

Brief Operating Instructions

Float level gauge LT5

Mechanical tank gauge for measuring liquid level

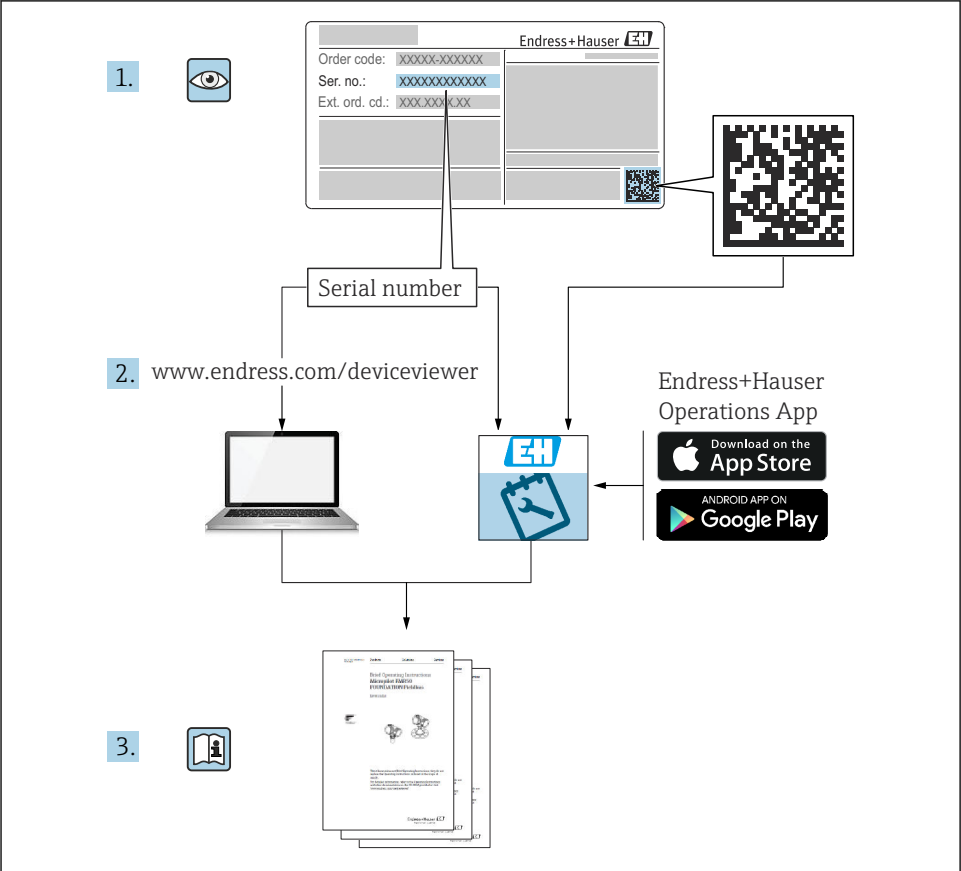


These Instructions are Brief Operating Instructions; they are not a substitute for the Operating Instructions pertaining to the device.

Detailed information about the device can be found in the Operating Instructions and the other documentation:

Available for all device versions via:

- Internet: www.endress.com/deviceviewer
- Smart phone/tablet: *Endress+Hauser Operations App*



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Table of contents

1	Document information	4
1.1	Symbols used	4
1.2	Documentation	6
2	Safety-related basic instructions	7
2.1	Basic safety instructions	7
2.2	Intended use	7
2.3	Workplace safety	7
2.4	Operational safety	7
2.5	Product safety	8
3	Product description	8
3.1	Designated use	8
3.2	Delivery examples	9
4	Incoming acceptance and product identification	10
4.1	Incoming acceptance	10
4.2	Product identification	10
4.3	Manufacturer address	10
4.4	Storage and transport	10
5	Installation	11
5.1	Measuring tape and wire lengths	11
5.2	Sealing materials for wetting liquid and gas parts	14
5.3	Material certificates	16
5.4	Reference diagrams and order codes for installation	17
6	Commissioning	43
6.1	Dial display	43
6.2	Counter display	45
6.3	Indicator adjustment	47
6.4	Precautions for water-filling and airtightness tests and handling of gauge at startup	54

1 Document information

1.1 Symbols used

1.1.1 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.

1.1.2 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.

1.1.3 Tool symbols



Phillips head screwdriver



Flat blade screwdriver



Torx screwdriver

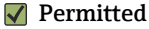


Allen key



Open-ended wrench

1.1.4 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

1.2 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.

1.2.1 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.

1.2.2 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.

1.2.3 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 must fulfill the following requirements for its tasks:

- ▶ 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.

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.

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

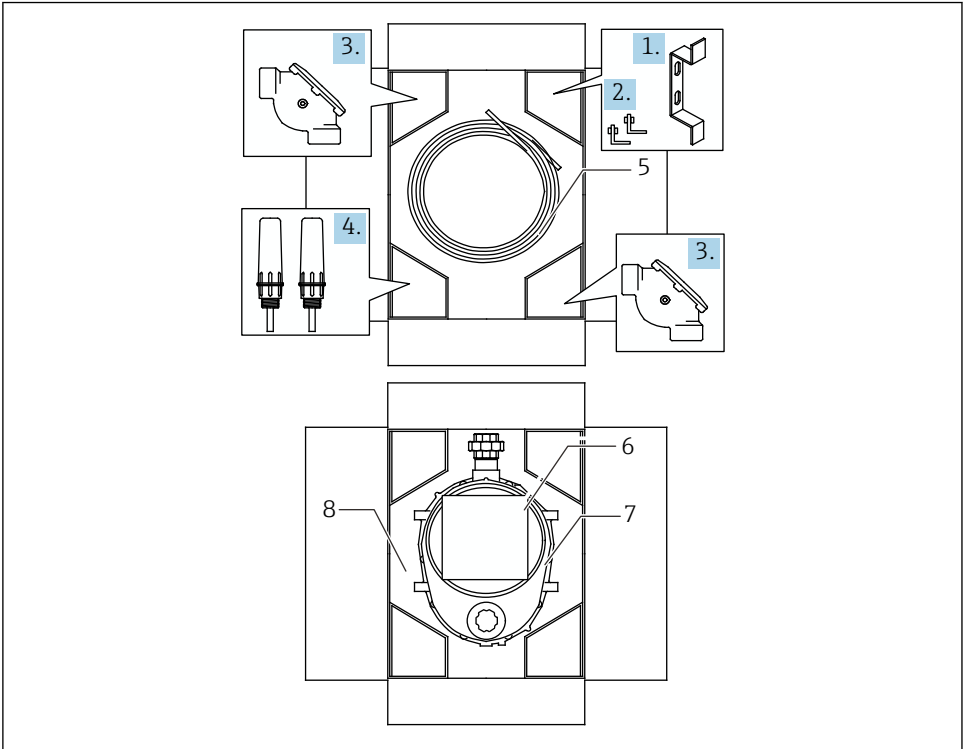
3.1 Designated use

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

- Inventory management
- Batch processing
- Management of a process tank
- Safe tank operation

3.2 Delivery examples

The packaging method will vary depending on the order code, etc. For flange type, the sheave elbow will be delivered in a separate packaging box.



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1 Packaging

- 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.

4.3 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 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
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

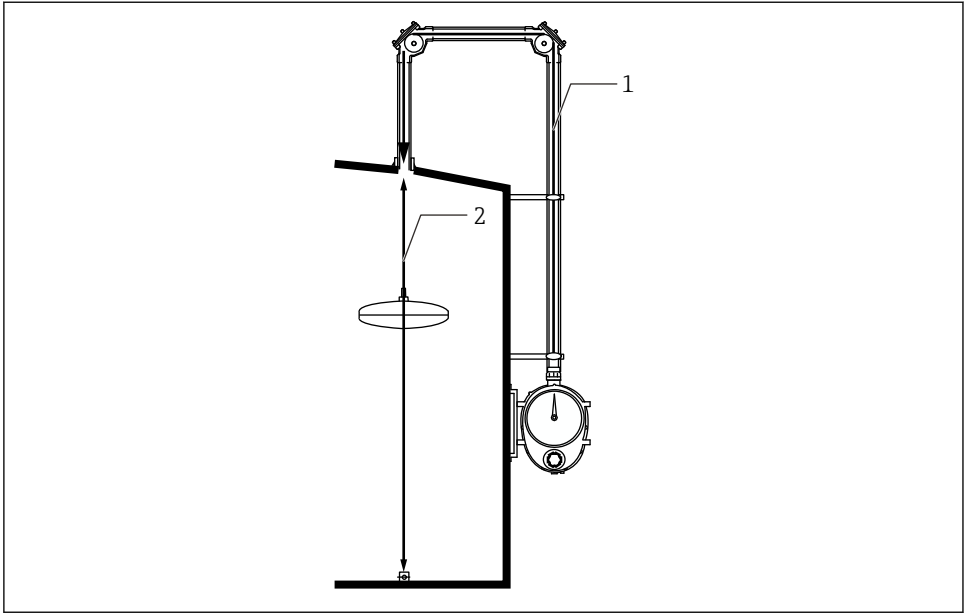
4. Measuring tape SUS316 + wire SUS316, FRT

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

060 measurement range		Length (total length)	Perforated tape (measurement length)	Non-perforated tape	Wire	Spare parts
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



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

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

i In the 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.

5.2 Sealing materials for wetting liquid and gas parts

5.2.1 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	Spring retainer packing	
Stainless steel, flange welding type				
LT5-4/ LT5-6	Gauge head	Rear cover	Cover packing	PTFE
		Check handle unit	Gland packing	PTFE/CR
		Internal magnet cover	O-ring	PTFE
		External magnet cover	O-ring	NBR *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

Product name	Component name	Sealing material application site	Sealing material type	Packing/O-ring materials
		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		

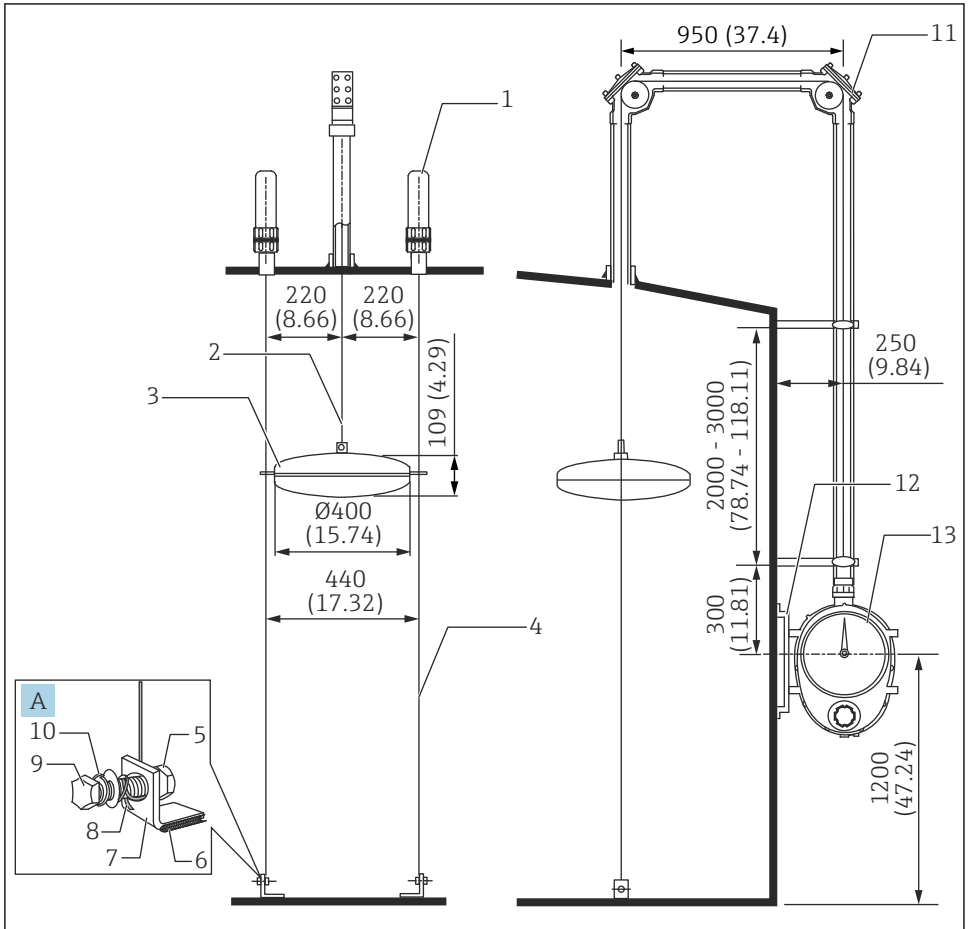
5.3 Material certificates

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

5.4 Reference diagrams and order codes for installation

5.4.1 For cone roof tanks (CRT)



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

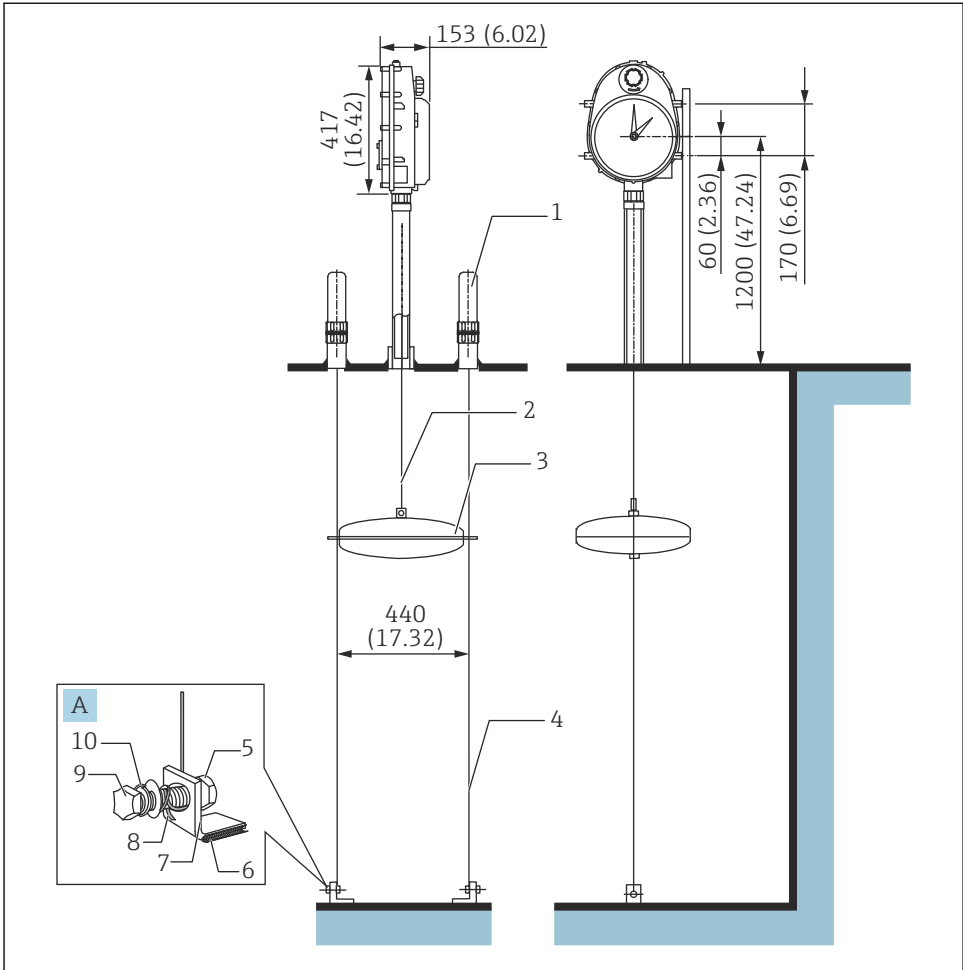
- A Anchor hook
- 1 Top anchor
- 2 Measuring tape
- 3 Float
- 4 Guide wire
- 5 Nut
- 6 Wetted part (welded to the tank)
- 7 Anchor hook
- 8 Guide wire
- 9 Bolt

- 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

5.4.2 Tank top mounting (for underground tank)



A0041197

4 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*

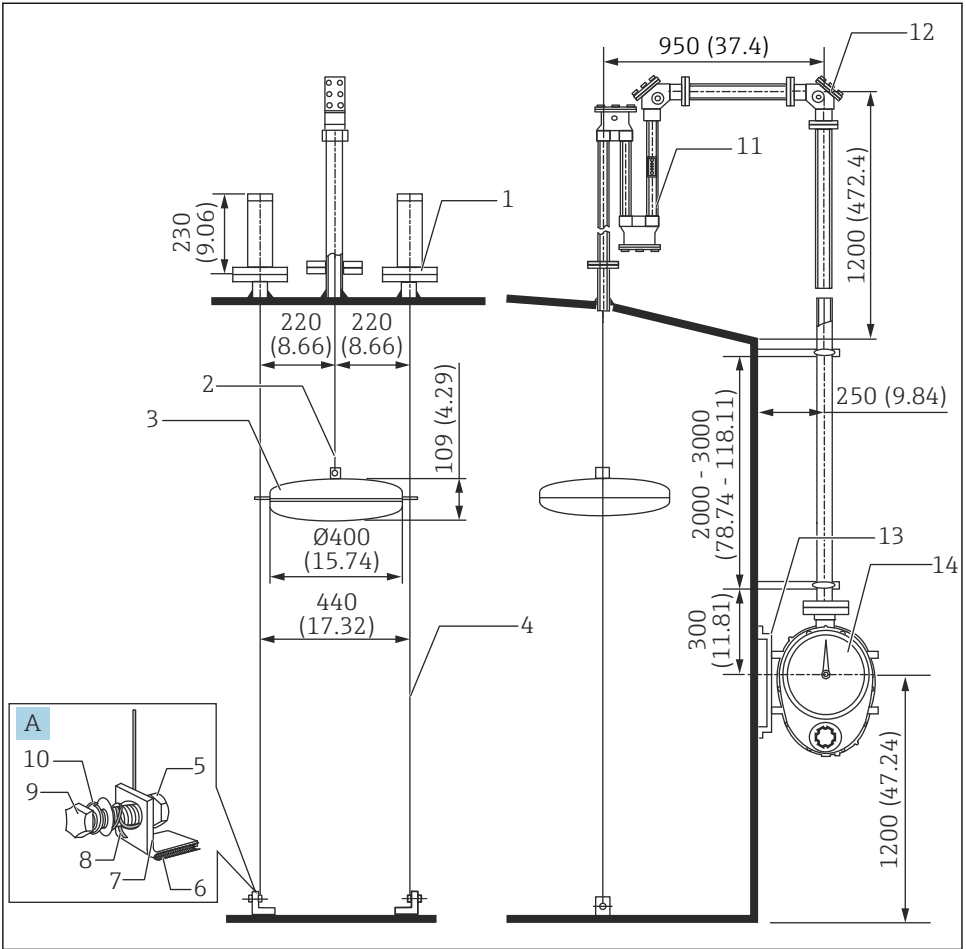
9 *Bolt*

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, $0.65 \leq \text{density} 1.05$, 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		

5.4.3 Cone roof tank (with seal pot for CRT)



A0041198

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

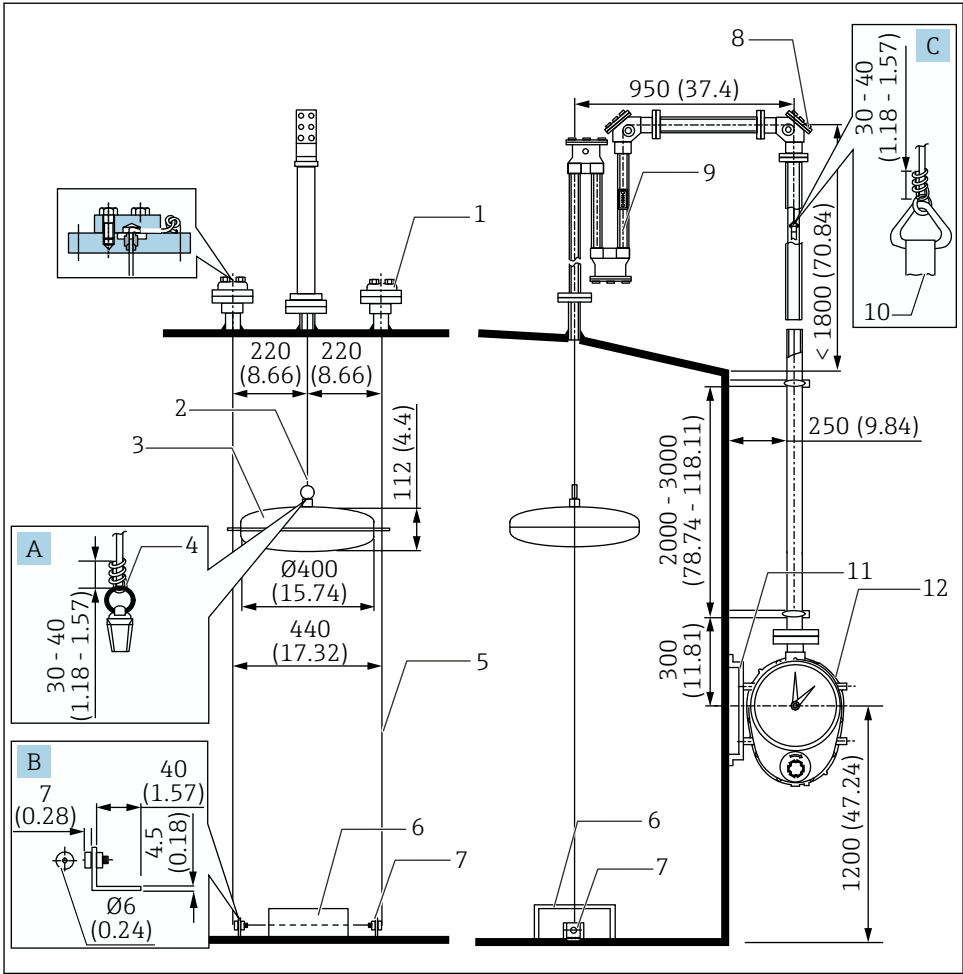
- A Anchor hook
- 1 Top anchor
- 2 Measuring tape
- 3 Float
- 4 Guide wire
- 5 Nut
- 6 Wetted part (welded to the tank)
- 7 Anchor hook
- 8 Guide wire
- 9 Bolt
- 10 Washer

- 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

5.4.4 Cone roof tank (with PVC seal pot for CRT)



A0041199

6 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

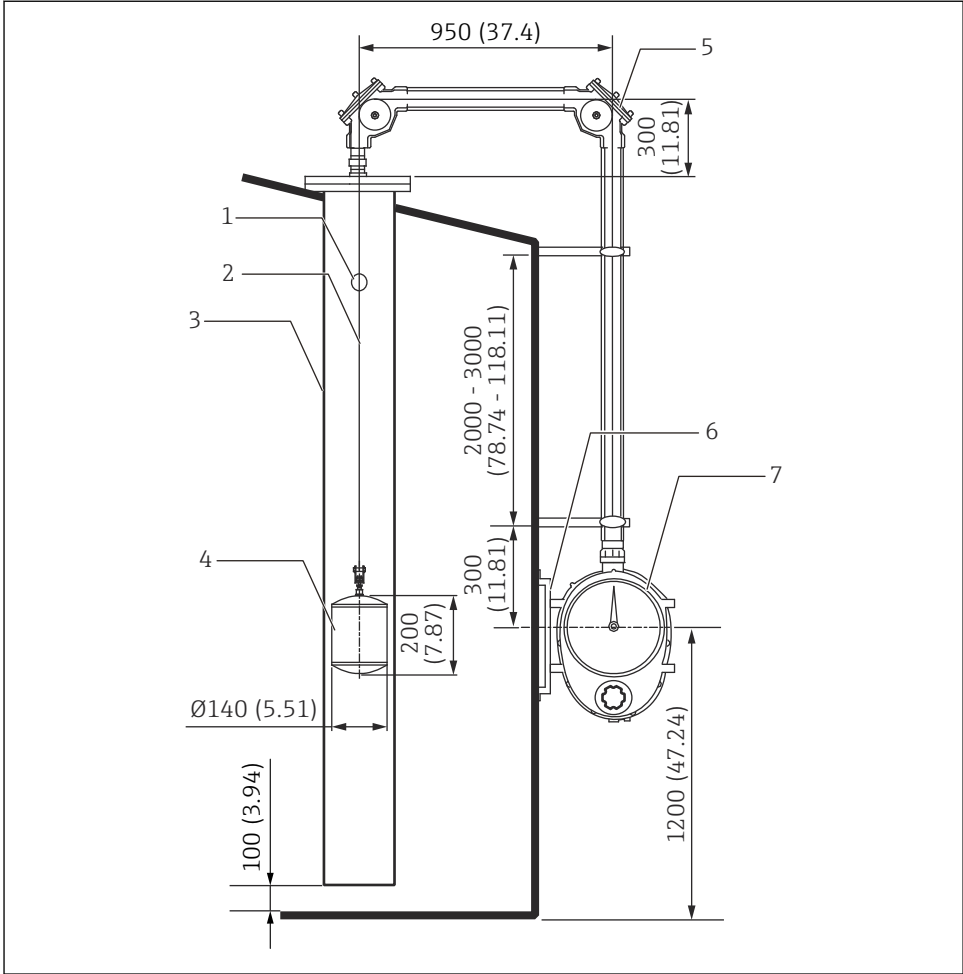


- Wrap the included Teflon tube around the measuring wire 10 to 15 times.
- Coat the anchor hook if necessary.
- Position connection C in the diagram so that it is approximately 10 mm (0.39 in) below the sheave elbow when the liquid level is 0 and approximately 100 mm (3.94 in) away from the gauge head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

5.4.5 Compact cone roof tank (guide pipe type)



A0041200

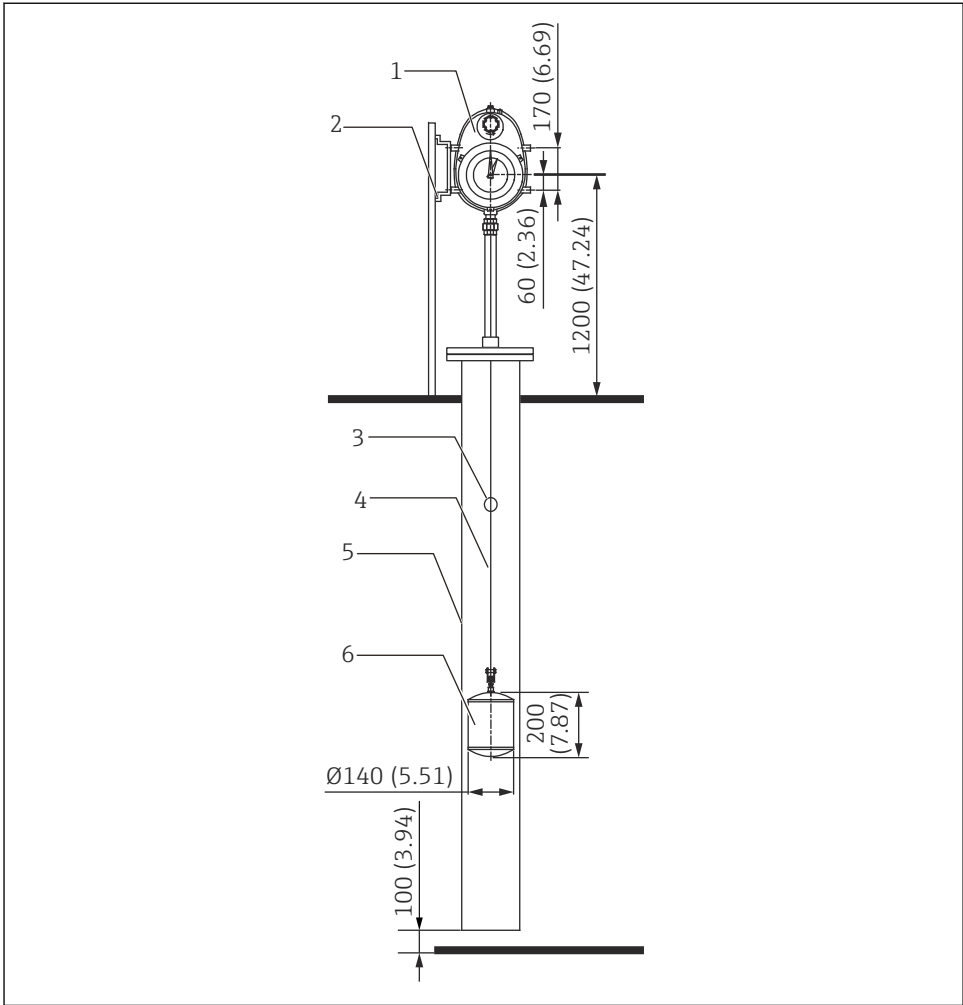
7 Mounting on a compact cone roof tank. Unit of measurement mm (in)

- 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

5.4.6 Tank top mounting (guide pipe type)



A0041201

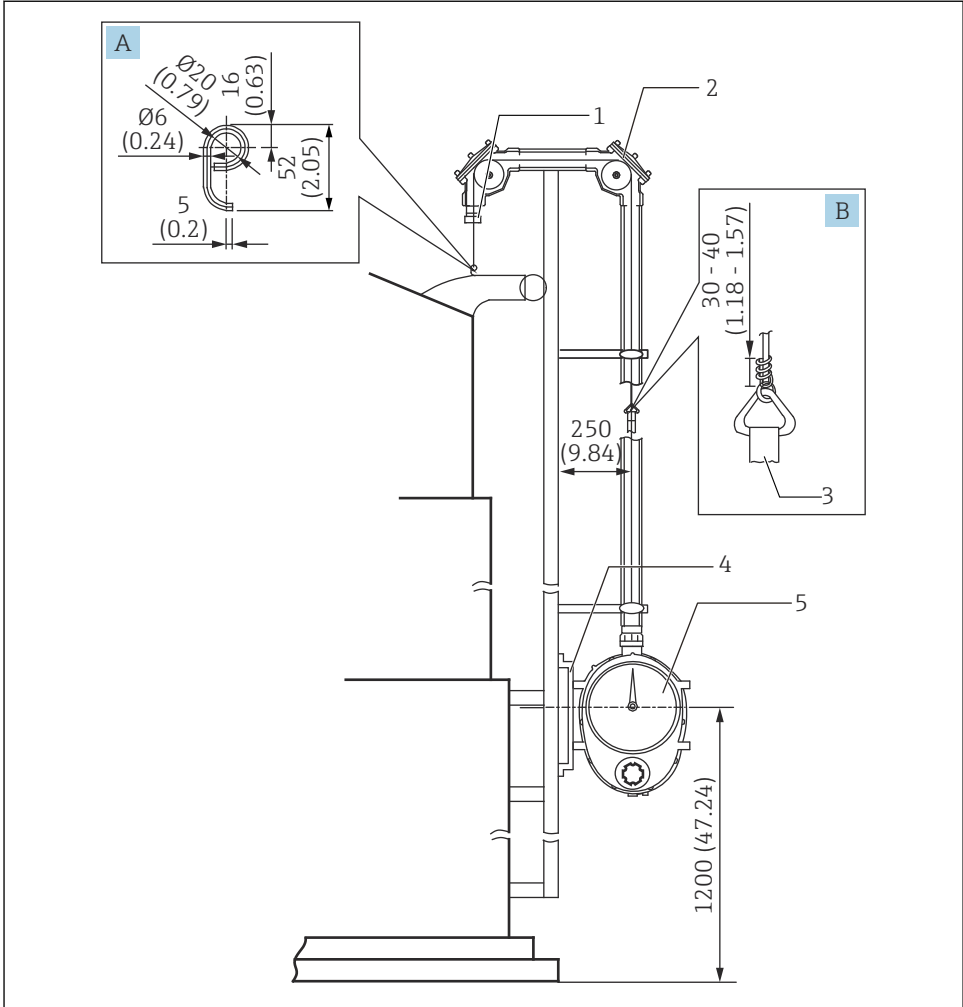
8 Mounting on tank top, unit. Unit of measurement mm (in)

- 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

5.4.7 Gas holder



A0041202

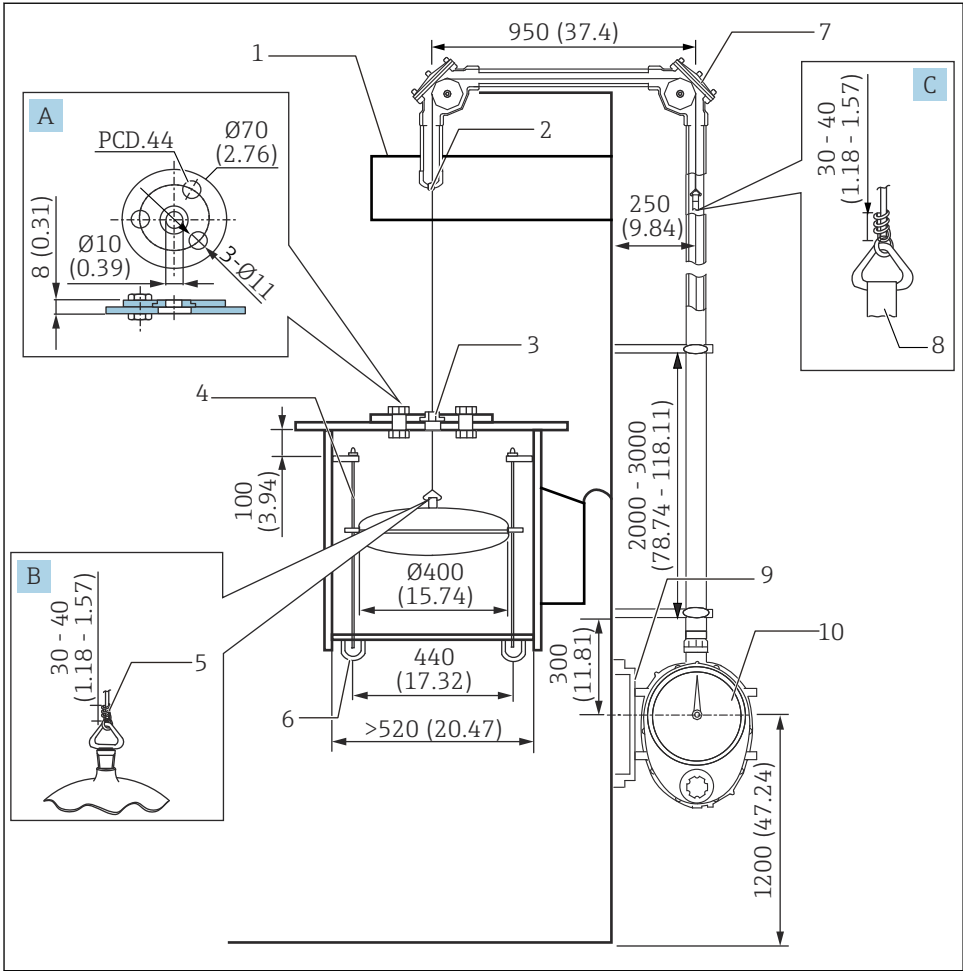
9 Mounting a gas holder. Unit of measurement mm (in)

- 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	

5.4.8 For floating roof (FRT)



A0041203

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

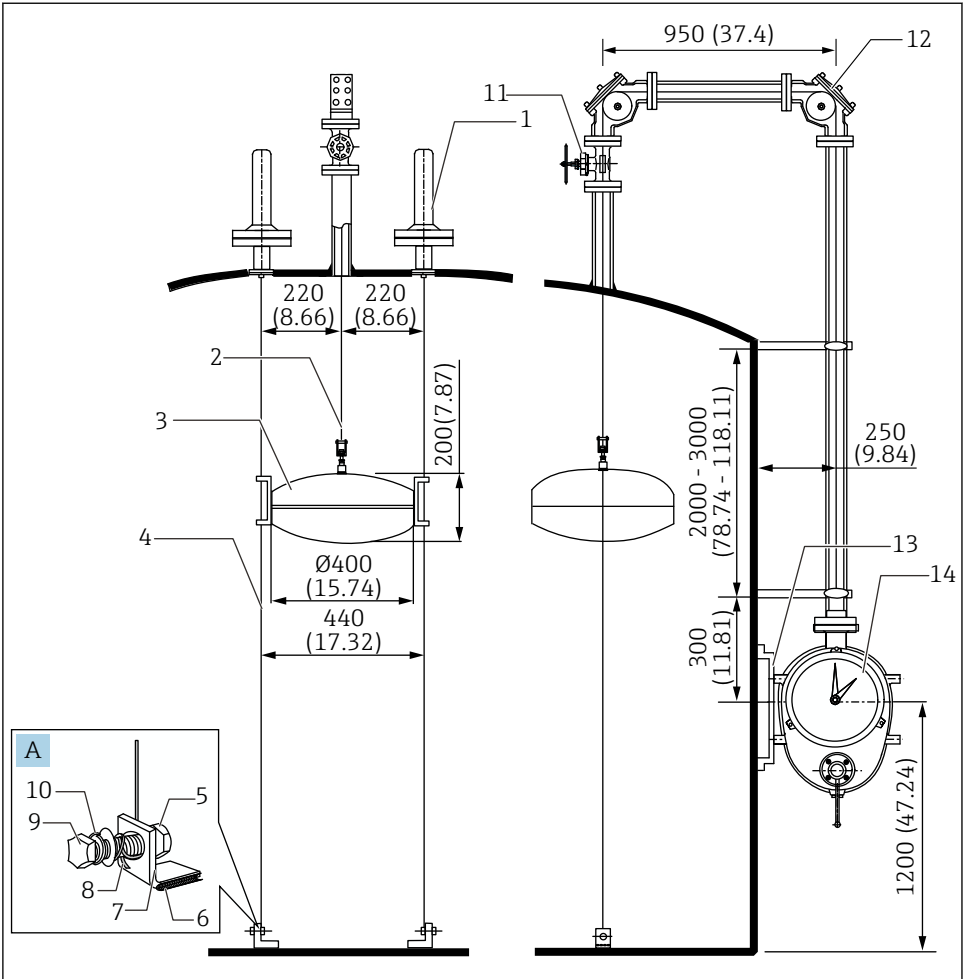
- A Wire guide metal
- B Top of the float
- C Triangle bracket for measuring wire
- 1 Roof stand
- 2 Wire guide socket
- 3 FRT wire guide metal
- 4 Guide bar: $\phi 16$ mm (0.63 in)
- 5 Stainless steel wire (accessory)
- 6 Pipe end: 1^B Sch 40 to 80
- 7 90° sheave elbow

- 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, $0.65 \leq \text{density} 1.05$, 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	

5.4.9 Dome roof tank for medium pressure



A0041204

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

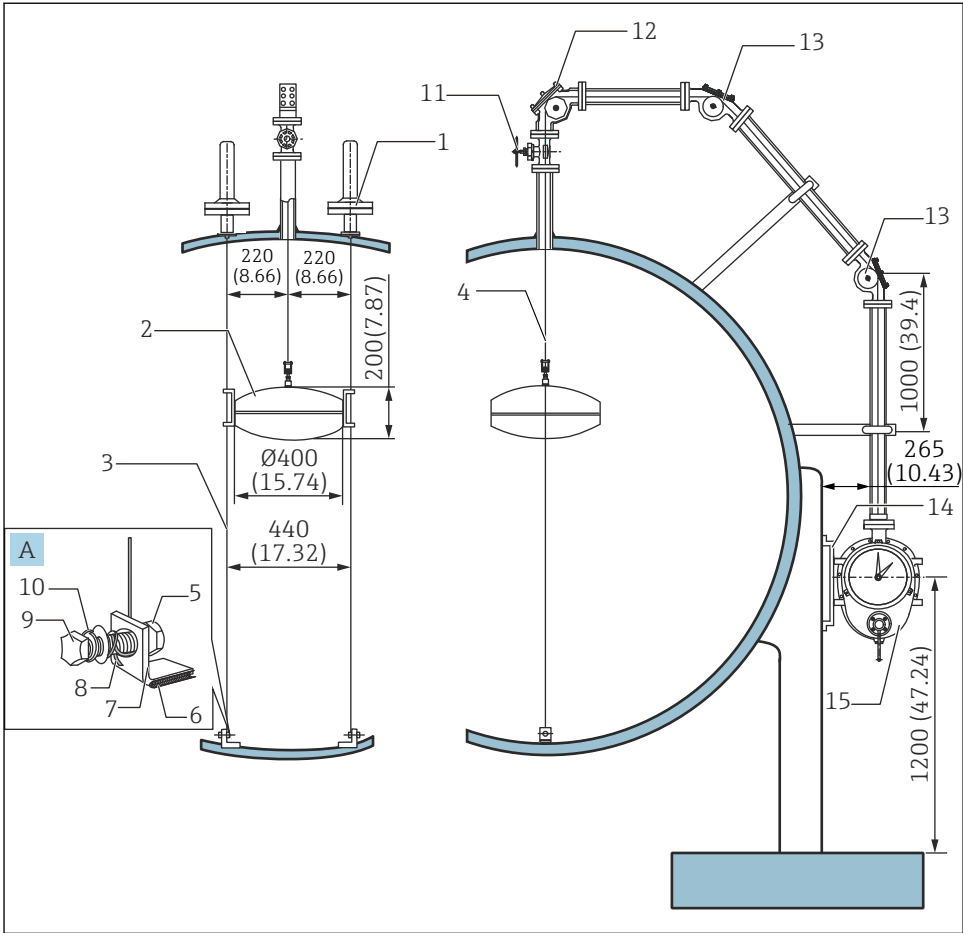
- A Anchor hook
- 1 Top anchor
- 2 Measuring tape
- 3 Float
- 4 Guide wire
- 5 Stainless steel wire (accessory)
- 6 Nut
- 7 Anchor hook
- 8 Guide wire
- 9 Bolt

- 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, $0.5 \leq \text{density}$ 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	

5.4.10 Spherical tank for high pressure



A0041205

12 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, $0.5 \leq \text{density} < 0.7$, with ring	
090	Top anchor	6G	2x 20K 40A RF, iron (SCPL1), flange JIS B2220	
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	

6 Commissioning

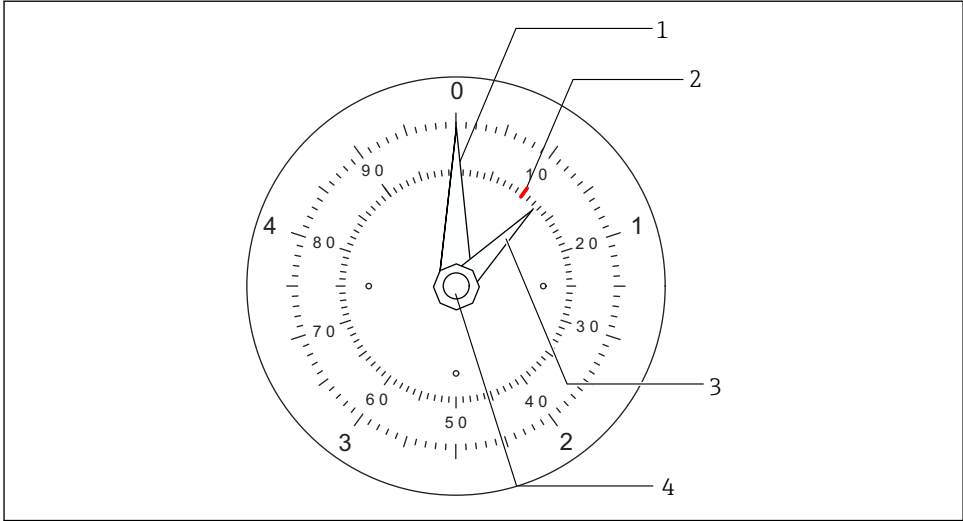
6.1 Dial display

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.



A0041231

13 Dial display (5 m (16.4 ft) scale plate)

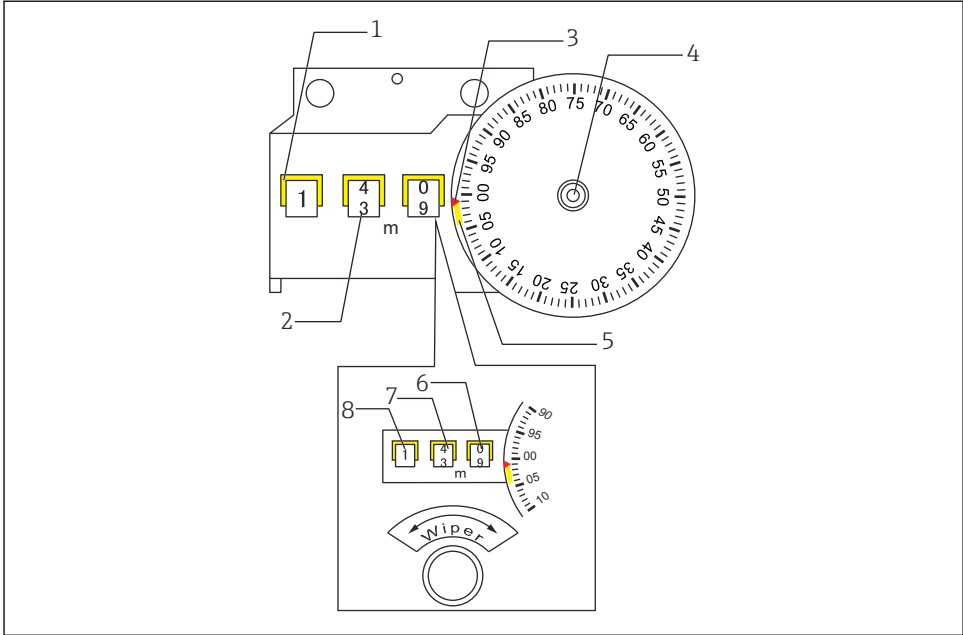
- 1 Long needle (white)
- 2 Example: 10 mm position
- 3 Short needle (green)
- 4 Cap nut

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.



A0041232

14 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

i 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)
$L_f = \left(\frac{h}{2} + \frac{\frac{W - T}{\rho} - \frac{V}{2}}{S} \right) \times 10 \text{ mm (0.39 in)}$	
Tape tension	T 1 200 g (2.65 lb)

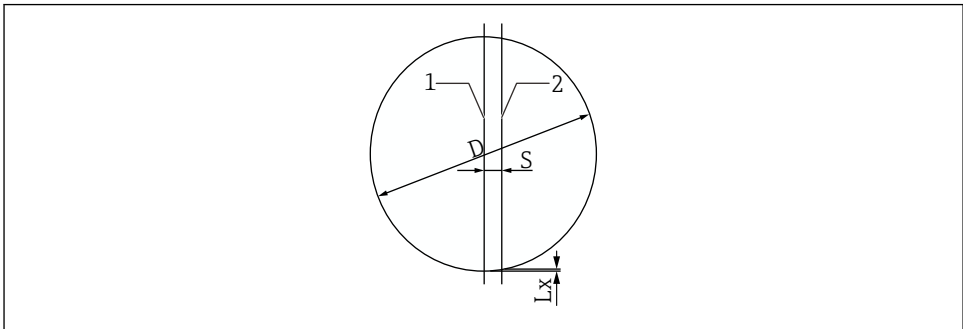
Specific action	Float (D)	Materials	Weight (W)	Cross-sectional area (S)	Height (h)	Volume (V)	Liquid density (g/cm³)			
Low pressure	400 mm (15.75 in)	SUS316	4 200 g (9.26 lb)	1 257 cm²	10.9 cm (4.29 in)	10 520 cm³	0.5 ≤ ρ < 0.65			
			5 000 g (11.02 lb)				0.65 ≤ ρ < 1.05			
			8 000 g (17.64 lb)				1.05 ≤ ρ ≤ 2.0			
		PVC	4 200 g (9.26 lb)				1 257 cm²	11.2 cm (4.41 in)	10 870 cm³	0.5 ≤ ρ < 0.65
			5 000 g (11.02 lb)							0.65 ≤ ρ < 1.05
			8 000 g (17.64 lb)							1.05 ≤ ρ ≤ 2.0
	140 mm (5.51 in)	SUS316	2 100 g (4.63 lb)	154 cm²	20.0 cm (7.87 in)	2 661 cm³				0.5 ≤ ρ < 0.94

Specific ation	Float (D)	Materi als	Weight (W)	Cross-sectional area (S)	Height (h)	Volume (V)	Liquid density (g/cm ³)
			2 400 g (5.29 lb)				$0.94 \leq \rho \leq 2.0$
		PVC	2 100 g (4.63 lb)	154 cm ²	21.0 cm (8.27 in)	2 946 cm ³	$0.5 \leq \rho < 0.94$
			2 400 g (5.29 lb)				$0.94 \leq \rho \leq 2.0$
Mediu m/high pressur e	400 mm (15.75 in)	SUS316	8 300 g (18.3 lb)	1 257 cm ²	20.0 cm (7.87 in)	19 200 cm ³	$0.5 \leq \rho \leq 0.7$

i 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.

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



A0041235

15 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

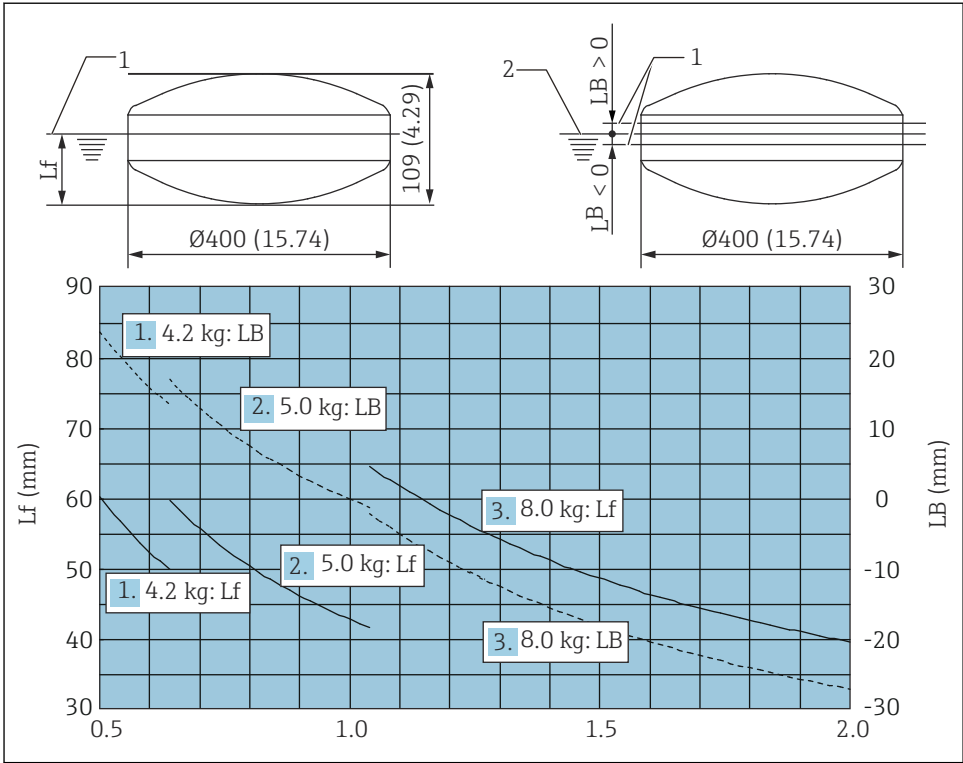
adjusted when the tank is filled with water and then re-adjusted once the tank has been filled with actual liquid. In this case, the following equation is used to determine the difference in the initial floating position of the float when the tank is filled with water and actual liquid in order to correct the value that is indicated when the tank is filled with water.



After calibrating the gauge indicator to the measured value with water, determine L_b from the following equation. If L_b 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 L_f (the height of the liquid level from the bottom of the float when the float gains buoyancy)				
$L_f = \left(\frac{h}{2} + \frac{\frac{W - T}{\rho} - \frac{V}{2}}{S} \right) \times 10 \text{ mm (0.39 in)}$					
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	L _f (water)	42.9 mm (1.69 in)
	ρ (with actual liquid)	0.8 g (0.002 lb)/ cm ³		L _f (actual liquid)	50.4 mm (1.98 in)
2.	Correction of indicated value with simulated actual liquid		L _b = L _f (water) - L _f (actual liquid)		-7.5 mm (-0.3 in)



A0041238

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

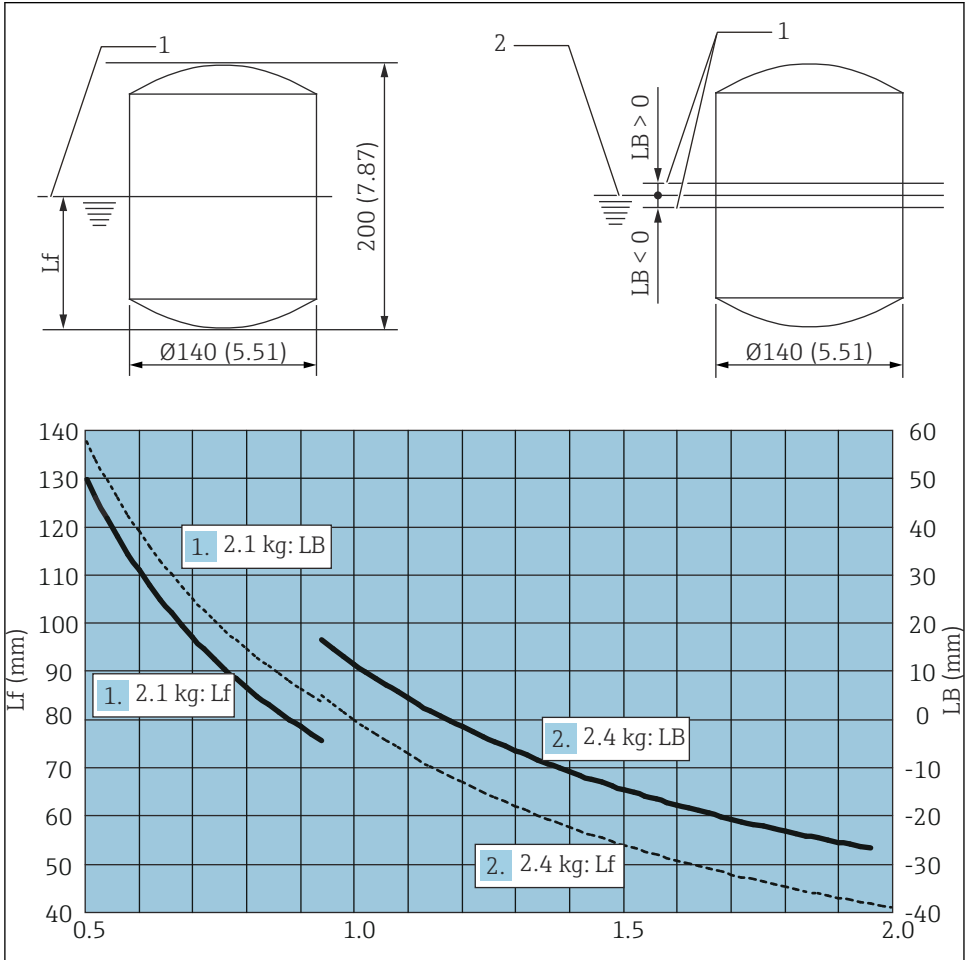
- 1 Draft surface at density ρ
- 2 Water (draft surface at a density of 1.0 g (0.002 lb)/cm³)

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)				
$L_f = \left(\frac{h}{2} + \frac{\frac{W - T}{\rho} - \frac{V}{2}}{S} \right) \times 10 \text{ mm (0.39 in)}$					
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 = π D ² /4	153.94 cm ²	Tape tension	T	1 200 g (2.65 lb)

1. Liquid level at which float gains buoyancy (in water)					
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		$L_b = L_f \text{ (water)} - L_f \text{ (actual liquid)}$		-14.6 mm (-0.57 in)

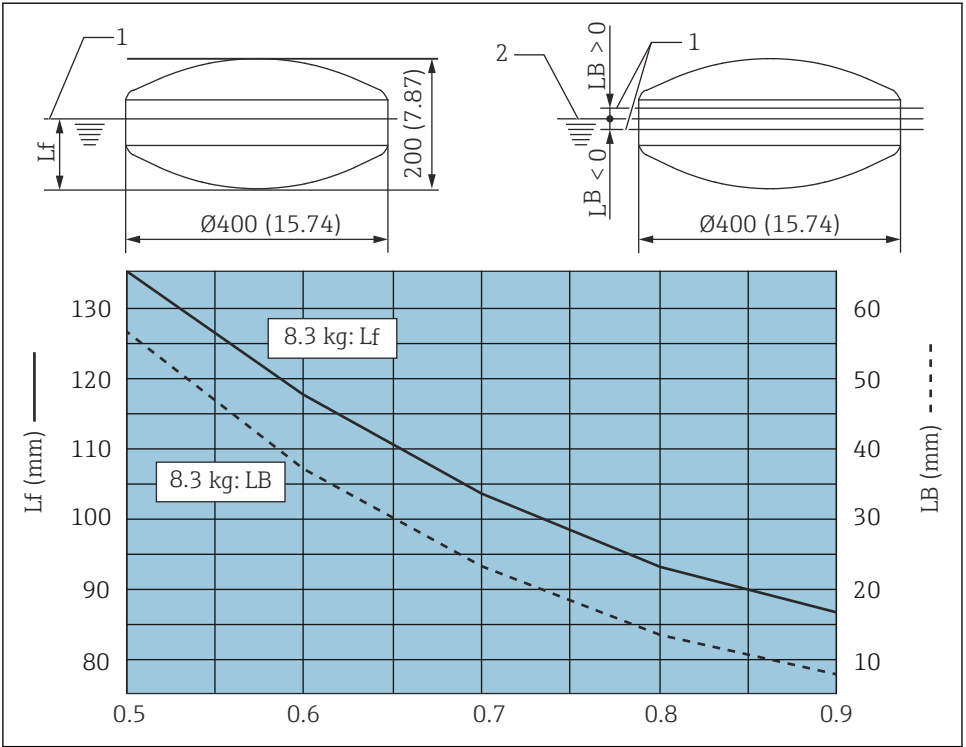


17 Indicator value when the tank is filled with water. Measurement unit mm (in)

- 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)					
$L_f = \left(\frac{h}{2} + \frac{\frac{W - T}{\rho} - \frac{V}{2}}{S} \right) \times 10 \text{ mm (0.39 in)}$					
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)



A0041243

18 Graph of LT5-4/LT5-6 \varnothing 400 mm (15.75 in) float: Density of measurement liquid ρ (g/cm^3). Measurement unit mm (in)

- 1 Draft surface at density ρ
- 2 Water (draft surface at a density of 1.0 g (0.002 lb)/ cm^3)

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.



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