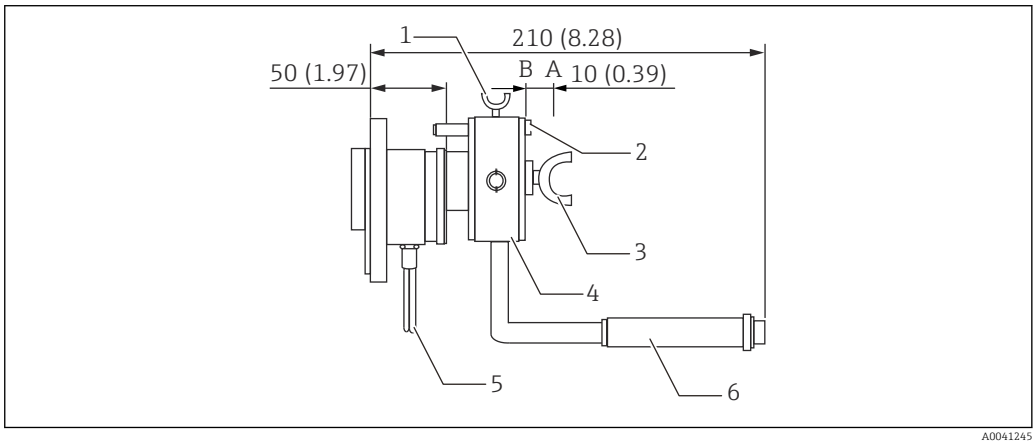
1. Secure the handle to the knob using a wing bolt.
2. Push in the knob while pulling the puller and release the puller once it has been fully pushed in to position B.
3. After confirming that the knob is securely positioned in position B, rotate it counterclockwise at an approximate rate of 2 seconds per rotation.
4. To stop hoisting in the middle of the procedure, push in the stopper to the deepest level and secure it with a wing bolt.
5. Bring the handle back slowly and place the stopper against the main unit.
   ↳ The float will no longer fall even if you let go of the handle.
   Remove the handle when it is not being used after the float has been hoisted.

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 float has been lowered, pull the knob while pulling on the puller, and then let go of the puller once condition A is reached.
4. Remove the handle when it is not being used after the float has been lowered.

This completes the lowering procedure.



64 *Handling a 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

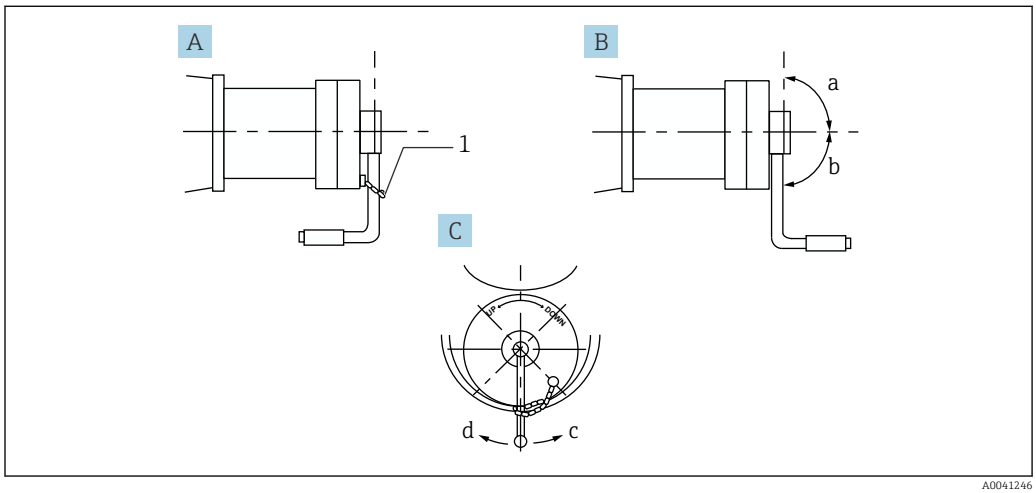
7.2.2 Handling a hoist handle (for LT5-4/LT5-6)

- 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. When letting go of the handle during the operation, lock the hoist handle.
- Do not tilt the hoist handle more than 90 ° towards the shaft. This may damage the float, tape, conster, and other components.

Hoisting and lowering procedure

1. Remove the lock chain.
2. Move the handle slightly in the circumferential direction, and then gradually rotate it 180 ° towards the shaft.
   ↳ The tape drum gear and the hoist shaft gear will begin to engage starting from around the 90 ° position.
3. Once the handle has been rotated to position B, rotate the handle counterclockwise to hoist the float.
4. Once the float has been hoisted, always secure it in place with a lock chain before letting go of the handle (refer to 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 indicator or counter display will stop at the current liquid level.
6. Once the float has been hoisted, rotate the handle 180 ° towards the shaft to put it in measurement mode.
7. To keep it in measurement mode, wrap the lock chain around the handle once or twice and place the end hook into the ring near the bolt (refer to A).

This completes the hoisting and lowering procedure.



65 *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 Causes of malfunction and countermeasures

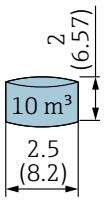
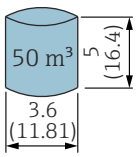
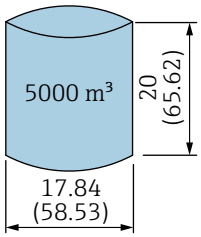
Error	Possible cause	Countermeasure
Indicator does not change at all	Severed measuring tape	Open the tank and replace the measuring tape
	Guide wire is caught on the float	Open the tank and replace the guide wire if necessary
	Broken conster	Replace the conster
	Check handle is caught	Open the gauge rear cover and perform repair and inspection
	Worn transmission gear that is connected to the indicator	Replace the entire reduction gear unit of the indicator
	Improper installment of sprocket or dislodged measuring tape	Open the gauge rear cover and perform an inspection
	Sunken float	Open the tank and replace it
Frequent indicator error	Deterioration of conster	Investigate any variance in the indicated values when operating the check handle and replace if deteriorated
	Corresponding to 2, 4, 5, and 6 in the previous section	Inspect the internal parts of the gauge head
	Loose indicator pointer	Remove the indicator cover and inspect the cap nut of the pointer
	Improper setting of tape guide	Check the gap between the sprocket and tape guide.
	Twisted measuring tape	Open the sheave elbow cover, forcefully pull out the measuring tape to inspect it, and repair it if necessary
Discrepancy between measured values and indicated values	Gauge error	Perform the inspection in the preceding section and implement measures
	No gauge error	Various problems caused by measurement
		Effects of the measurement technique
		Effects of sludge deposit
		Effects of strong wind
		Error in the measuring scale
Check handle does not turn or return to position	The check shaft is rusted	Clean the shaft and replace the entire check handle unit
	The spring in the check unit has deteriorated	Replace the spring
Check handle does not work (LT5-4/LT5-6)	The check handle set screw is loose	Tighten the set screw
	Broken check driver spring	Replace the entire check unit
	Tape drum does not move because a spring is caught in it	Repair manually or replace the entire check unit
Gas leak (LT5-4/LT5-6)	Compromised airtightness of the gauge head rear cover joint surface	Replace the packing or apply an end sealant to the joint surface
	Compromised airtightness at check handle shaft	Replace the seal metal

9 Maintenance

9.1 Maintenance work

9.1.1 Before performing maintenance

- Let tanks rest sufficiently before performing maintenance, especially tanks for flammable liquids (refer to the table below).
- When working on a flammable liquid tank, wear anti-static clothing, safety footwear, and gloves.
- Perform maintenance in the presence of a safety controller.

Conductivity of charged object (S/m)	**Flammable liquid Example**	**Volume of charged object (m^3)**			
		10 or less	**10 to 50**	**50 to 5000**	**5000 or more**
10^{-8} 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_{-12} to 10^{-8}	Vinyl acetate Toluene Benzene Gasoline	2 minutes or longer	3 minutes or longer	10 minutes or longer	30 minutes or longer
10^{-14} to 10^{-12}	Methyl cyclohexane	4 minutes or longer	5 minutes or longer	60 minutes or longer	120 minutes or longer
10^{-14} or lower	Carbon tetrachloride	10 minutes or longer	10 minutes or longer	120 minutes or longer	240 minutes or longer
		 *Unit of measurement mm (in)*	 *Unit of measurement mm (in)*	 *Unit of measurement mm (in)*	

9.2 Periodic inspection

Perform periodic inspection according to the procedures in the table below.

Product/component	Inspection item	Inspection method
Gauge head (for all LT)	Corrosion check and cleaning of tape protective pipe	Open the rear cover of the gauge head and check the state of rust deposition.
		If necessary, remove rust by tapping the protective pipe with a wooden hammer.
	Bearing and engagement of reduction gear in the indicator	Remove the indicator cover, rotate the reduction gear, and check if the engagement play is within 1 mm (0.04 in).
		Similarly, check the wear on the bearing.
	Friction on tape drum and sprocket	Open the rear cover of the gauge head, check the degree of wear of the bearing in each drum as well as deposition of rust and dust, and clean them.
	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 it with a new one.
	Condensation and fogging of indicator window	Check to make sure that the indicator cover is tightened properly and that there is no foreign matter lodged in the packing surface.
	Check handle inspection	Check to make sure that the check handle returns to the original position after it is 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 deformation and check the operation condition as well.
	Magnet coupling inspection	Remove the sprocket and completely remove any rust or debris (once or twice a year).
	Leaky packing inspection for gauge head	Check airtightness using soapy water.
Sheave elbow	Wear on sheave elbow	For the sheave elbow, remove the measuring tape from the roller surface and check to ensure that it rotates smoothly.
		Remove the bearing and check for wear.
		Clean off anything adhering to the guide roller.

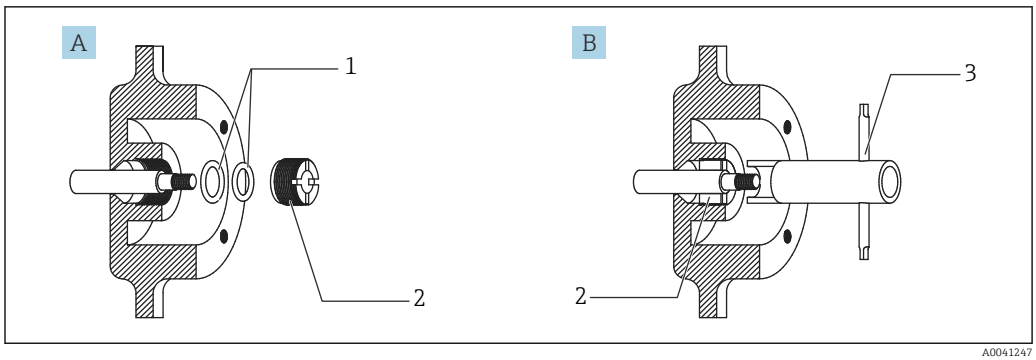
9.3 Replacement of O-ring for transmitter (LT5-4/LT5-6)

If gas begins leaking from the main unit side, sealing O-rings must be replaced. The following procedure 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 all residual pressure inside the LT main unit and pipes.
3. Remove the rear cover of the main unit.
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. When replacing O-rings, replace any other parts that are worn.
7. Replace the O-rings and then tighten the gland. Reassemble the unit by following the above procedure in reverse order.
8. Gradually open the gate valve.
   ↳ Opening the gate valve abruptly will release a sudden burst of air from the system, which may result in damage to the measuring tape.

This completes the replacement procedure.



66 Replacement of O-rings

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

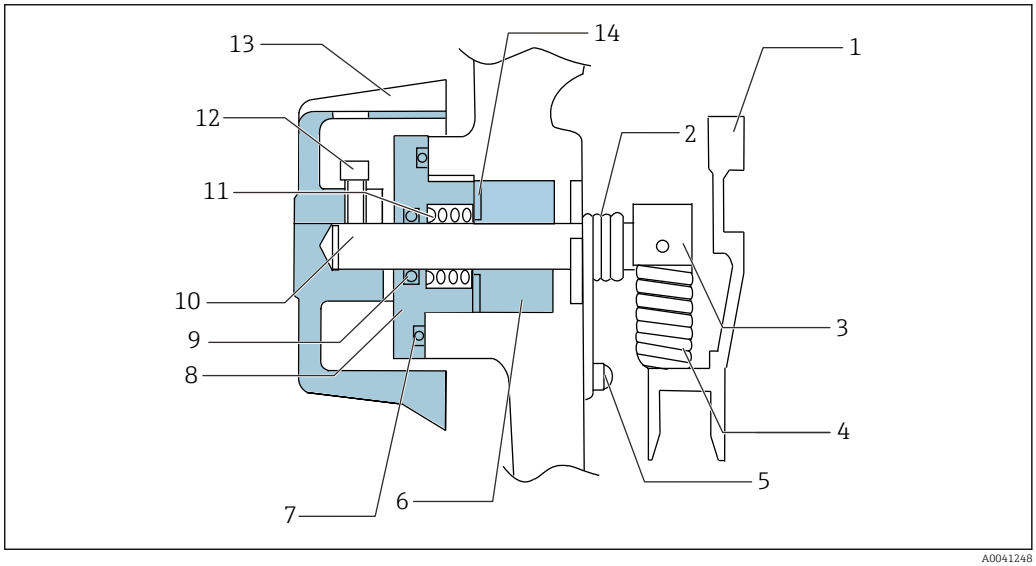
9.4 Replacement of the check handle unit (LT5-4/LT5-6)

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

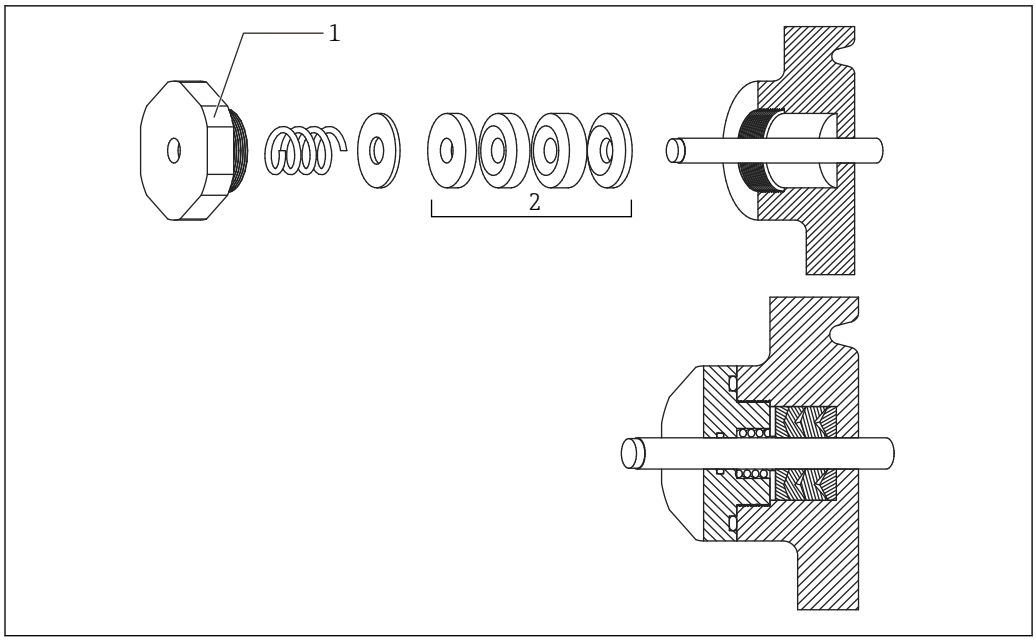
1. Remove the LT rear cover and the tape drum.
2. Loosen the socket head screw on the check handle and remove the check handle.
3. Remove the gland clamp with a No. 46 spanner or a monkey wrench.
4. Remove the gland spring, collar, and seal metal.
5. Pull out the check shaft towards the tape drum.
6.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

This completes the replacement procedure.



67 *Names of the check handle unit*

1 Tape drum
2 Check spring
3 Check boss
4 Spring
5 Spring set screw
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



68 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.

10.2 Spare parts

Some replaceable device components are clearly listed on the overview label found on the terminal unit cover.

The spare parts overview label contains the following information:
- List of major device spare parts (including ordering information for the spare parts)
- URL of *W@M Device Viewer* (www.endress.com/deviceviewer):
  All spare parts for the device are listed together with their order codes so that you can order them. 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 web page for information:
   http://www.endress.com/support/return-material
   ↳ Select the region.
2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

10.5 Disposal

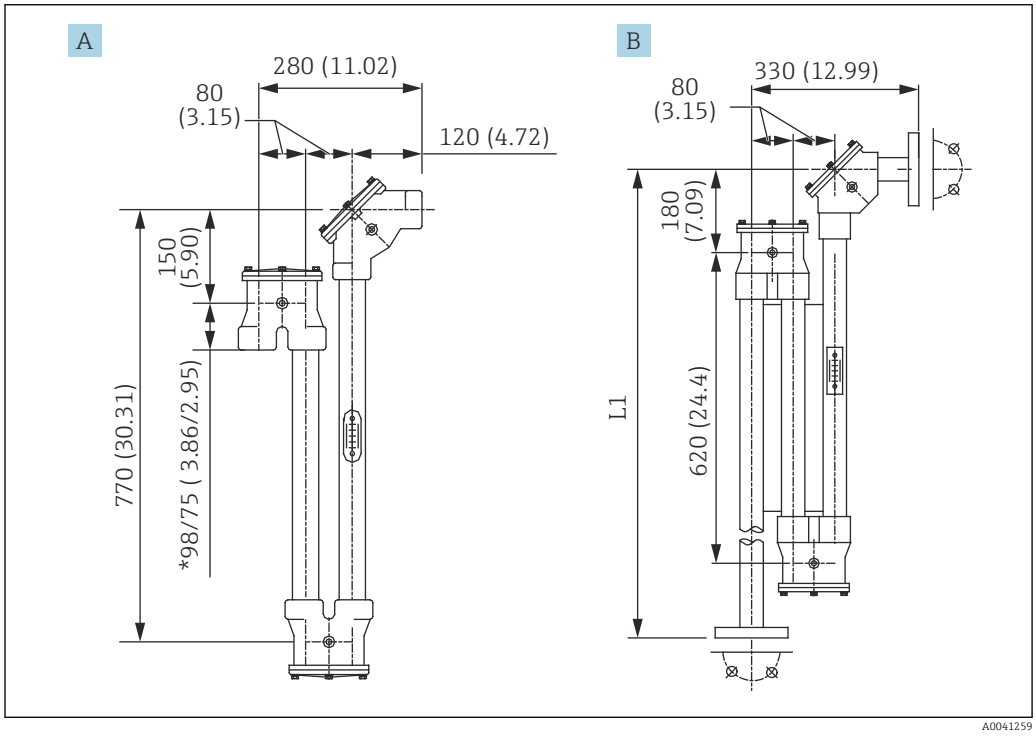
Observe the following notes during disposal:
- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

11 Accessories

11.1 Seal pot

A seal pot is filled with liquid sealant to prevent vapor from escaping the tank.

Liquid sealant	Liquid paraffin (spindle oil): 1 150 cc
Maximum sealing pressure	400 mm H_2O
Shape	U-shaped
Connection specification	Screw-in type / flange type
Materials	AC4A+SGP galvanized pipe / SUS316 / PVC



69 *Seal pot. Unit of measurement mm (in)*

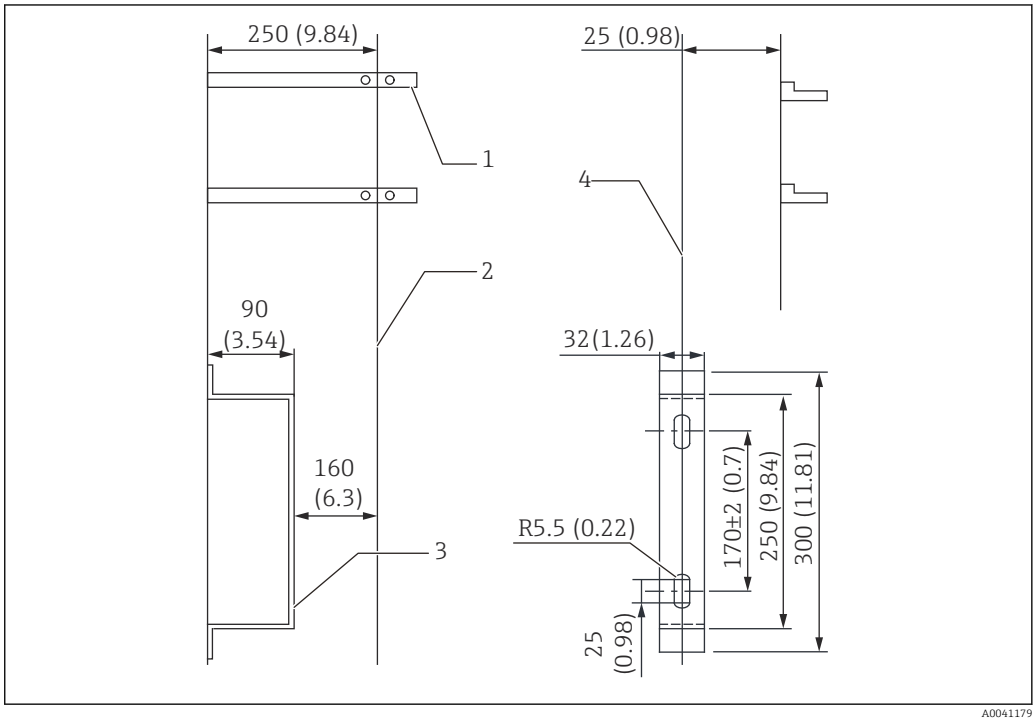
A Seal pot (SUS316/SGP/AC4A)
B Seal pot (PVC)
L1 Tape + wire: 1 500 mm (59.06 in) / tape only: 960 mm (37.8 in)

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

11.2 Gauge supporter

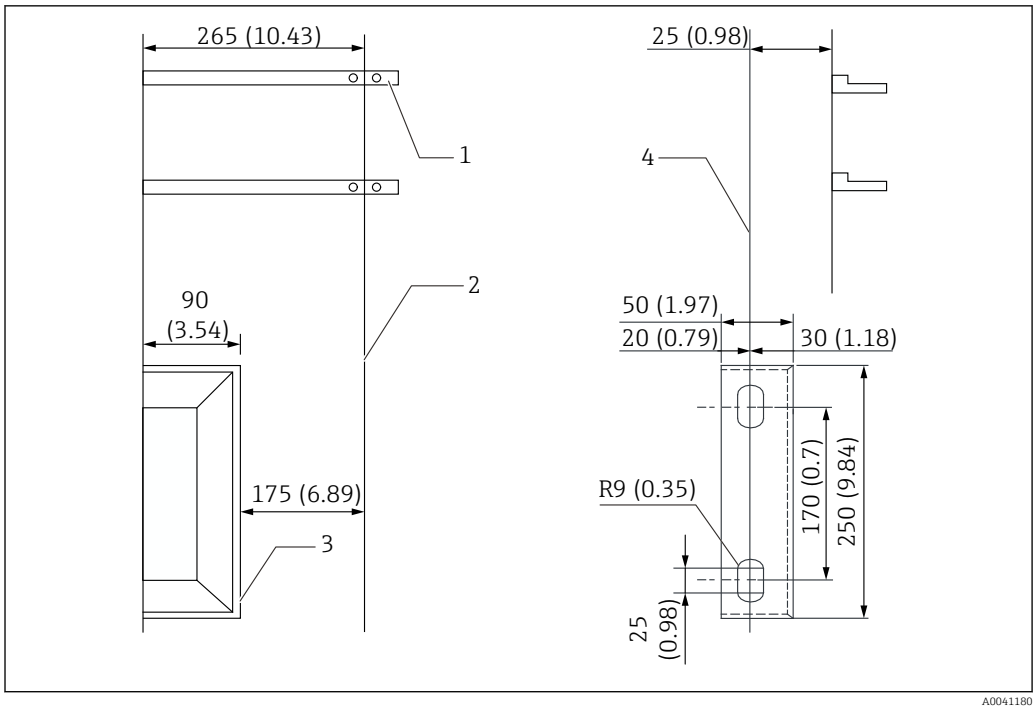
A gauge supporter is used for installation on the outer tank wall. Note that pipe supporters are not supplied.

The distance from the outer tank wall to the gauge head center is 15 mm (0.59 in) longer for LT5-6 (high-pressure gauge head) compared to LT5-1 (low-pressure gauge head) and LT5-4 (medium-pressure gauge head).



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

1 *Pipe supporter (not supplied)*
2 *Center line for installation*
3 *Gauge supporter (depending on the selected option, SS400: t = 4.5 / SUS304: t = 4.0) with mounting bolts*
4 *Center line of the gauge supporter*



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

1 Pipe supporter (not supplied)
2 Center line for installation
3 Gauge supporter (depending on the selected option, SS400: t = 4.0 / SUS304: t = 4.0) with mounting bolts
4 Center line of the gauge supporter

11.3 Guide pipe

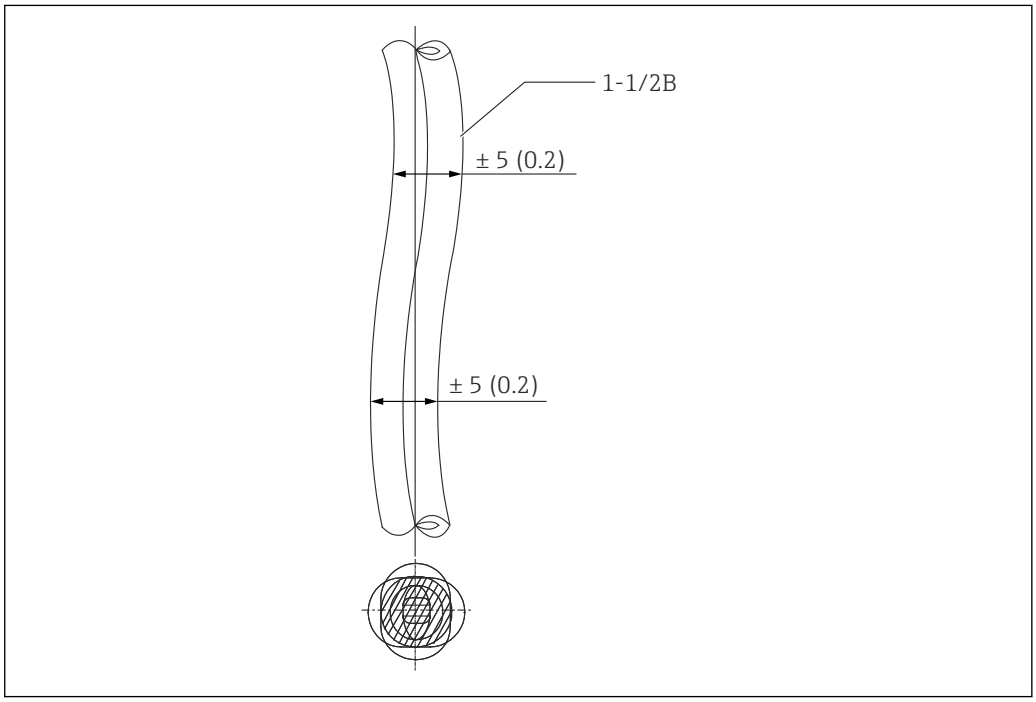
11.3.1 Selection and installation of guide pipe

Guide pipe installation is required for most applications, except for tank top and underground applications. Guide pipes are generally used in three areas:

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

Precautions regarding installation

- Guide pipes and pipe supporters are not supplied by Endress+Hauser.
- Keep the bend in guide pipe to 5 mm (0.17 in) or less.
- The space between two sheave elbows (piping distance) must not exceed 2.5 m (8.2 ft).



72 *Guide pipe installation. Unit of measurement mm (in)*

NOTICE

Recommended materials for guide pipes

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

11.4 Mounting and enclosed accessories

Ordering information: 610 mounting accessories

NA	Copper-free gear	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 magnet coupling and drain plug sealant will be changed from NBR to CR. It is effective for applications such as those involving ammonia. As a general rule, copper materials cannot be used for the gear mechanism.
NB	Custody transfer seal	This is an option in which a hole is created on the rear cover of the main unit and the bolt for the display cover. Subsequent to bonded approval, a displacer wire for sealing may be inserted.
NC	Fixed tape guide	This is an option for securing the tape inside so that it does not become detached. It is useful for applications in which hunting may occur with the float. It comes with LT5-4 and LT5-6 as a standard item.
ND	Dust cover	This is an internal component that prevents dust, which is generated when iron pipes are used, from entering the gear inside the gauge head. It comes with LT5-4 and LT5-6 as a standard item.
NE	Conster winding drum, aluminum	This is a conster winding drum made of aluminum. It is effective when a standard conster winding drum made of Bakelite cannot be used. An aluminum conster winding drum is standard for LT5-4 and LT5-6.

Ordering information: 620 enclosed accessories

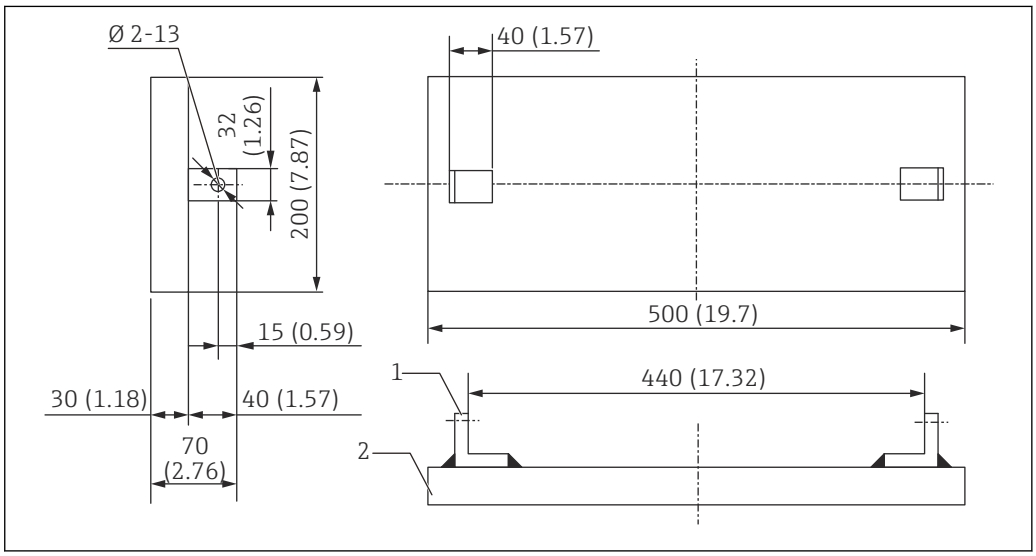
PE	FRT wire guide metal	This wire guide is installed on the floating roof. It protects the measuring wire from wear due to contact with the roof.
PF	Wire guide socket Rc 1-1/2	This is a socket for mounting on the pipes of a floating roof tank or a gas holder tank. It protects the measuring wire from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

11.5 Anchor weight

When an anchor hook cannot be installed at the bottom of the tank (such as when there is liquid inside the tank), use an anchor weight to keep the guide wire taut.

Materials	SS400/SUS316
Weight	Approx 23 kg (50.71 lb)

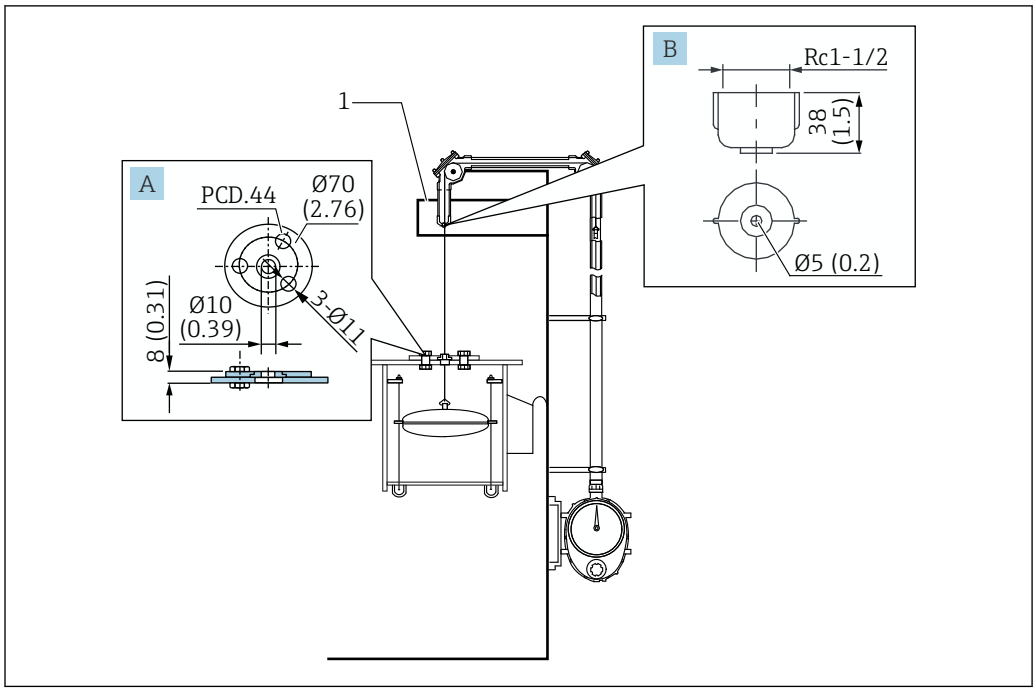
Special specification is required in order to use this anchor weight.



73 *Anchor weight. Unit of measurement mm (in)*

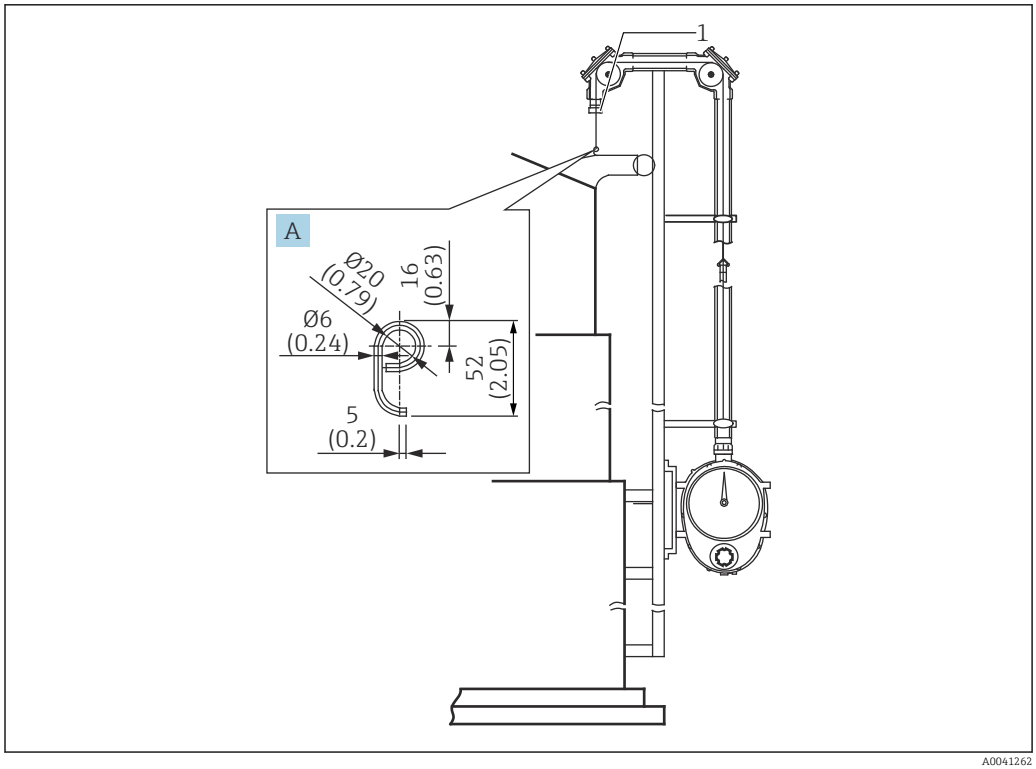
1 *Anchor hook*
2 *Anchor weight*

11.6 Wire guide metal and wire guide socket



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

A Wire guide metal
B Wire guide socket
1 Roof stand



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

A Wire hook
1 Wire guide socket

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