Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operation Instructions

Float Tank Gauge
LT11/LT12/LT14/LT16

BA00404G/08/EN/04.13
71238386

Endress+Hauser

People for Process Automation

Table of Contents

1 Safety Instructions

1.1 Designated Use

The Float Tank Gauge LT11/12/14/16 perform an important role in all areas of industry. Many years of operation in wide variety of applications have proven their reliability. No electrical power is required to perform the measurement. In addition, LT series can be installed easily in your site and can measure the liquid level accurately, and can be used for the detector of the remote command. Therefore LT series are best suited for use in the following operations.

- Management of Inventory
- Batch Process
- Management of Process Tank
- Safety Drive of Tanks

1.2 Installation, Commissioning, and Operation

- Mounting, electrical installation, start-up, and maintenance of the instrument may only be performed by trained personnel authorized by the operator of the facility.
- Personnel must read and understand these installation instructions before performing the procedures.
- The instrument may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual must be observed.
- The installer must make sure that the measuring system is correctly wired according to the wiring diagrams. The measuring system must be grounded.
- Observe all law and regulations applicable and valid for your country and pertaining to the opening and repairing of electrical devices.

1.3 Operational Safety

Caution!

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

1.4 Notes on Safety Conventions and Symbols

To highlight safety-relevant or alternative operating procedures in this manual, the following conventions have been used, each indicated by a corresponding symbol on the left.

Safety Conventions	
	**Warning!** Indicates an action or procedure that, if not performed correctly, will lead to personal injury, a safety hazard, or destruction of the instrument
	**Caution!** Indicates an action or procedure that, if not performed correctly, may lead to personal injury or malfunction of the instrument
	**Note!** Indicates an action or procedure that, if not performed correctly, may indirectly affect operation or lead to an unexpected instrument response.

2 Identification

2.1 Device Designation

2.1.1 Nameplate

The following technical data are given on the instrument nameplate:

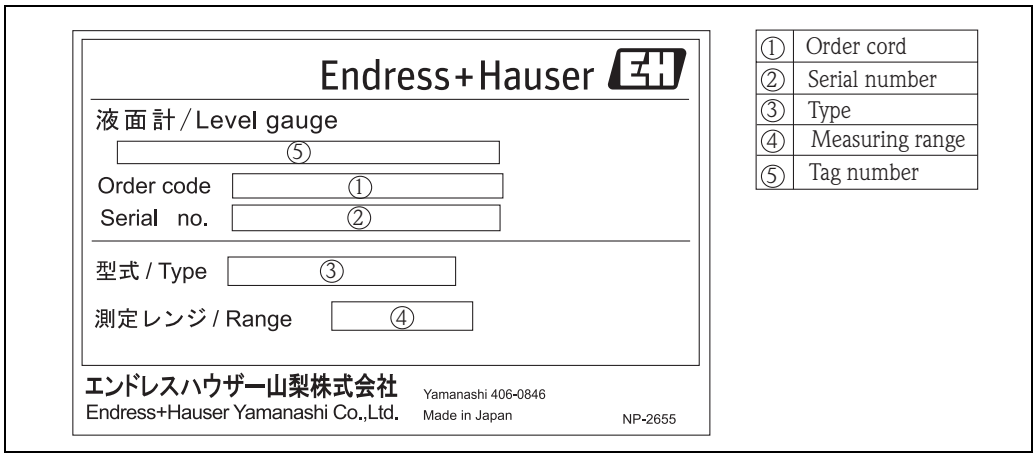


Figure 1: Nameplate

2.2 Order Information

2.2.1 LT11 (Threaded Type, Low Pressure)

010	**Display:**							
	1	Dial 2 pointers						
	2	Numeric (mechanical counter)						
	5	Dial 2 pointers, up side down						
	9	Special version, TSP-no. to be spec						
020		**Crank Unit:**						
		0	Not selected					
		1	Selected					
030			**Function:**					
			0	Basic version				
			9	Special version, TSP-no. to be spec.				
040				**Process Connection:**				
				0	Thread JISB0203 Rp1-1/2, w/o union nut, SUS316			
				A	Thread JISB0203 Rc1-1/2, union nut, sleeve, SUS316			
				B	Thread ANSI NPT1-1/2, union nut, sleeve, SUS316			
				C	Thread JIS B0202 G1-1/2, union nut, sleeve, SUS316			
				9	Special version, TSP-no. to be spec.			
050					**Measuring Range:**			
					1	2.5m		
					2	5m		
					3	10m		
					4	16m		
					5	20m		
					6	30m (numeric display only)		
					9	Special version, TSP-no. to be spec.		
060						**Application:**		
						AAA	Gauge head only, accessories ordered by selection tool	
						000	Gauge head only	
						005	CRT, guide pipe installation	
						008	Tank top, guide pipe installation	
						060	PVC, SS400 wire hook	
						062	PVC, SUS316 wire hook	
						251	Gas holder	
						261	FRT tank	
						A01	Standard application for CRT, tape not installed (solid guide wire, 2 anchor hooks)	
						A04	Wetted parts, SUS316, tape not installed (solid guide wire, 2 anchor hooks)	
						A06	Wetted / gas parts, SUS316, tape not installed (solid guide wire, 2 anchor hooks)	
						A07	Underground standard, tape not installed (solid guide wire, 2 anchor hooks)	
						A10	Underground standard, SUS316 tape not installed (solid guide wire, 2 anchor hooks)	
						A50	Seal pot standard tape not installed (solid guide wire, 2 anchor hooks)	
						A54	Seal pot all, SUS316, tape not installed (solid guide wire, 2 anchor hooks)	
						B01	Standard, crank unit, tape not installed (solid guide wire, 2 anchor hooks)	
						B04	Wetted parts, SUS316, crank unit, tape not installed (solid guide wire, 2 anchor hooks)	
						B06	Wetted / gas parts, SUS316, crank unit, tape not installed (solid guide wire, 2 anchor hooks)	
						B50	Seal pot standard, crank unit, tape not installed (solid guide wire, 2 anchor hooks)	
						B54	Seal pot, SUS316 + crank unit, tape not installed (solid guide wire, 2 anchor hooks)	
						C07	Underground tank installation, crank unit, tape not installed (solid guide wire, 2 anchor hooks)	
						C10	Underground tank installation, tape not installed (solid guide wire, 2 anchor hooks)	
						999	Special version, TSP-no. to be spec.	
LT11-							Product designation (part 1)	

070							Float:
							1 4.2kg d = 400mm,
							2 5.0kg, d = 400mm
							3 8.0kg, d = 400mm
							4 Not selected
							5 2.1kg, d = 140mm
							6 2.4kg, d = 140mm
							9 Special version, TSP-no. to be spec.

080								Additional Option; Color:
								0 Basic version
								C Copper free
								D Glass display cover
								J Copper free, glass display cover
								9 Special version, TSP-no. to be spec.

LT11-									Completed product designation

2.2.2 LT12 (Flange Type, Low Pressure)

010	**Display:**	
	1	Dial 2 pointers
	2	Numeric (mechanical counter)
	5	Dial 2 pointers, up side down
	9	Special version, TSP-no. to be spec.

020	**Crank Unit:**	
	0	Not selected
	1	Selected

030	**Function:**	
	0	Basic version
	9	Special version, TSP-no. to be spec.

040	**Process Connection:**	
	1	10K 40A RF, AC4A, flange JIS B2220
	A	10K 40A RF, SUS316, flange JIS B2220
	2	1-1/2 150lbs RF, AC4A, flange ANSI B16.5
	B	1-1/2 150lbs RF, SUS316, flange ANSI B16.5
	B	40A 150lbs RF, AC4A, flange JPI 7S-15
	C	40A 150lbs RF, SUS316, flange JPI 7S-15
	9	Special version, TSP-no. to be spec.

050	**Measuring Range:**	
	1	2.5m
	2	5m
	3	10m
	4	16m
	5	20m
	6	30m(numeric display only)
	9	Special version, TSP-no. to be spec.

060	**Application:**	
	AAA	Gauge head only, accessories ordered by selection tool
	000	Gauge head only
	061	PVC, SS400 wire hook
	063	PVC, SUS316 wire hook
	252	Gas holder
	262	FRT tank
	A11	Standard application for CRT, tape not installed (solid guide wire, 2 anchor hooks)
	A14	Wetted parts, SUS316, tape not installed (solid guide wire, 2 anchor hooks)
	A15	Wetted / gas parts, SUS316, tape not installed (solid guide wire, 2 anchor hooks)
	A40	Underground standard, tape not installed (solid guide wire, 2 anchor hooks)
	A43	Underground standard, SUS316 tape not installed (solid guide wire, 2 anchor hooks)
	A55	Standard, seal pot, tape not installed (solid guide wire, 2 anchor hooks)
	A59	Seal pot all SUS316, tape not installed (solid guide wire, 2 anchor hooks)
	B55	Standard, seal pot, crank unit, tape not installed (solid guide wire, 2 anchor hooks)
	B59	Seal pot all SUS316, crank unit, tape not installed (solid guide wire, 2 anchor hooks)
	B11	Standard, crank unit, tape not installed (solid guide wire, 2 anchor hooks)
	B14	Wetted parts SUS316, crank unit, tape not installed (solid guide wire, 2 anchor hooks)
	B15	Wetted / gas parts SUS316, crank unit, tape not installed (solid guide wire, 2 anchor hooks)
	B40	Underground tank installation, crank unit, tape not installed (solid guide wire, 2 anchor hooks)
	B43	UNI, Wetted parts SUS316, crank unit, tape not installed UNI = Underground tank install (solid guide wire, 2 anchor hooks)
	999	Special version, TSP-no. to be spec.

LT12-		Product designation (part1)

070	**Float:**	
	1	4.2kg d = 400mm
	2	5.0kg, d = 400mm
	3	8.0kg, d = 400mm
	4	Not selected
	9	Special version, TSP-no. to be spec.

080	**Additional Option; Color:**	
	0	Basic version
	C	Copper free
	D	Glass display cover
	J	Copper free, glass display cover
	9	Special version, TSP-no. to be spec.

LT12-	Complete product designation

2.2.3 LT14 (Flange Type, Medium Pressure)

010	**Display:**	
	1	Dial 2 pointers
	2	Numeric (mechanical counter)
	5	Dial 2 pointers, up side down
	9	Special version, TSP-no. to be spec.

020	**Crank Unit:**	
	0	Not selected
	1	Selected

030	**Function:**	
	0	Basic version
	9	Special version, TSP-no. to be spec.

040	**Process connection:**	
	1	10K 40A RF, AC4CT6, flange JIS B2220
	A	10K 40A RF, SCS13, flange JIS B2220
	3	1-1/2 150lbs RF, AC4CT6, flange ANSI B16.5
	C	1-1/2 150lbs RF, SCS13, flange ANSI B16.5
	5	40A 150lbs RF, AC4CT6, flange JPI 7S-15
	E	40A 150lbs RF, SCS13, flange JPI 7S-15
	9	Special version, TSP-no. to be spec.

050	**Measuring Range:**	
	1	2.5m
	2	5m
	3	10m
	4	16m
	5	20m
	6	30m(numeric display only)
	9	Special version, TSP-no. to be spec.

060	**Application:**	
	AAA	Gauge head only, accessories ordered by selection tool
	000	Gauge head only
	040	Standard, sheave elbow 90°x 2
	041	Wetted / gas parts, SUS316, sheave elbow 90°x 1, 135°x 2
	078	Alu, sheave elbow 90°x1, 135°x 2
	094	Standard, sheave elbow 90°x 2, crank unit
	095	Wetted / gas parts, SUS316, crank unit, sheave elbow 90°x 1, 135°x 2
	098	Alu, sheave elbow 90°x1, 135°x 2, crank unit
	999	Special version, TSP-no. to be spec.

070	**Float:**	
	4	Not selected
	5	8.3kg, d=400mm
	9	Special version, TSP-no. to be spec.

080	**Additional Option; Color:**	
	0	Basic version
	C	Copper free
	9	Special version, TSP-no. to be spec.

LT14-	Complete product designation

2.2.4 LT16 (Flange Type, High Pressure)

010	**Display:**	
	1	Dial 2 pointers
	2	Numeric (mechanical counter)
	5	Dial 2 pointers, up side down
	9	Special version, TSP-no. to be spec.
020	**Crank Unit:**	
	0	Not selected
	1	Selected
030	**Function:**	
	0	Basic version
	9	Special version, TSP-no. to be spec.
040	**Process Connection:**	
	1	10K 40A RF, SCPL1,SNB7, flange JIS B2220
	2	20K 40A RF, SCPL1,SNB7, flange JIS B2220
	A	10K 40A RF, SCS13, SUS304, flange JIS B2220
	B	20K 40A RF, SCS13, SUS304, flange JIS B2220
	G	20K 40A RF, SCS13, SNB7, flange JIS B2220
	3	1-1/2 150lbs RF, SCPL1, SNB7, flange ANSI B16.5
	4	1-1/2 300lbs RF, SCPL1, SNB7, flange ANSI B16.5
	C	1-1/2 150lbs RF, SCS13, SUS304, flange ANSI B16.5
	D	1-1/2 300lbs RF, SCS13, SUS304, flange ANSI B16.5
	H	1-1/2 300lbs RF, SCS13, SNB7, flange ANSI B16.5
	5	40A 150lbs RF, SCLP1, SNB7, flange JPI 7S-15
	6	40A 300lbs RF, SCLP1, SNB7, flange JPI 7S-15
	E	40A 150lbs RF, SCS13, SUS304, flange JPI 7S-15
	F	40A 300lbs RF, SCS13, SUS304, flange JIS B2220
	J	40A 300lbs RF, SCS13, SNB7, flange JIS B2220
		Special version, TSP-no. to be spec.
050	**Measuring Range:**	
	1	2.5m
	2	5m
	3	10m
	4	16m
	5	20m
	6	30m (numeric display only)
	9	Special version, TSP-no. to be spec.
060	**Application:**	
	AAA	Gauge head only, accessories ordered by selection tool
	000	Gauge head only (except tank top installation)
	042	Standard, sheave elbow 90°x 1, 135°x 2
	043	Sheave elbow 90°x 2
	044	Tank top installation
	096	Standard, sheave elbow 90°x 1, 135°x 2 , crank unit
	097	Sheave elbow 90°x 2 , crank unit
	999	Special version, TSP-no. to be spec.
070	**Float:**	
	4	Not selected
	5	8.3kg, d=400mm
	9	Special version, TSP-no. to be spec.
080	**Additional Option; Color:**	
	0	Basic version
	B	Gauge head bolts SUS304
	C	Cooper free
	F	Cooper free, Gauge head bolts SUS304
	9	Special version, TSP-no. to be spec.

LT16-	Complete product designation

2.3 Scope of Delivery

Caution!

It is extremely important to follow the instructions concerning the unpacking, transportation and storage of measuring instruments provided in the chapter "3.1 Incoming Acceptance, Transportation, Storage".

Following products is delivered as standard items.

LT11/LT12

Item	Unit	Item	Unit
Gauge head	1	Gauge supporter	1
Measuring tape	1	Guide wire	2
Float	1	Anchor hook	2
90 Sheave elbow (see note)	2	union (option)	1
Top anchor	2		

LT14/16

Item	Unit	Item	Unit
Gauge head	1	Plug gate valve (see note)	1
Measuring tape	1	Top anchor (see note)	2
Float	1	Guide wire (see note)	2
90 Sheave elbow (see note)	2	Wire hook (see note)	2
135 Sheave elbow (see note)	1		

Note!

Delivered Items vary depending on the product specifications (refer to "3.8 General View of Standard Drawings and Kit Codes").

Accompanying documentation:

- Operating Instructions (this manual)

2.3.1 Standard Packing Layout with Carton Box

The packing layout and its procedure are vary depending on the kit codes.
The flange type of the sheave elbow is delivered separately.

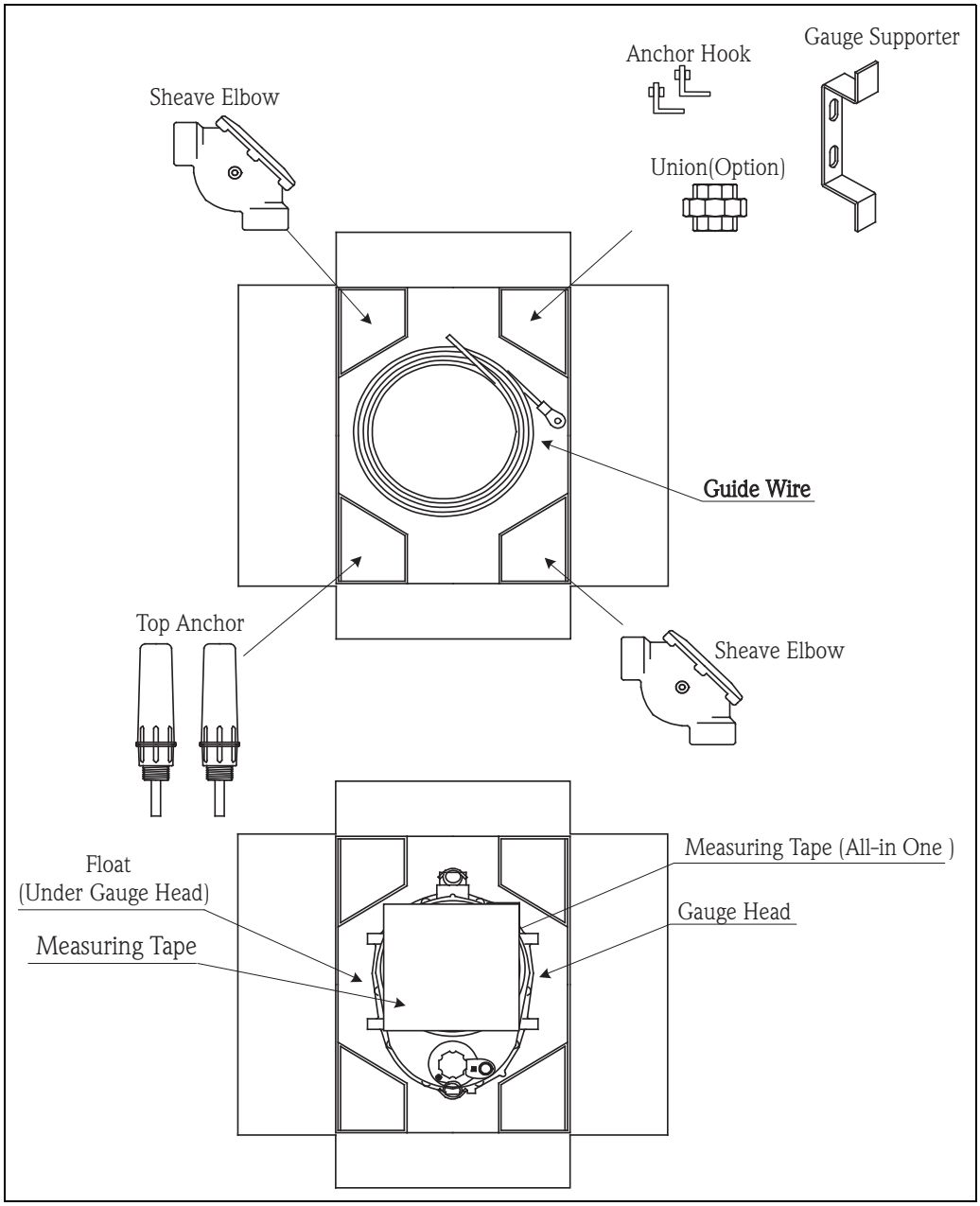


Figure 2: Packing Layout

3 Installation

3.1 Incoming Acceptance, Transport, Storage

3.1.1 Incoming Acceptance

Check the packing and contents for any signs of damage.
Check the shipment, and make sure that nothing is missing and that the items match your order.

3.1.2 Transportation

- Follow the safety instructions and conditions of transportation for instruments in excess of 18kg (40 lbs.).
- Do not lift the measuring instrument by its head during transportation.

3.1.3 Storage

Pack the measuring instrument so that it is protected against impacts during storage and transportation.
The original packing material provides the optimum protection for this.
The allowed storage temperature is -20 to +70 °C.

3.2 Installation Location

Be sure to perform the following operation prior to installation of LT.

Note!

- LT series should be installed in a place where meter can be easily read.
- The float must be installed so it is positioned near the tank sidewall and where measurement depth is greatest.
- In a spherical tank, the float must be installed so that it is positioned in line with the center of the tank and where measurement depth is greatest.
- When installing LT on tanks that have a dome roof with a steep incline, the float must be installed so it is positioned in line with the center of the tank.
- Use an appropriate gasket on flange connection to maintain airtightness.

Caution!

The float should be positioned as far from the tank inlet or stirrer as possible, so that the waves, which caused by liquid inflow, do not directly impact the float. If there is no choice but to position the float near an inlet or stirrer, install a wave guard to protect the float. If liquid flows into the tank abruptly, the float line may be severed.

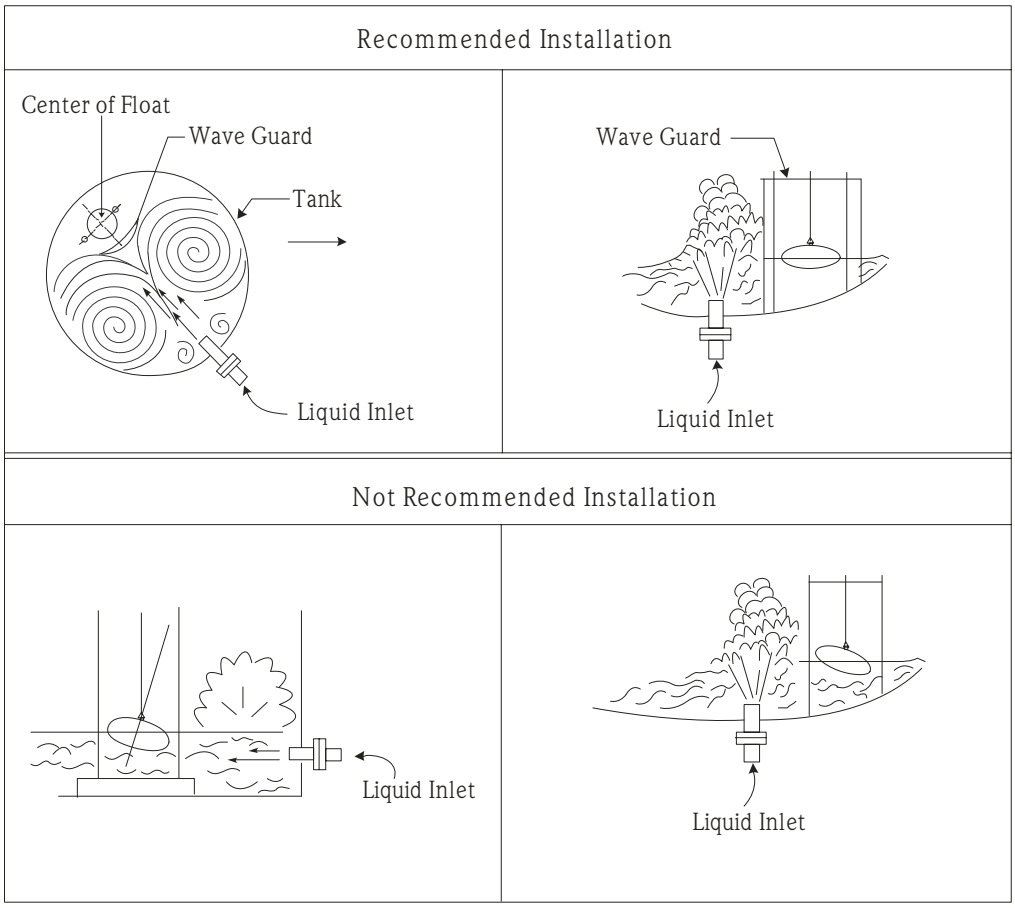


Figure 3: Setup Condition

3.3 Installation Tool

When installing LT series, prepare the following tools.

●: Use on Tank Top
○: Use at Ground Level
◎: Use at Both Places
—: Not Use

Recommended Tools for Installation

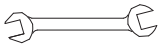
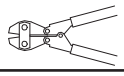
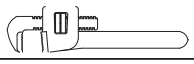
		LT11	LT12	LT14	LT16
Box End Wrench 	19mm: Sheave elbow cover removal & installation	●	●	●	—
	24mm: Seave elbow cover removal & installation	—	—	—	●
	17mm: Gauge head installation	○	○	○	—
	24mm: Gauge head installation	—	—	—	●
	24mm: JIS flange installation (M16, 2pcs.) 21mm: 150lbs flange installation (1/2", 2pcs.) 32mm: 300lbs flange installation (3/4", 2pcs.)	—	◎	◎	◎
Open End Wrench 	19mm : Tighten guide wire bolt & nut of top anchor, compressing tension spring	●	●	●	●
Water Pump Plier 	250mm or more : Install Top anchor (Threaded type LT1100)	●	—	—	—
Wire Cutter 	Trim guide wire for the appropriate length	●	●	●	●
Phillips Screwdriver 	Measuring tape clump tool installation Counter type display adjustment	○	○	—	○
Box End Driver 	5.5mm : Measuring tape clump tool installation Dial type display adjustment 8mm : Removal & reinstall display cover	○	○	○	○
Plier 	Tightening measuring clump tool	○	○	○	○
Metal Scissors 	Trim measuring tape	○	○	○	○
Pipe wrench 	600mm or more: Gauge head installation for guide pipe	○	○	—	—

Figure 4: Tools to Be Prepared

3.4 Welding for Gauge and Pipe Supporters

When welding the gauge and the pipe supporters, refer to the drawing below.

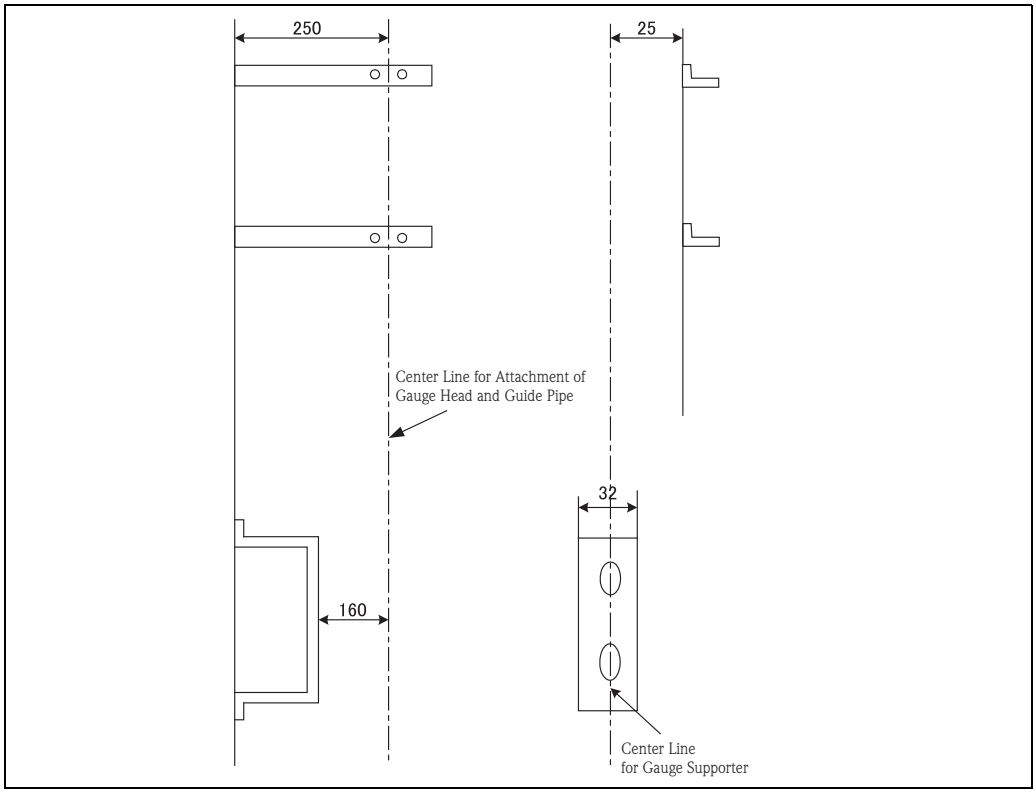
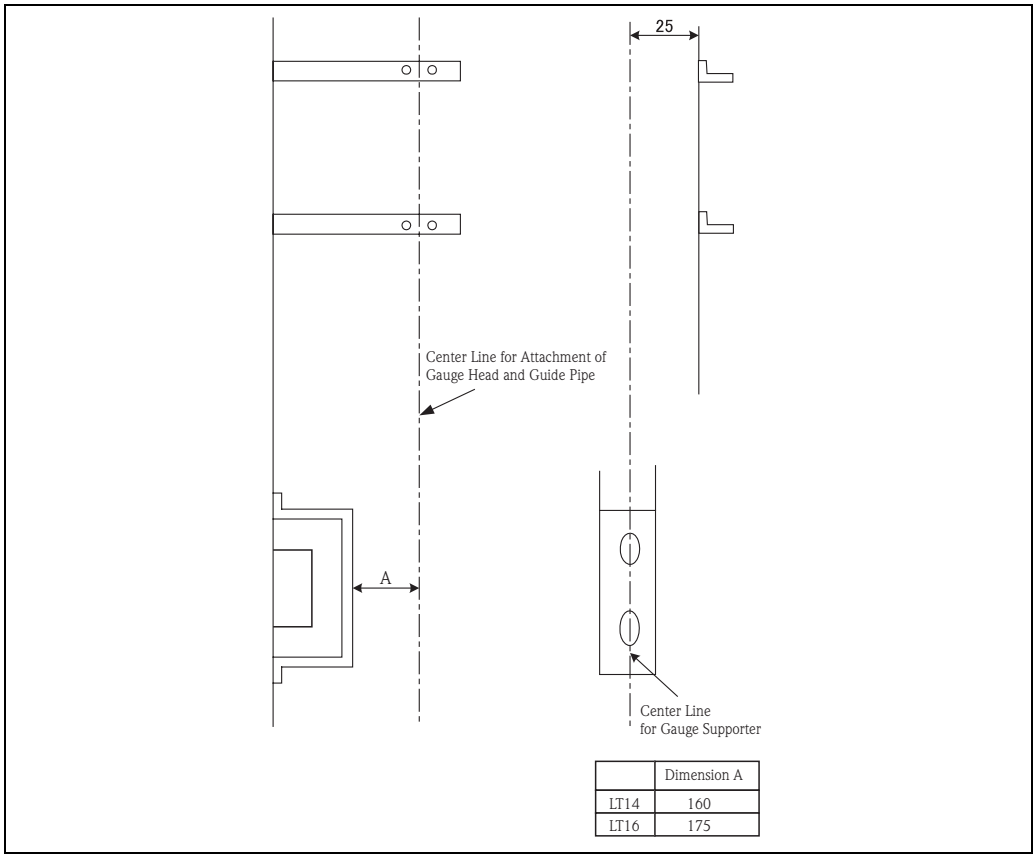


Figure 5: LT11/LT12 Gauge and Pipe Supporters



	Dimension A
LT14	160
LT16	175

Figure 6: LT14/LT16 Gauge and Pipe Supporters

3.5 Guide Pipe

3.5.1 Guide Pipe Material and Installation

Most LT installations will require the use of guide pipes, excluding some tank top or underground applications. Pipe supporters are generally used in three sections (gauge head to elbow, elbow to elbow, and elbow to tank roof). However, Endress+Hauser does not supply a pipe supporter. These must be supplied by the customer.

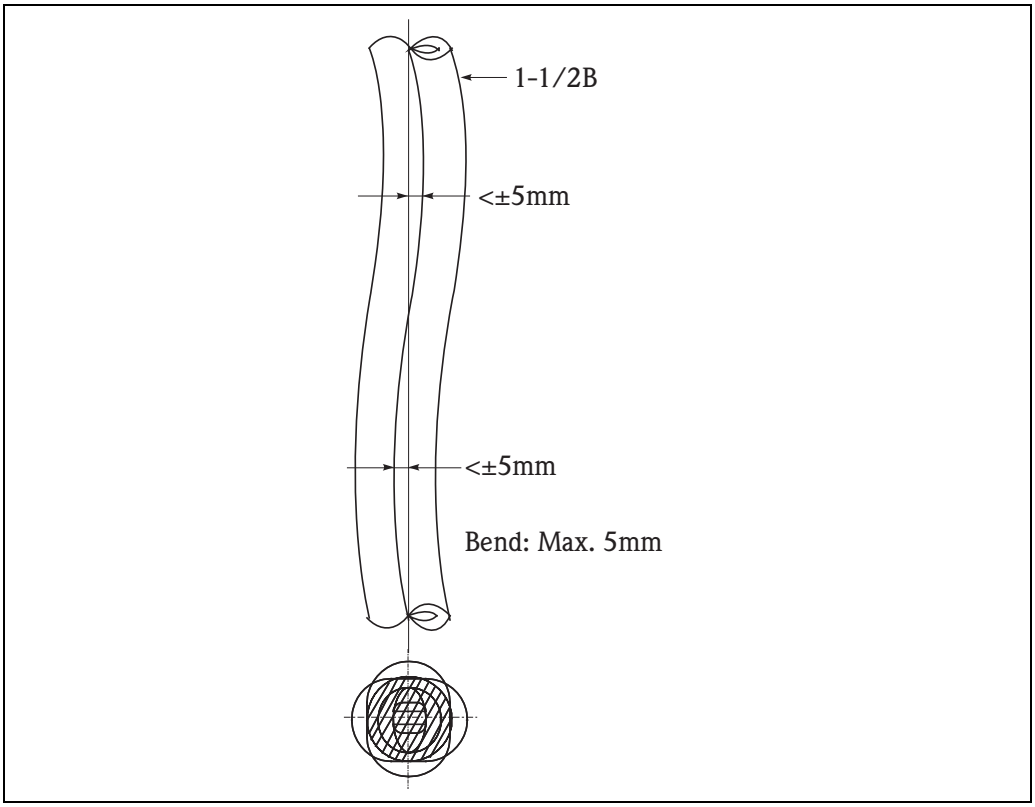


Figure 7: Attachment of Guide Pipe

Note!
If the application is for extremely corrosive gas, stainless steel or hard PVC pipe, with a resin inner lining is recommended.

3.5.2 Guide Pipe Connection

Note!

- Use a teflon sealing tape or packing for a union joint and a socket flange to maintain airtightness against gas or rain.
- Be sure connection between the guide pipe and the union is secure so that rain water does not enter LT from the union connection.
- Be sure that threaded connections are properly threaded to avoid a distorted or bent connection, and be sure that welded connections are straight with no burrs left on the inside.

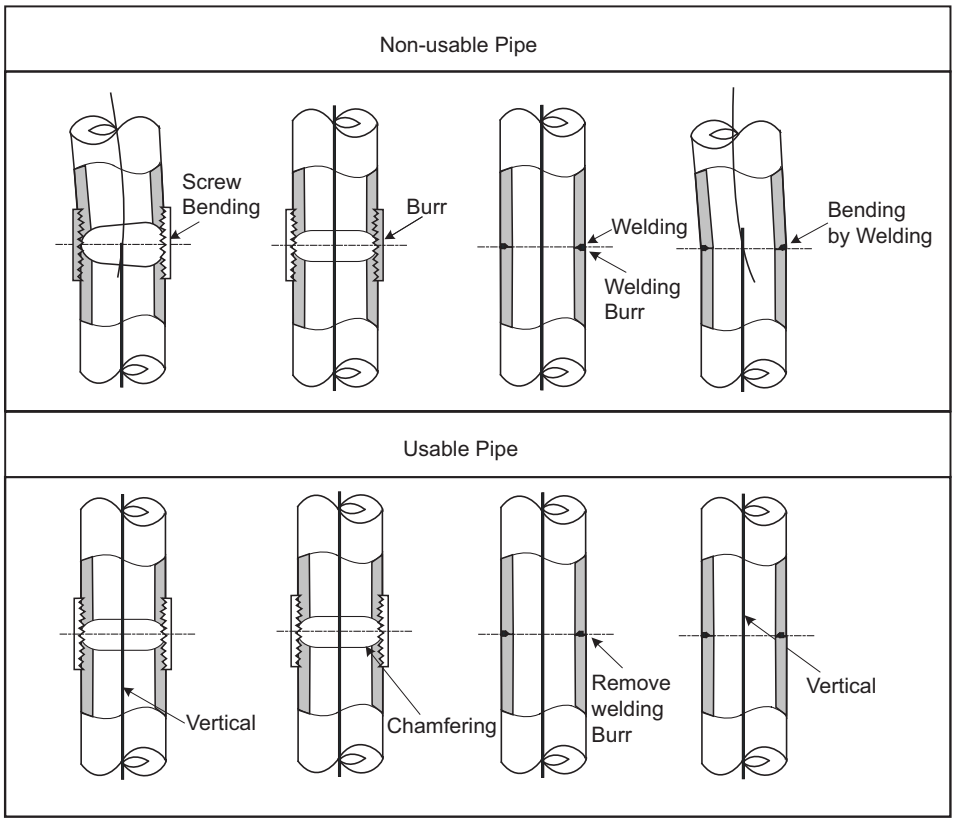


Figure 8: Guide Pipe Connection

3.6 Top Anchor, Hook and Base Plate Set Up Location

When attaching the anchor hook, take the anchor hook down so that it is positioned vertically against the top anchor using a plumb.

Note!
The flange of LT11** is a socket type.

LT12 (Flange Connection)

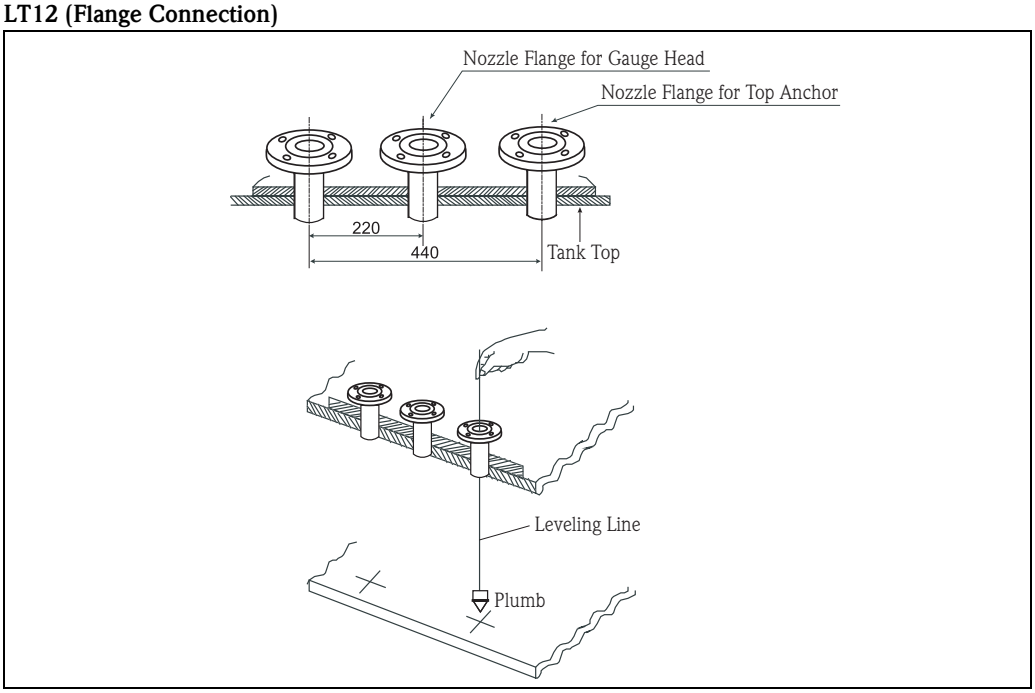


Figure 9: Top Anchor of LT12**

Note!
The socket of LT12** is a flange type.

LT11 (Threaded Connection)

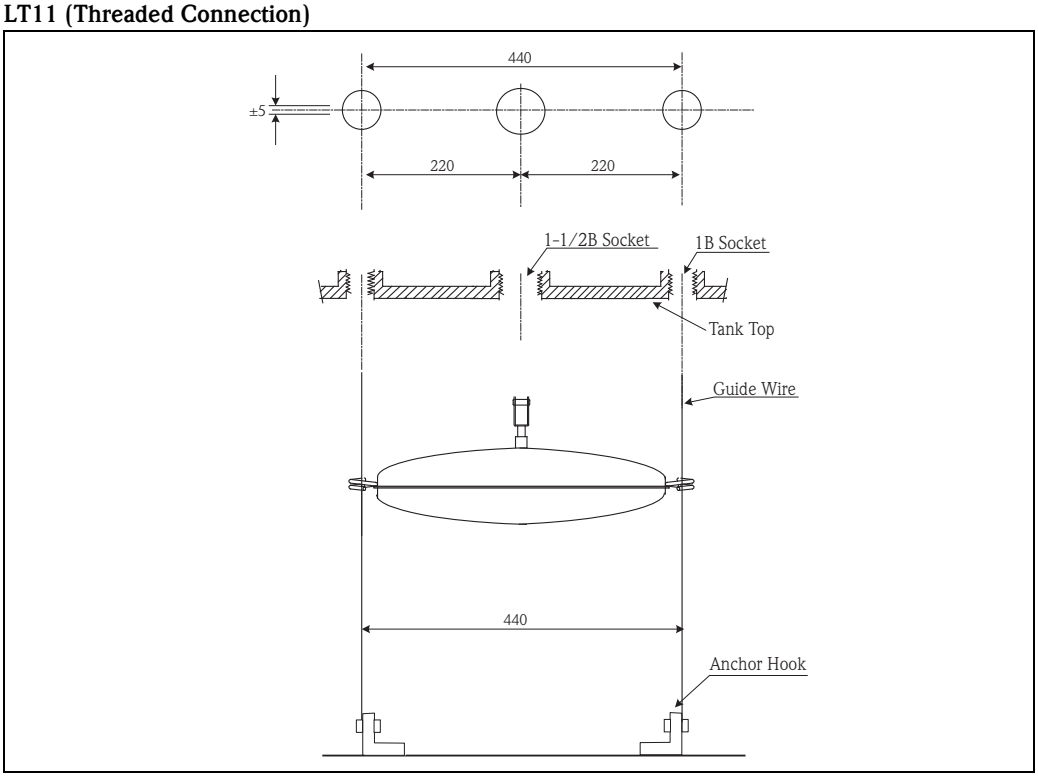


Figure 10: Attachment of Anchor Hook

3.7 Set Up Condition

3.7.1 Dimensions of LT11 (Low Pressure Threaded Type)

040	Gauge Head		Sheave Elbow	Seal Pot	Top Anchor (except Socket Type)	Top Anchor/Seal Pot (PVC)
0	Rp 1-1/2	Without Union	Rp 1-1/2	Rp 1-1/2	R1	10K 40A FF JIS
A	Rc 1-1/2	With Union	Rp 1-1/2	Rp 1-1/2	R1	10K 40A FF JIS
B	NPT1-1/2	With Union	NPT1-1/2	NPT1-1/2	NPT1	150lbs 1-1/2 FF ANSI
C	G1-1/2	With Union	Rp 1-1/2	Rp 1-1/2	R1	10K 40A FF JIS

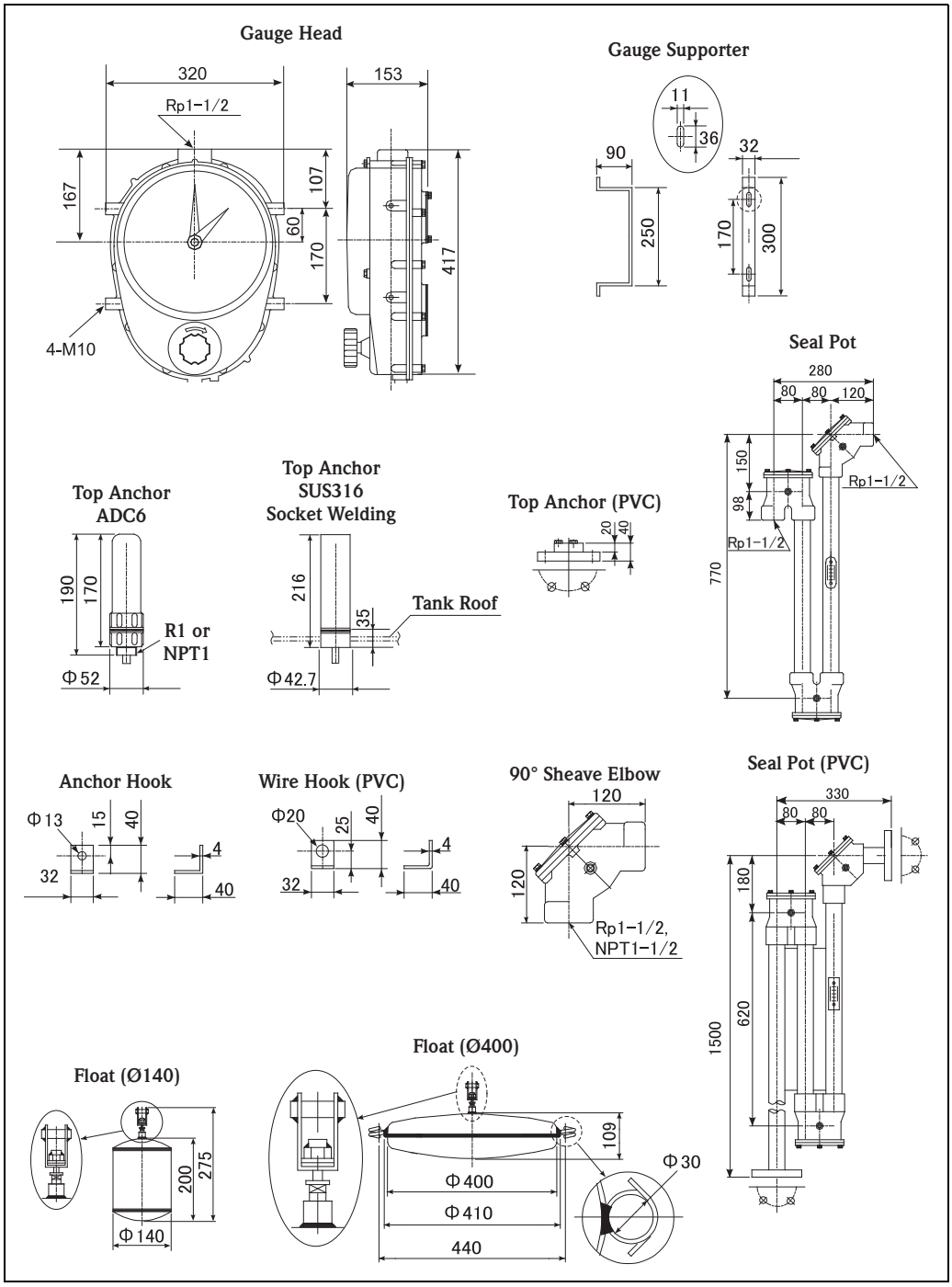


Figure 11: Dimensions of LT11

3.7.2 LT12 (Low Pressure Flange Type)

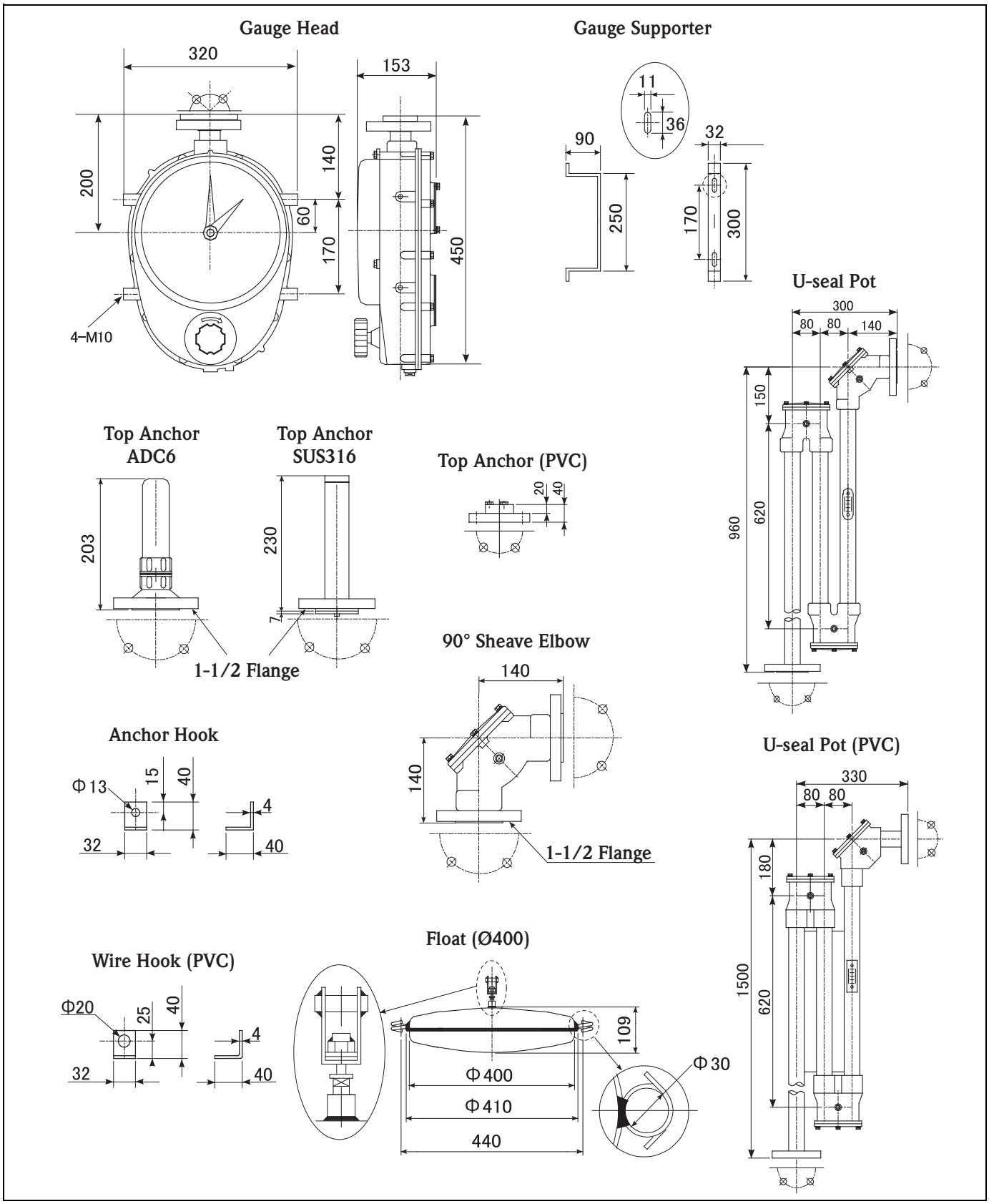


Figure 12: Dimensions of LT12

3.7.3 LT14 (Medium Pressure Flange Type)

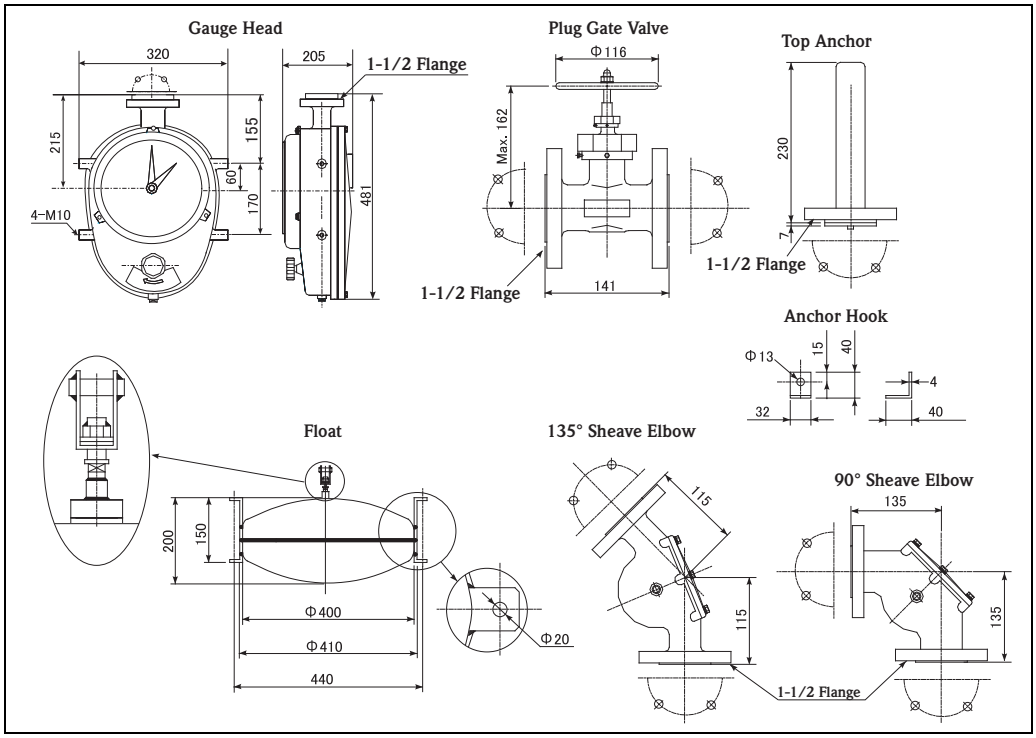


Figure 13: Dimensions of LT14

3.7.4 LT16 (High Pressure Flange Type)

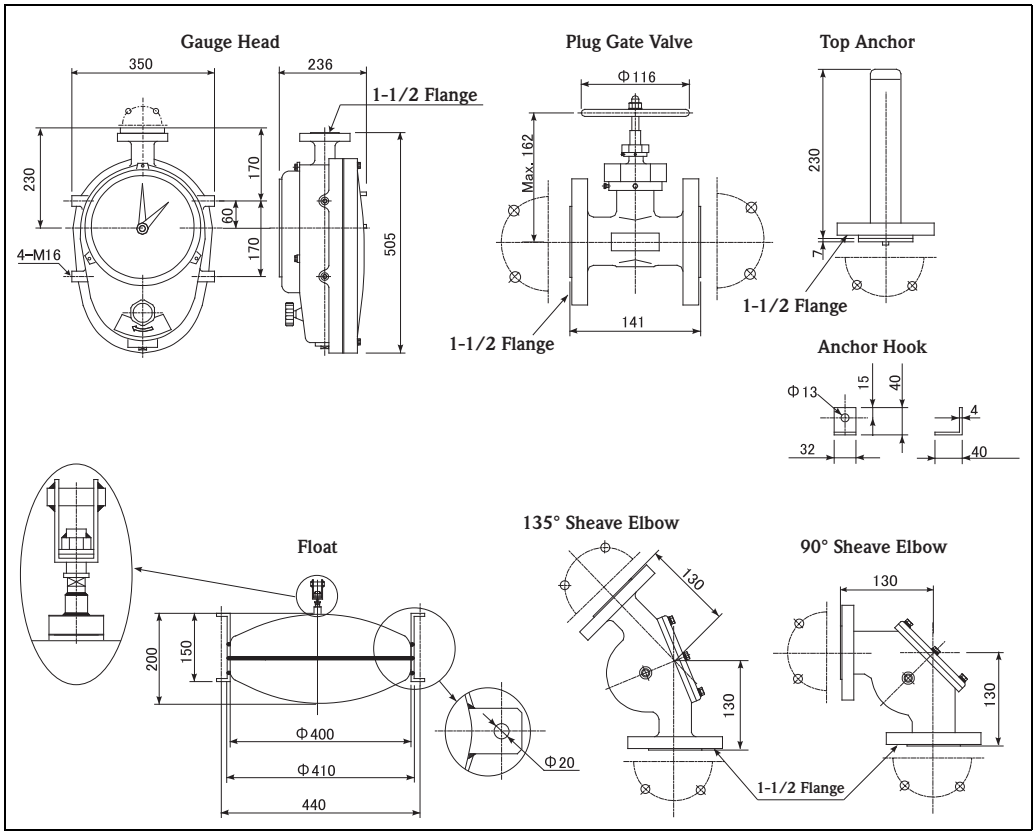


Figure 14: Dimensions of LT16

3.8 List of Sealing Materials for Wetting Liquid and Gas Part

Products	Units	Parts Name	Name of Sealing Parts	Materials of Packing/O-ring
LT11/12	Gauge Head	Rear Cover	Rear Packing	HYCAR Cork
		Check Shaft	O-ring	FKM
		Sprocket Shaft	Oil Seal	FKM
		Blind Board	Packing	NBR
	90° Sheave Elbow	Aluminum Sheave Elbow	Rear Packing	HYCAR Cork
		Stainless Steel Sheave Elbow		V#6502
		Bearing	O-ring	Silicon Rubber
	Liquid Seal Unit	Aluminum Sheave Elbow	Rear Packing	HYCAR Cork
			Bearing O-ring	Silicon Rubber
		Stainless Steel Sheave Elbow	Rear Packing	V#6502
			Bearing O-ring	Silicon Rubber
		PVC Sheave Elbow	Rear Packing	V#6502
			Bearing O-ring	PTFE
LT11	Top Anchor	Aluminum Threaded Type	Rear Packing	HYCAR Cork
		Stainless Tank Welding Type		V#6502
LT12	Top Anchor	Aluminum Flange/Threaded Type		HYCAR Cork
		Stainless Flange Welding Type	Spring Negator Packing	V#6502
LT14/16	Gauge Head	Rear Cover	Rear Packing	V#6502
		Check Handle	Gland Packing	PTFE/CR
		Internal Magnet Cover	O-ring	PTFE
		External Magnet Cover	O-ring	NBR (* When selecting copper free, the material of O-ring is CR.)
		Coupling	O-ring	PTFE
	Gate Valve	Shaft	Shaft Packing	PTFE
		Cap Nut	Packing	V#6502
LT14	90° Sheave Elbow (Aluminum/Stainless)	Cover	Rear Packing	V#6502
		Bearing	O-ring	PTFE
	135°Sheave Elbow (Aluminum/Stainless)	Cover	Rear Packing	V#6502
		Bearing	O-ring	PTFE
	Top Anchor	Flange Integral Pattern	Spring Negator Packing	V#6502
		Stainless Flange Welding Type		V#6502
LT16	90° Sheave Elbow (Iron/Stainless)	Cover	Rear Packing	V#6502
		Bearing	O-ring	PTFE
	135°Sheave Elbow (Iron/Stainless)	Cover	Rear Packing	V#6502
		Bearing	O-ring	
	Top Anchor	Rolled Steel Flange Welding Type	Spring Negator Packing	V#6502
		Stainless Flange Welding Type		V#6502

3.9 General View of Standard Specifications and Kit Codes

3.9.1 LT11/LT12 Cone Roof Tank (CRT)

Note!
Gauge head, sheave elbow and top anchor are connected with flange.
Refer to the list in "Process Cconnection".

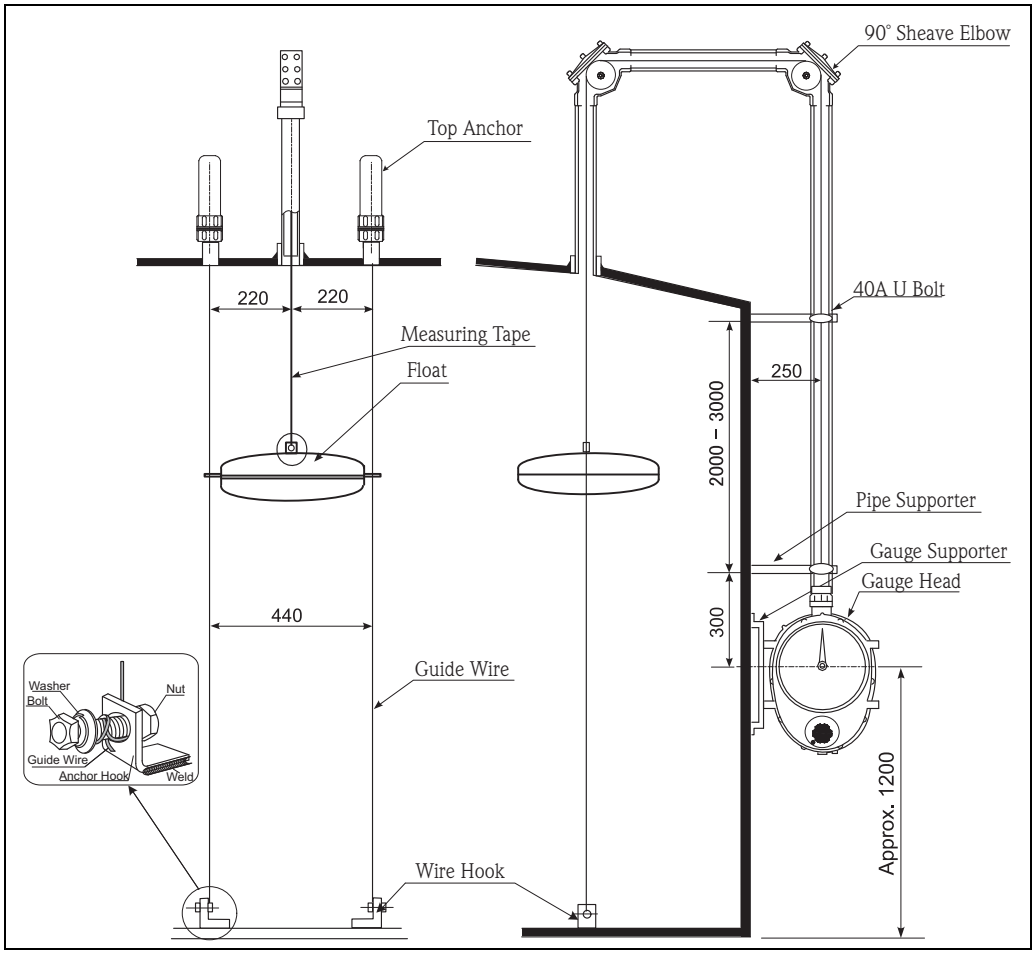


Figure 15: Cone Roof Tank (CRT)

Application (060)

LT11		Wetted parts	Wetted parts : SUS316	Wetted parts:SUS316, Top anchor:SUS316
Application	without Crank unit	A01	A04	A06
	with Crank unit	B01	B01	B06
	Guide wire	Single wire	Single wire	Single wire
Item		Material/Quantity	Material/Quantity	Material/Quantity
Guage head (threaded 11/2)		Outer coating : ADC12/1	Outer coating : ADC12/1	Outer coating : ADC12/1
90° sheave elbow (threaded 11/2)		Outer coatimg : ADC6 / Roller : SUS316L/2	Outer coatingADC6 / Roller : SUS316L/2	Outer coating : ADC6 / Roller : SUS316L/2
Top anchor		Outer coating : ADC6 / Inner coatimg : SUS316(threaded 1)/2	Outer coating : ADC6 / Inner coating : SUS316(threaded1")/2	All SUS316 (Socket weld type)/2
Float Ø400		Outer coatimg : SUS316/1	SUS316/1	SUS316/1
Guide wire		SUS316/2	SUS316/2	SUS316/2
Measuring tape		SUS316/1	SUS316/1	SUS316/1
Gauge supporter		SS400/1	SS400/1	SS400/1
Anchor hook		SS400/2	SUS316/2	SUS316/2
LT1200		Wetted parts	Wetted parts: SUS316	Wetted parts:SUS316, Top anchor:SUS316
Application	without Crank unit	A11	A14	A15
	with Crank unit	B11	B14	B15
	Guide wire	Single wire	Single wire	Single wire
Item		Material/Quantity	Material/Quantity	Material/Quantity
Guage head (flange11/2)		Outer coating : ADC12/1	Outer coating : ADC12/1	Outer coating : ADC12/1
90°sheave elbow (flange11/2)		Outer coating : ADC6 / Roller : SUS316L/2	Outer coating : ADC6 / Roller : SUS316L/2	Outer coating : ADC6/Roller : SUS316L/2
Top anchor(flange 11/2)		Outer coating : ADC6 / Inner : SUS316/2	Outer coating : ADC6 / inner coating : SUS316/2	All SUS316/2
Float Ø400		SUS316/1	SUS316/1	SUS316/1
Guide wire		SUS316/2	SUS316/2	SUS316/2
Measuring tape		SUS316/1	SUS316/1	SUS316/1
Gauge supporter		SS400/1	SS400/1	SS400/1
Anchor hook		SS400/2	SUS316/2	SUS316/2

3.9.2 Installation at Tank Top for Underground Tank

Note!
Gauge head and top anchor of LT12 are connected with flange.
Refer to the list in "Process Cconnection".

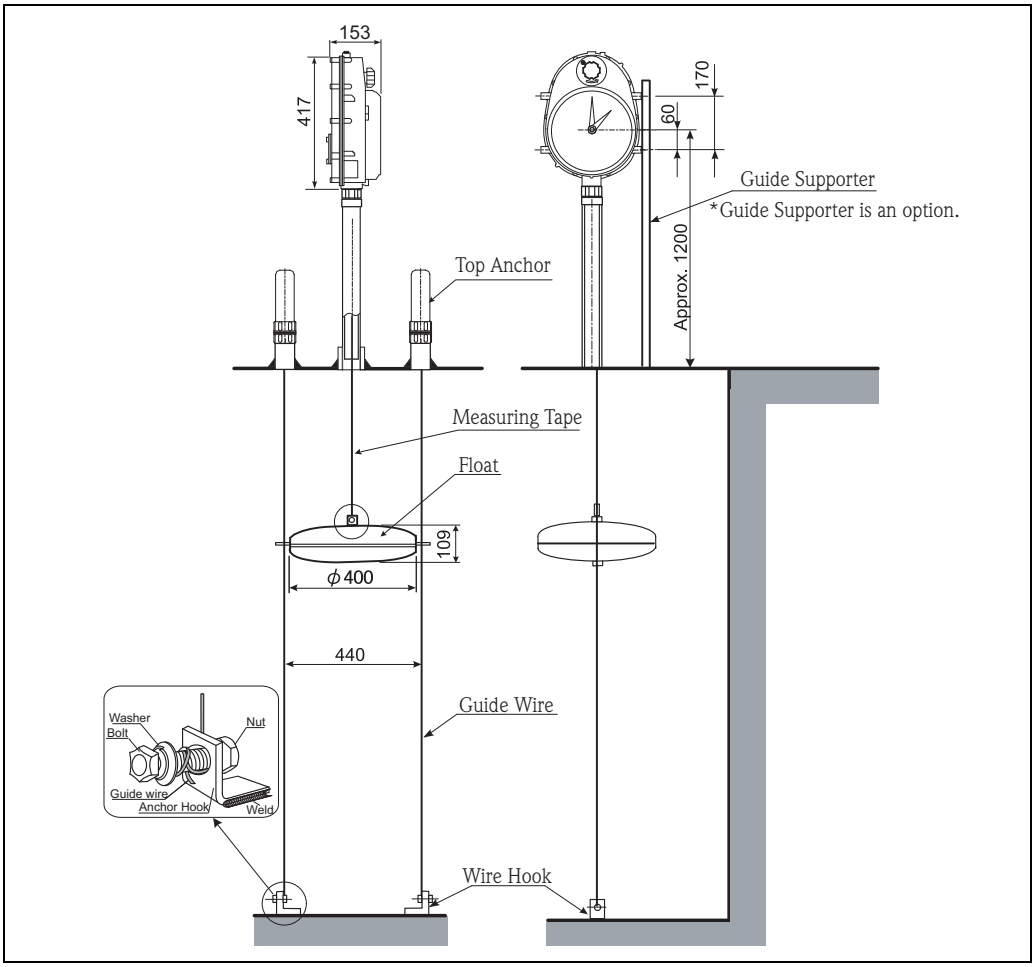


Figure 16: Underground Tank

Application (060)

LT11		Wetted parts	Wetted parts:SUS316, Top anchor:SUS316
Application	without Crank unit	A07	A10
	with Crank unit	C07	C10
	Guide wire	Single wire	Single wire
Item		Material/Qty.	Material/Qty.
Guage head (threaded 11/2)		Outer coating : ADC12 (inverted mounting) /1	Outer coating : ADC12 (inverted mounting) /1
Top anchor		Outer coating : ADC6 /I nner coating : SUS316(threaded1) /2	All SUS316 (Socket weld type) /2
Float Ø400		SUS316/1	SUS316/1
Guide wire		SUS316/1	SUS316/1
Measuring tape		SUS316 (all hole) /1	SUS316 (all hole) /1
Anchor hook		SS400/2	SUS316/2

LT1200		Wetted parts	Wetted parts:SUS316, Top anchor:SUS316
Application	without Crank unit	A40	A43
	with Crank unit	B40	B43
	Guide wire	Single wire	Single wire
Item		Material/Quantity	Material/Quantity
Guage head		Outer coating : ADC12 (inverted mounting) /1	Outer coating : ADC12 (inverted mounting) /1
Top anchor (flange11/2)		Outer coating : ADC6 / Inner coating : SUS316/2	All SUS316/2
Float Ø400		SUS316/1	SUS316/1
Guide wire		SUS316/2	SUS316/2
Measuring tape		SUS316 (all hole) /1	SUS316 (all hole) /1
Anchor hook		SS400/2	SUS316/2

3.9.3 Cone Roof Tank with Seal Pot

Note!
Gauge head, sheave elbow, and top anchor of LT11 are connected with flange.
Refer to the list in "Process Cconnection".

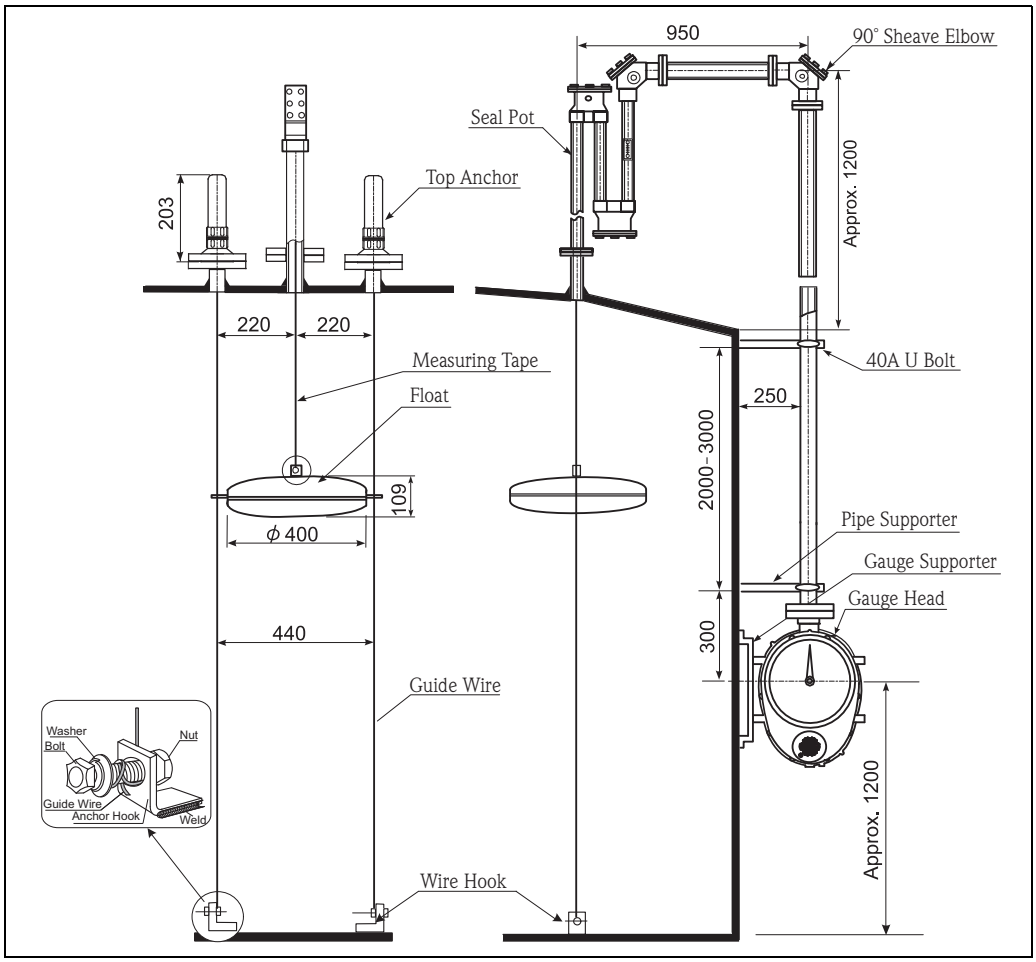


Figure 17: Cone Roof Tank with Seal Pot

Application (060)

LT11		Wetted parts	Wetted and gas parts: SUS316
Application	without Crank unit	A50	A54
	with Crank unit	B50	B54
	Guide wire		Single wire
Item		Material/Qty.	Material/Qty.
Guage head (threaded1 1/2)		Outer coating : ADC12/1	Outer coating : ADC12/1
Seal pot (threaded1 1/2)		Outer coating : ADC, AC,SGP / Roller : SUS316L/2	Outer coating : SCS14, SUS316 / Roller : SUS316L/1
90°sheave elbow (threaded1 1/2)		Outer coating : ADC6 / Roller : SUS316L1	Outer coating : ADC6 / Roller : SUS316L/1
Top anchor		Outer coating : ADC6 / Inner coating : SUS316(threaded 1")/2	All SUS316(Socket weld type)/2
Float Ø400		SUS316/1	SUS316/1
Guide wire		SUS316/2	SUS316/2
Measuring tape		SUS316/1	SUS316/1
Gauge supporter		SS400/1	SS400/1
Anchor hook		SS400/2	SUS316/2

LT12		Wetted parts	Wetted and gas parts: SUS316
Application	without Crank unit	A55	A59
	with Crank unit	B55	B59
	Guide wire	Single wire	Single wire
Item		Material/Qty.	Material/Qty.
Guage head (flange11/2)		Outer coating : ADC12/1	Outer coating : ADC12/1
Seal pot (flange11/2)		Outer coating : ADC, AC, SGP / Roller : SUS316L/1	Outer coating : SCS14, SUS316 / Roller : SUS316L/1
90°sheave elbow (flange11/2)		Outer coating : ADC6 / Roller : SUS316L/1	Outer coating : ADC6 / Roller : SUS316L/1
Top anchor (flange11/2)		Outer coating : ADC6 / Inner coating : SUS316/2	All SUS316/2
Float Ø400		SUS316/1	SUS316/1
Guide wire		SUS316/2	SUS316/2
Measuring tape		SUS316/1	SUS316/1
Gauge supporter		SS400/1	SS400/1
Anchor hook		SS400/2	SUS316/2

3.9.4 Cone Roof Tank with Seal Pot PVC

Note!
For LT11, gauge head, 90°sheave elbow are connected with threaded type and seal pot and top anchor are connected with flange.
Refer to the list in "Process Cconnection".

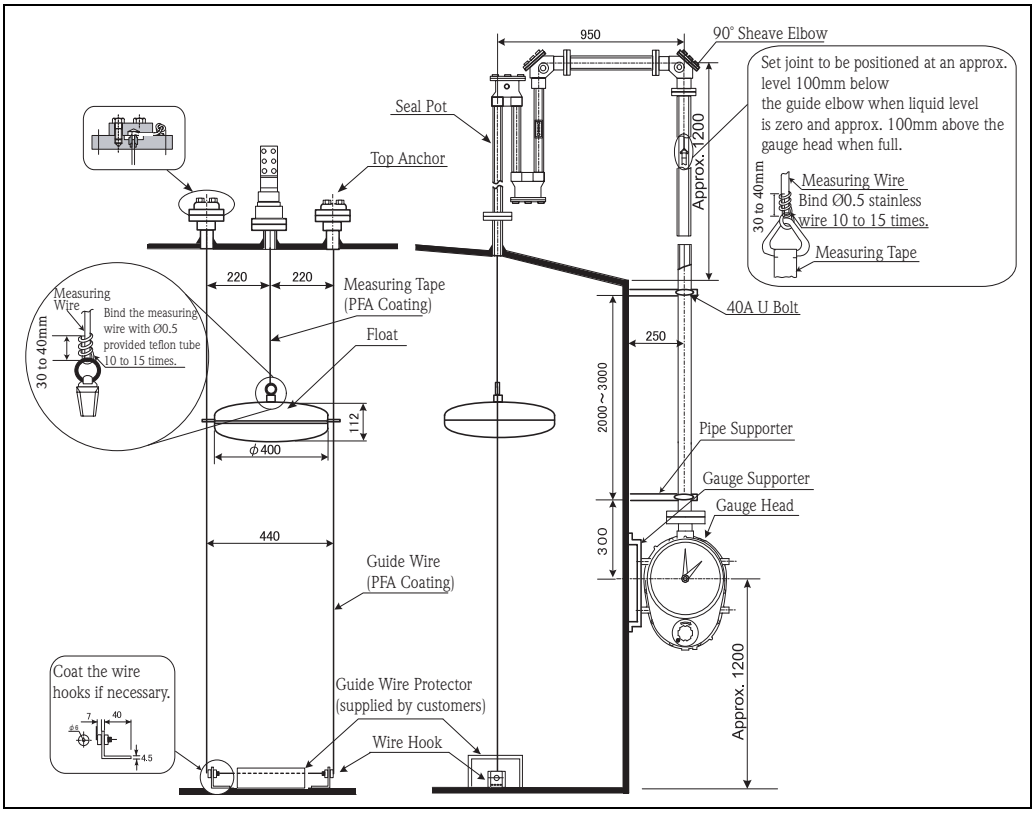


Figure 18: Cone Roof Tank with Seal Pot PVC

Application (060)

LT11		Wetted parts:PVC,SS400, Gas parts:PVC,PFA	Wetted parts:PVC,SUS316, Gas parts:PVC,PFA
Application	without Crank unit	060	062
	Guide wire	Stranded wire	Stranded wire
Item		Material/Quantity	Material/Quantity
Guage head (threaded 1-1/2)		Outer coating : ADC12/1	Outer coating : ADC12/1
Seal pot (flange1-1/2)		Outer coating :PVC / Roller : PVC/1	Outer coating : PVC / Roller : PVC/1
90° Sheave elbow (threaded 1-1/2)		Outer coating : ADC6 / Roller : SUS316L/1	outer coating : ADC6 / Roller : SUS316L/1
Top anchor (flange1-1/2)		All PVC/2	All PVC/2
Float Ø400		PVC/1	PVC/1
Guide wire		SUS316 (PFA coating)/1	SUS316 (PFA coating)/1
Meas. Wire + Meas. Tape		SUS316(PFA coating) + SUS316/1	SUS316(PFA coating)+SUS316/1
Guage supporter		SS400/1	SS400/1
wire hook		SS400 + PVC/2	SUS316 + PVC/2

LT12		Wetted parts:PVC,SS400,Gas parts:PVC,PFA	Wetted parts:PVC,SUS316, Gas parts:PVC,PFA
Application	without Crank unit	061	063
	Guide wire	Stranded wire	Stranded wire
Item		Material/Quantity	Material/Quantity
Guage head (flange 1-1/2)		Outer coating : ADC12/1	Outer coating : ADC12/1
Seal pot (flange 1-1/2)		Outer coating : PVC / Roller : PVC/1	Outer coating : PVC / Roller : PVC/1
90° Sheave elbow (flange 1-1/2)		Outer coating : ADC6 / Roller : SUS316L/1	Outer coating : ADC6 / Roller : SUS316L/1
Top ancher (flange 1-1/2)		All PVC/2	All PVC/2
Float Ø400		PVC/1	PVC/1
Guide wire		SUS316 (PFA coating)/1	SUS316 (PFA coating)/1
Meas. Wire + Meas. Tape		SUS316(PFA coating) + SUS316/1	SUS316(PFA coating) + SUS316/1
Guage supporter		SS400/1	SS400/1
Wire hook		SS400 + PVC/2	SUS316 + PVC/2

Note!
When hoisting up and down the float by using a crank unit, perform it slowly to prevent the float sticking from the guide pipe.
Refer to the list in "Process Cconnection".

3.9.5 Compact Cone Roof Tank for Guide Pipe Method

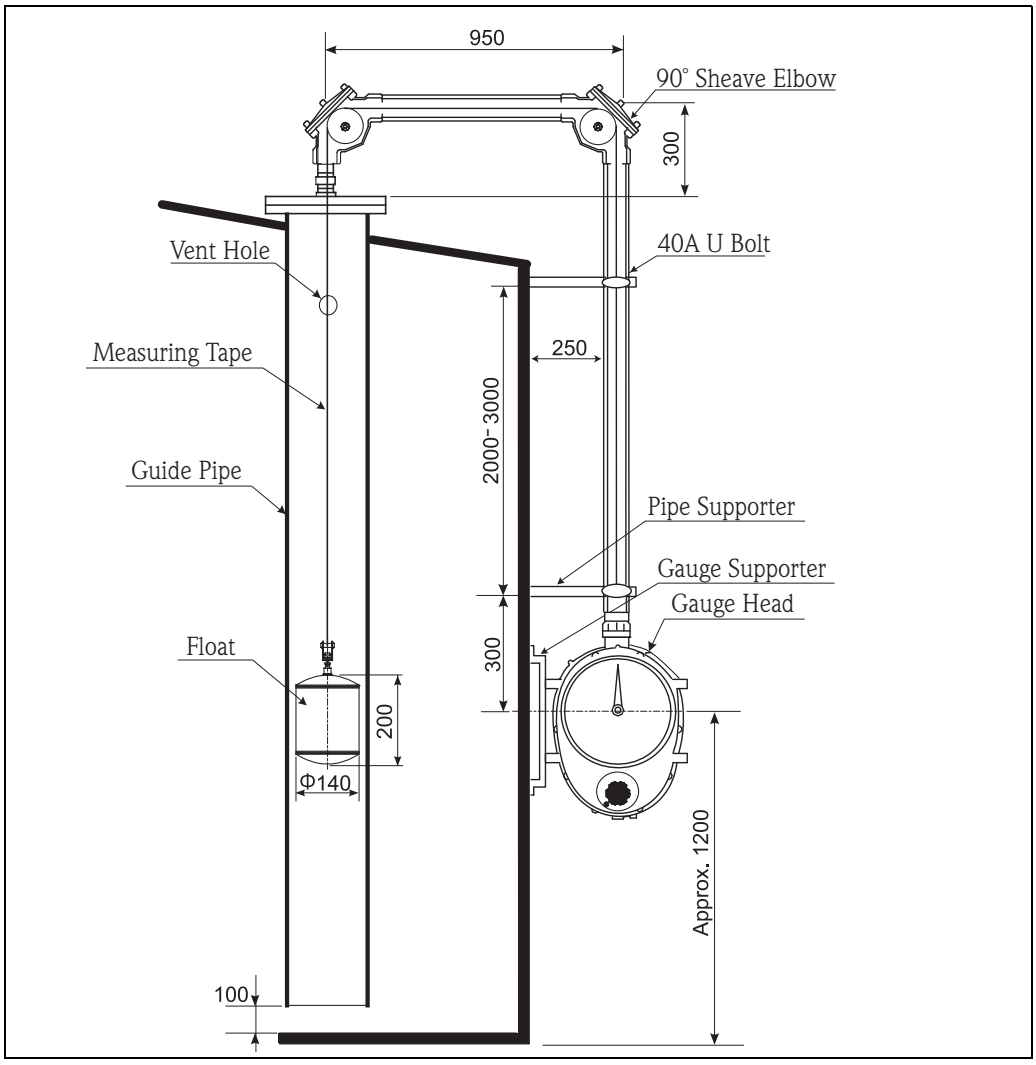


Figure 19: Compact Cone Roof Tank for Guide Pipe Method

Application (060)

LT11	**Max.10m/Guide pipe**
Application	**005**
Item	Material/Quantity
Guage head (threaded 1-1/2)	Outer coating : ADC12/1
90° Sheave elbow (threaded 1-1/2)	Outer coating : ADC6/Roller : SUS316L /2
Float Ø140	SUS316/1
Measuring tape	SUS316/1
Guage supporter	SS400/1

Note!
When hoisting up and down the float by using a crank unit, perform it slowly to prevent the float sticking from the guide pipe. Refer to the list in "Process Cconnection".

3.9.6 Mounting LT at Tank Top Using Guide Pipe Method

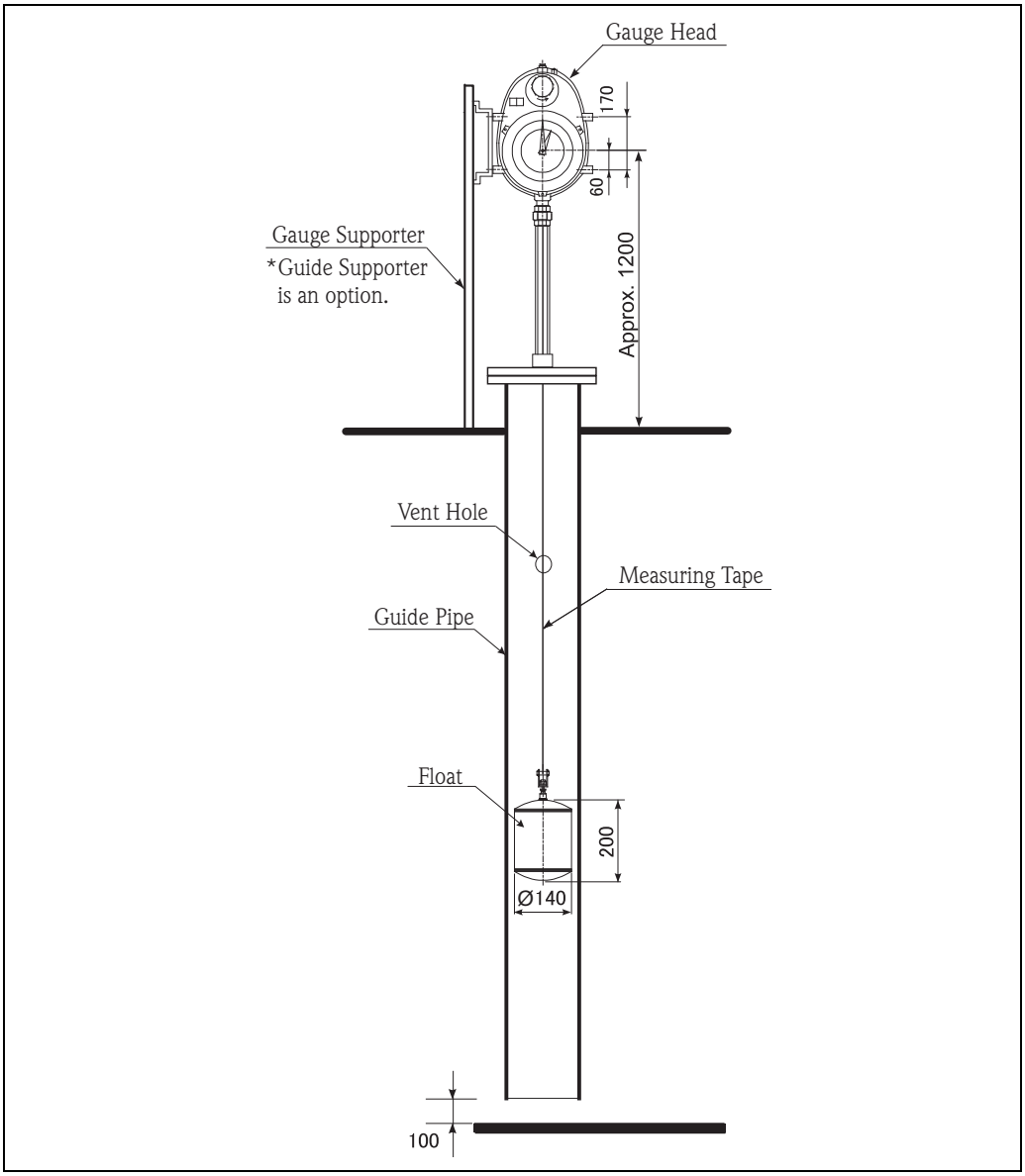


Figure 20: Mounting LT at Tank Top

Application (060)

LT11	Max.10m/Guide pipe
Application	**008**
Item	Material/Quantity
Guage head	Outer coating : ADC12 (inverted mounting)/1
Float Ø140	SUS316/1
Measuring tape	SUS316/1

3.9.7 Gas Holder

Note!
Gauge head, sheave elbow of LT11 are connected with flange. Refer to the list in "Process Cconnection".

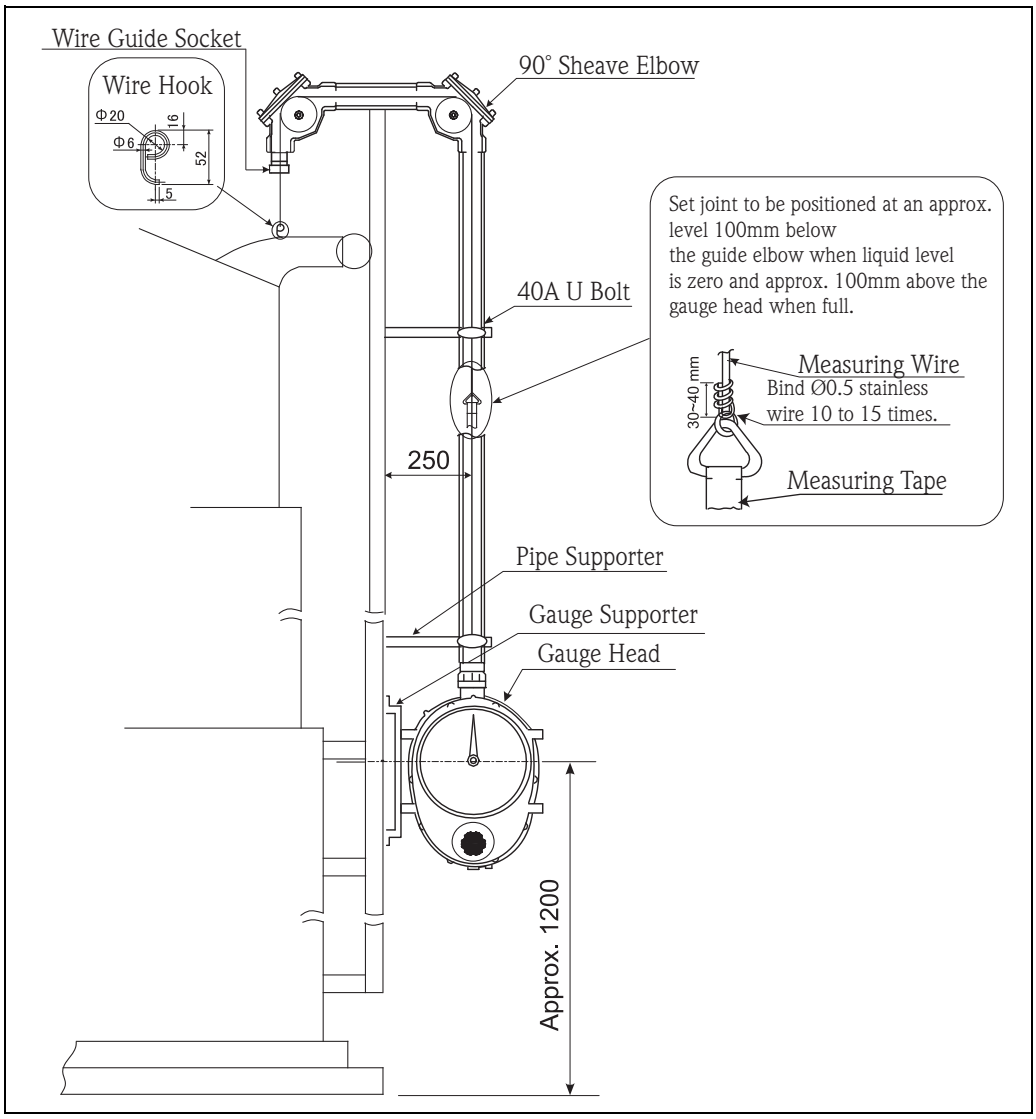


Figure 21: Gas Holder

Application (060)

	LT11	LT12
Application	**251**	**252**
Item	Material/Quantity	Material/Quantity
Gauge head	Outer coating : ADC12/1	Outer coating : ADC12/1
90°Sheave elbow	Outer coating : ADC6, Roller : SUS316L (threaded 1-1/2) /2	Outer coating : ADC6, Roller : SUS316L (flange 1-1/2) /2
Meas. wire + Meas. Tape	SUS316+SUS316/1	SUS316+SUS316/1
Gauge suppoter	SS400/1	SS400/1
Measuring wire hook	SS400/1	SS400/1
Wire guide socket (threaded 1-1/2)	Casting iron + PVC/1	Casting iron + PVC/1

3.9.8 Floating Roof Tank (FRT)

Note!
Gauge head, sheave elbow of LT11 are connected with flange. Refer to the list in "Process Cconnection".

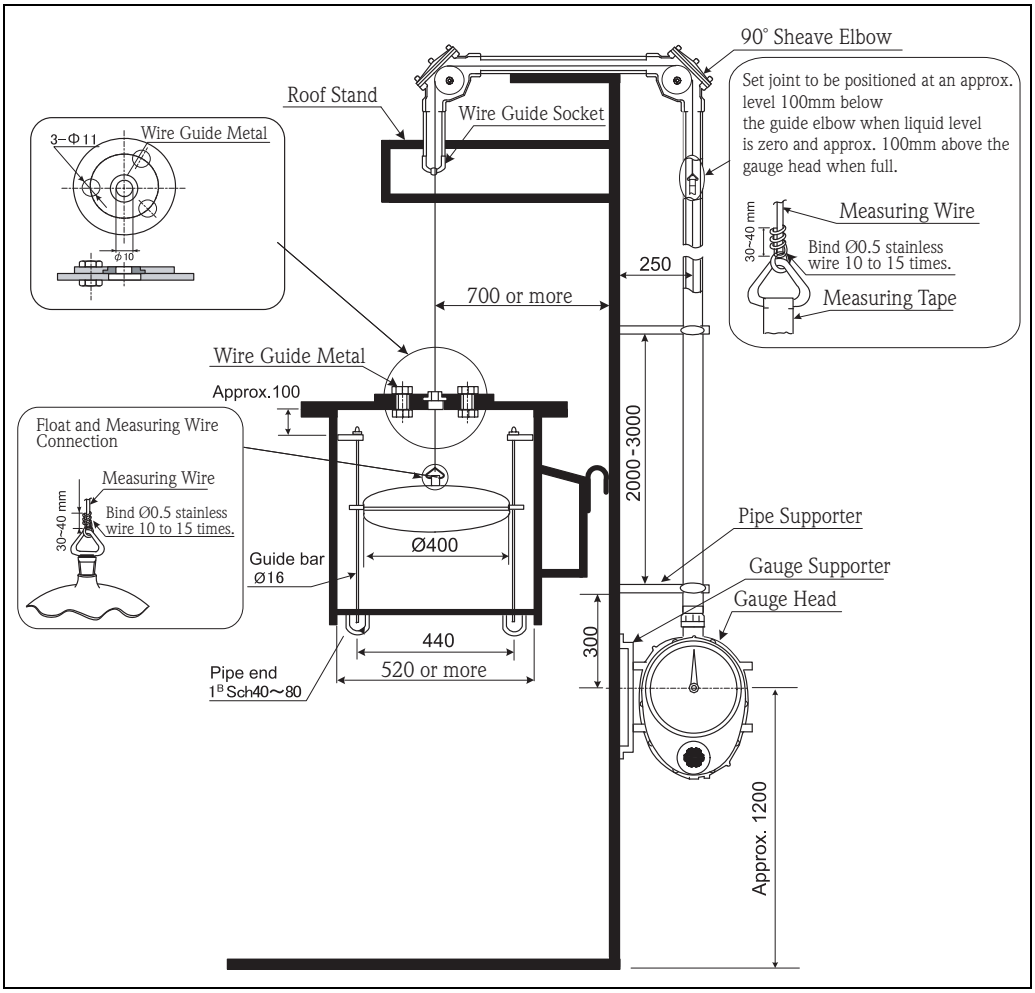


Figure 22: Floating Roof Tank

Application (060)

	LT11	LT12
Application	**261**	**262**
Item	Material/Quantity	Material/Quantity
Guage head	Outer coating : ADC12/1	Outer coating ADC12/1
90° Sheave elbow	Outer coating : ADC6, Roller : SUS316L (threaded 1-1/2)/2	Outer coating : ADC6, Roller : SUS316L (flange 1-1/2)/2
Float Ø400	SUS316/1	SUS316/1
Meas. Wire + Meas. Tape	SUS316 + SUS316/1	SUS316 + SUS316/1
Gauge suppoter	SS400/1	SS400/1
Wire guide metal (flange)	SS400 + PTFE/1	SS400 + PTFE/1
Wire guide socket	Casting iron + PVC/1	Casting iron + PVC/1

3.9.9 Doom Roof Tank for Medium Pressure LT14

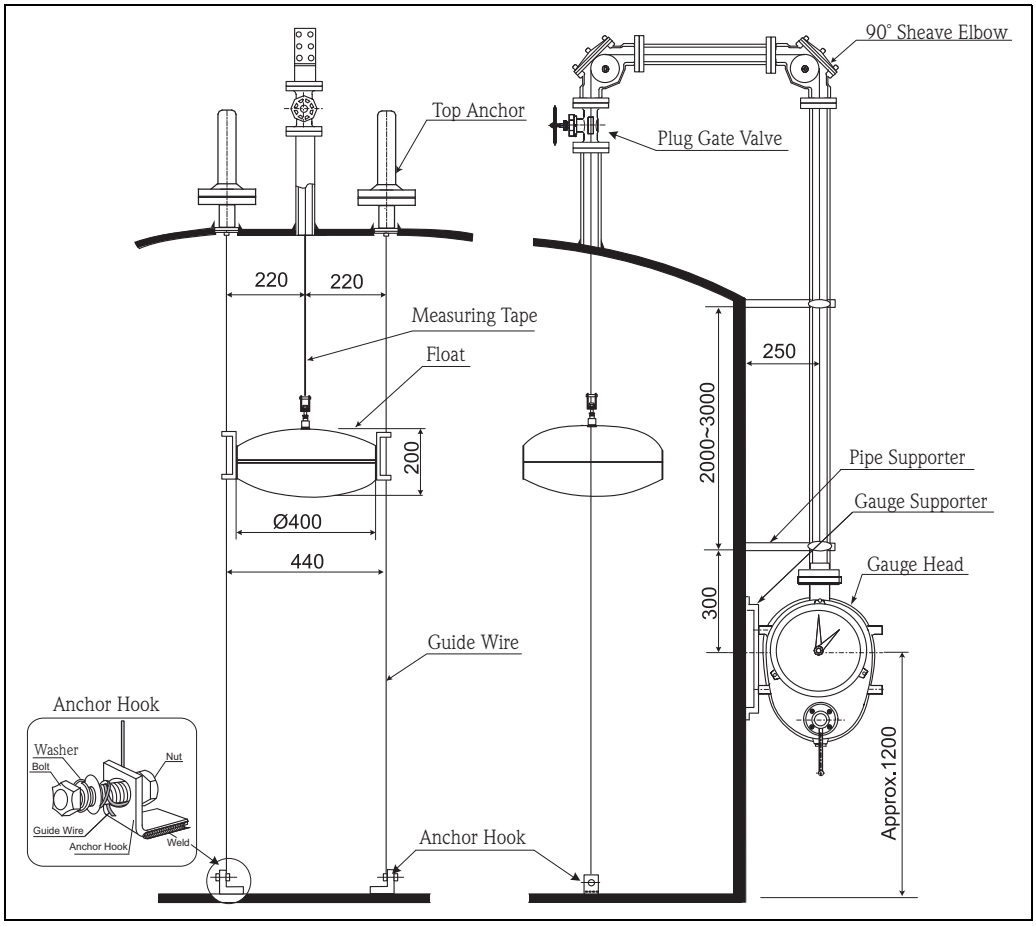


Figure 23: Dome Roof Tank for Medium Pressure LT14

Application (060)

LT14				
Tank Shape/ Application		Nonspherical Tank	Spherical Tank	Spherical Tank
		Wetted Parts: SUS316	Wetted Parts: SUS316	Wetted Parts: SUS316 Outer Coating: SCS13
Application	without Crank Unit	040	078	041
	with Crank Unit	094	098	095
Item		Material/Quantity	Material/Quantity	Material/Quantity
Gauge Head		Outer Coating: AC4CT6	Outer Coating: AC4CT6	Outer Coating: SCS13
Float Ø400		SUS316	SUS316	SUS316
Plug Gate Valve (Flange 1-1/2)		Outer Coating: AC4CT6	Outer Coating: AC4CT6	Outer Coating: SCS13
90° Sheave Elbow (Flange 1-1/2)		Outer Coating: AC4CT6 Roller: SUS316L (2pcs.)	Outer Coating: AC4CT6 Roller: SUS316L (1pc.)	Outer Coating: SCS13 Roller: SUS316L (1pc.)
135° Sheave Elbow (Flange 1-1/2)			Outer Coating: AC4CT6 Roller: SUS316L (1pc.)	Outer Coating: SCS13 Roller: SUS316L (2pcs.)
Measuring Tape		SUS316	SUS316	SUS316
Top Anchor (Flange 1-1/2)		Outer Coating: AC4CT6 Inner Coating: SUS316	Outer Coating: AC4CT6 Inner Coating: SUS316	Outer Coating: SUS316 Inner Coating: SUS316
Guide Wire (Single Wire)		SUS316	SUS316	SUS316
Anchor Hook		SUS316	SUS316	SUS316

3.9.10 Spherical Tank for High Pressure LT16

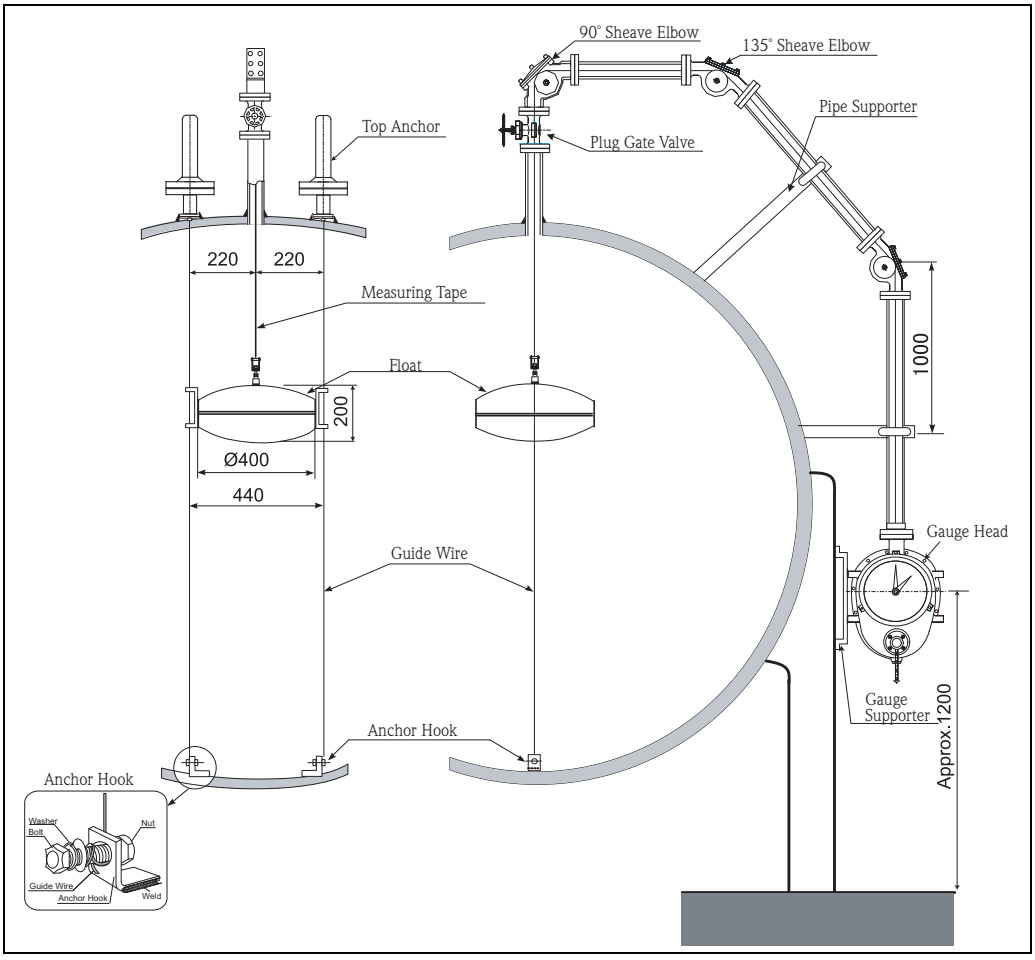


Figure 24: Spherical Tank for High Pressure LT16

Application (060)

LT16				
Tank Shape/ Application		Nonspherical Tank	Spherical Tank	Pressure Tank/Tank Top Mounting
		Wetted Parts: SUS316	Wetted Parts: SUS316	Wetted Parts: SUS316
Application	without Crank Unit	042	043	044
	with Crank Unit	096	097	
Item		Material/Quantity	Material/Quantity	Material/Quantity
Gauge Head		SCPL1	SCPL1	SCPL1
Float Ø400		SUS316	SUS316	SUS316
Plug Gate Valve (Flange 1-1/2)		Outer Coating: SCS13	Outer Coating: SCS13	Outer Coating: SCS13
90° Sheave Elbow (Flange 1-1/2)		Outer Coating: SCPL1 Roller: SUS304 (1pc.)	Outer Coating: SCPL1 Roller: SUS304 (2pcs.)	
135° Sheave Elbow (Flange 1-1/2)		Outer Coating: SCPL1 Roller: SUS304 (2pcs.)		
Measuring Tape		SUS316	SUS316	SUS316
Top Anchor (Flange 1-1/2)		Outer Coating: STPL380, S25C Inner Coating: SUS316	Outer Coating: STPL380, S25C Inner Coating: SUS316	Outer Coating: STPL380, S25C Inner Coating: SUS316
Guide Wire (Single Wire)		SUS316	SUS316	SUS316
Anchor Hook		SUS316	SUS316	SUS316

3.10 Guide Wire Installation

Installation Procedure

Note!

- Be careful not to bend the guide wire [3]
- Two guide wires should be arranged in parallel to one other and perpendicular to the tank floor.
- Check two packings (for top anchor and tank flange) on which slip washers are used, before setting the guide wires.
- Repairing the guide wires and anchor hooks, once the tank is full, can be very difficult. Be sure to inspect their hardness before filling.

1. Open the cover of the top anchor located in the top of the tank.
2. Straighten the guide wire, and lower it from the center hole in the top anchor, then temporarily attach the end of the wire to the top anchor.
3. Insert the guide wire into the guide ring [10] on the float at the bottom of the tank then, secure the guide wire to the anchor hooks by using two bolts [2] and nuts.
4. Cut and bend the end of the guide wire to prevent it from getting caught in the float.
   - Place the guide wire against the surface of inside anchor hook B and insert it through the anchor hook hole. Wind the end of the guide wire so that the excess is within dimension A.
   - Wind the wires 1 to 2 times each, on both the B and C sides. Adjust the number of times wound as needed.

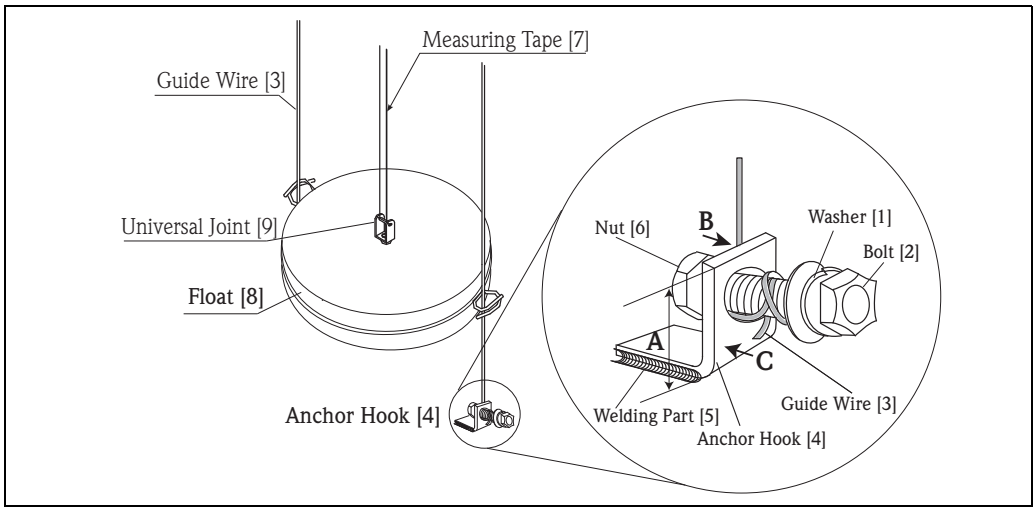


Figure 25: Guide Wire Installation 1

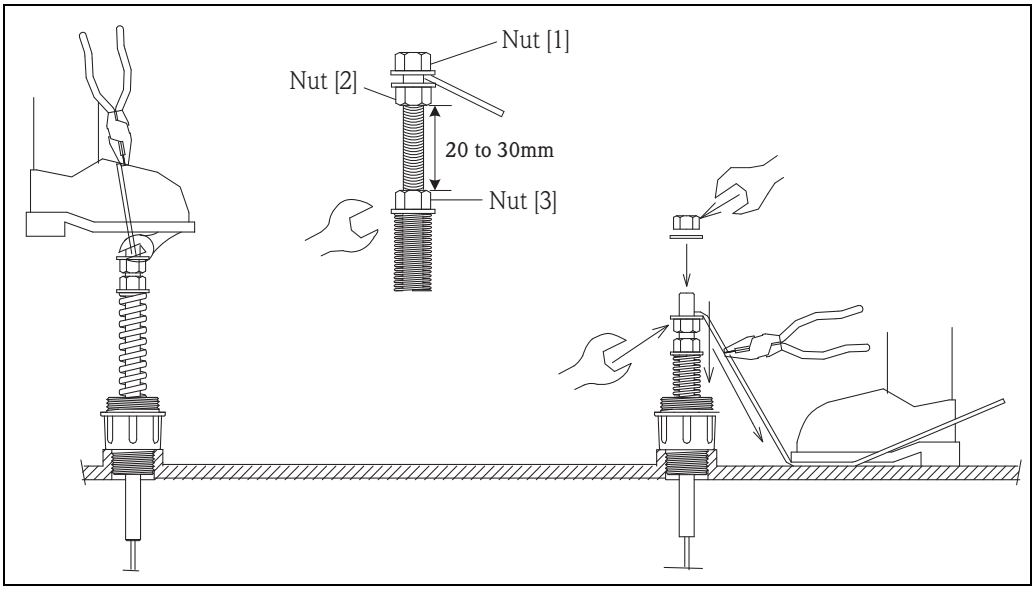


Figure 26: Guide Wire Installation 2

5. Extend the guide wire to the top of the tank and secure it to the top anchor.
6. Bend the end of the guide wire against the main shaft and cut it off leaving approx.100mm.
7. Tighten the end nuts [1] and [2].
8. Secure the wire with the nut [3] and release the spring.

This completes the installation procedure.

3.11 Measuring Tape and Measuring Wire Installation

Note!

- Do not bend or damage the measuring tape.
- Be sure to keep the measuring tape from twisting inside of the tank or pipe.
- There are small holes at intervals of 20mm along half of the entire length of measuring tape. Attach the measuring tape to LT so that the side with the holes are wound by LT.
- Check to make sure the measuring tape does not come off the sheave elbow roller. Inspect the measuring tape after installation.
- Secure the safety of workers to counteract the exteme dangers of poor footing when measuring wire is required to be inserted into 135° sheave elbows.
- Repairing the connection components between the float and measuring wires, once the tank is fill, can be very difficult. Be sure to inspect them thoroughly before filling.

Measuring Tape Preparation Procedure

1. Extend the measuring wire and fold, as shown below to a length of 1.5m so as not to twist it.
2. Open the rear cover of LT and sheave elbow cover.
3. Attach the measuring wire without twisting.

This completes the measuring tape installation.

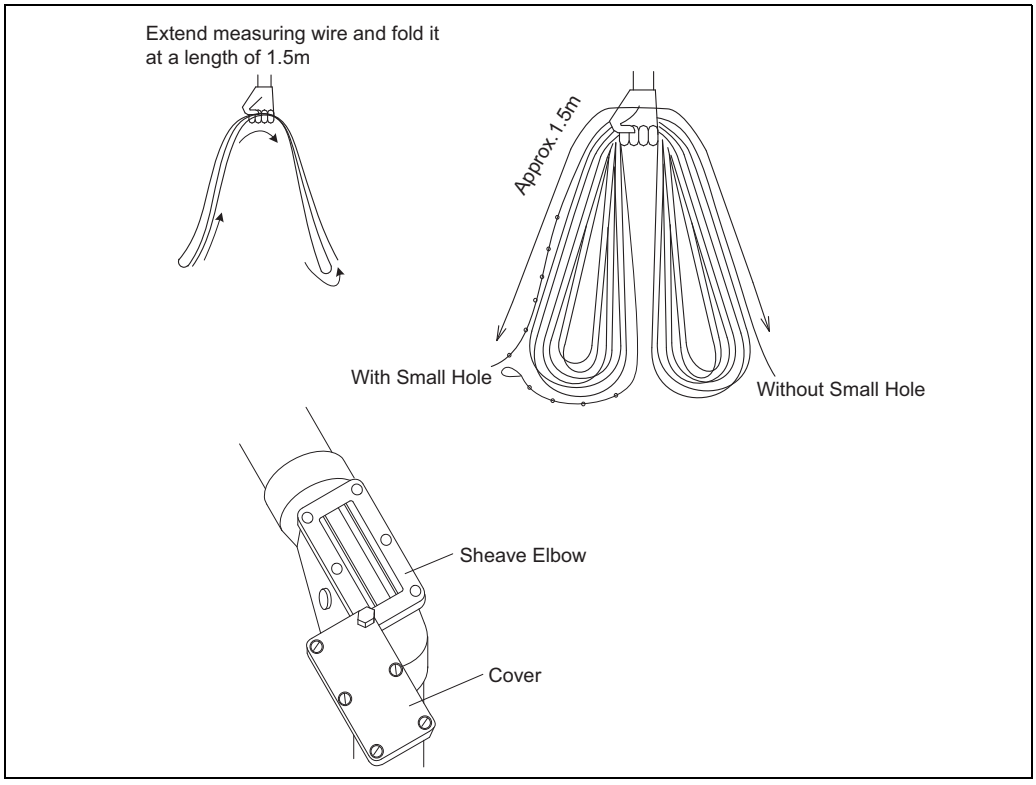


Figure 27: Measuring Tape Preparation

3.11.1 Measuring Tape Installation at Cone Roof Tank

Installation Procedure

1. Insert the non-perforated side of the measuring tape directly into the tank from the 90° sheave elbow.
2. Insert the other end of the measuring tape (perforated and looped) through the 90° sheave elbow to LT located directly above the tank.
3. Secure the measuring tape and pull it inside the tank.
4. Cut the measuring tape off leaving approx. 1.5m
5. Connect the measuring tape to the float.
   - Refer to "3.11.2 Connection of Measuring Tape to Float" for details on the connection of the measuring tape.
6. Confirm that there is no kink in the measuring tape.
7. Replace the sheave elbow cover.

This completes the measuring tape installation at cone roof tank.

When installing measuring tape;

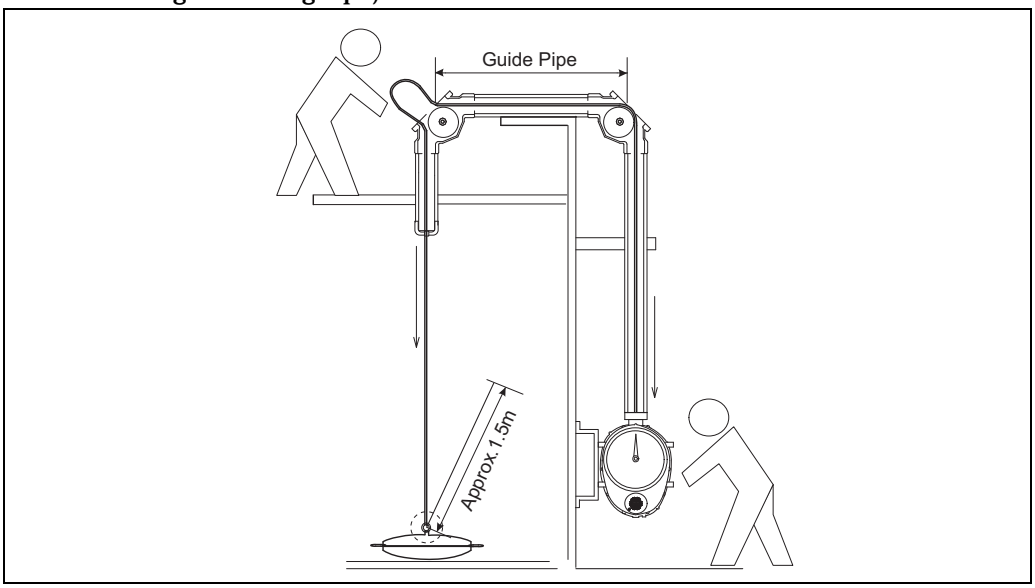


Figure 28: Measuring Installation

When installing measuring tape and measuring wire;

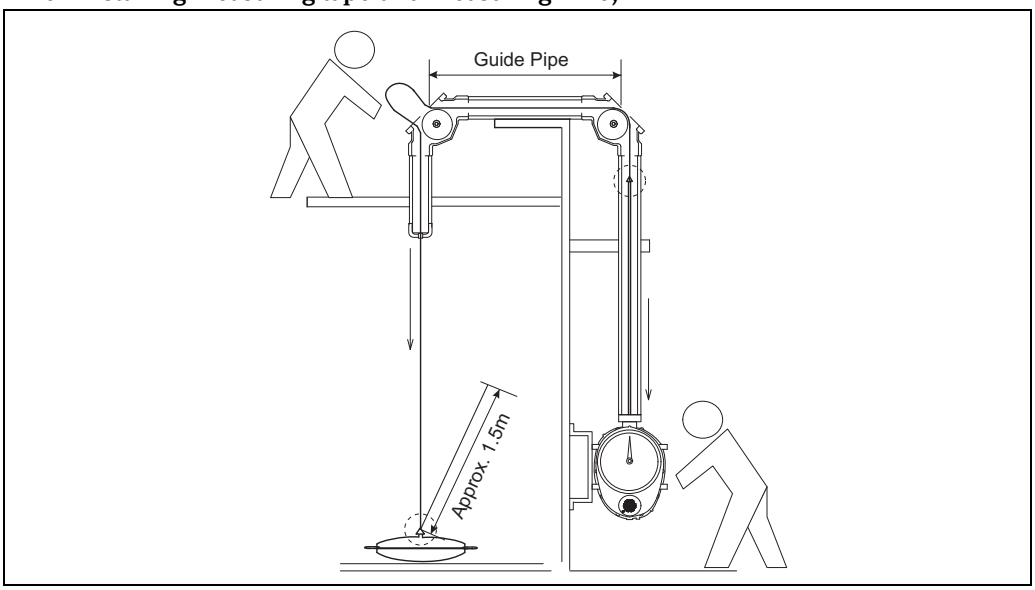


Figure 29: Measuring Tape Wire Installation

3.11.2 Connection Procedure of Measuring Tape to Float

1. Bend the measuring tape at the length of 65mm.
2. Bend the measuring tape once again at the location shown above.
3. Bend the measuring tape twice at the center.
4. Insert the joint shaft into the bended measuring tape.
5. Insert the tape clamp into the loop of the tape.
6. Tighten the clamp strip with a bolt and nut.
7. Strip the protruding end of the bolt with pliers to lock the nut.

This completes the connection procedure of measuring tape to float.

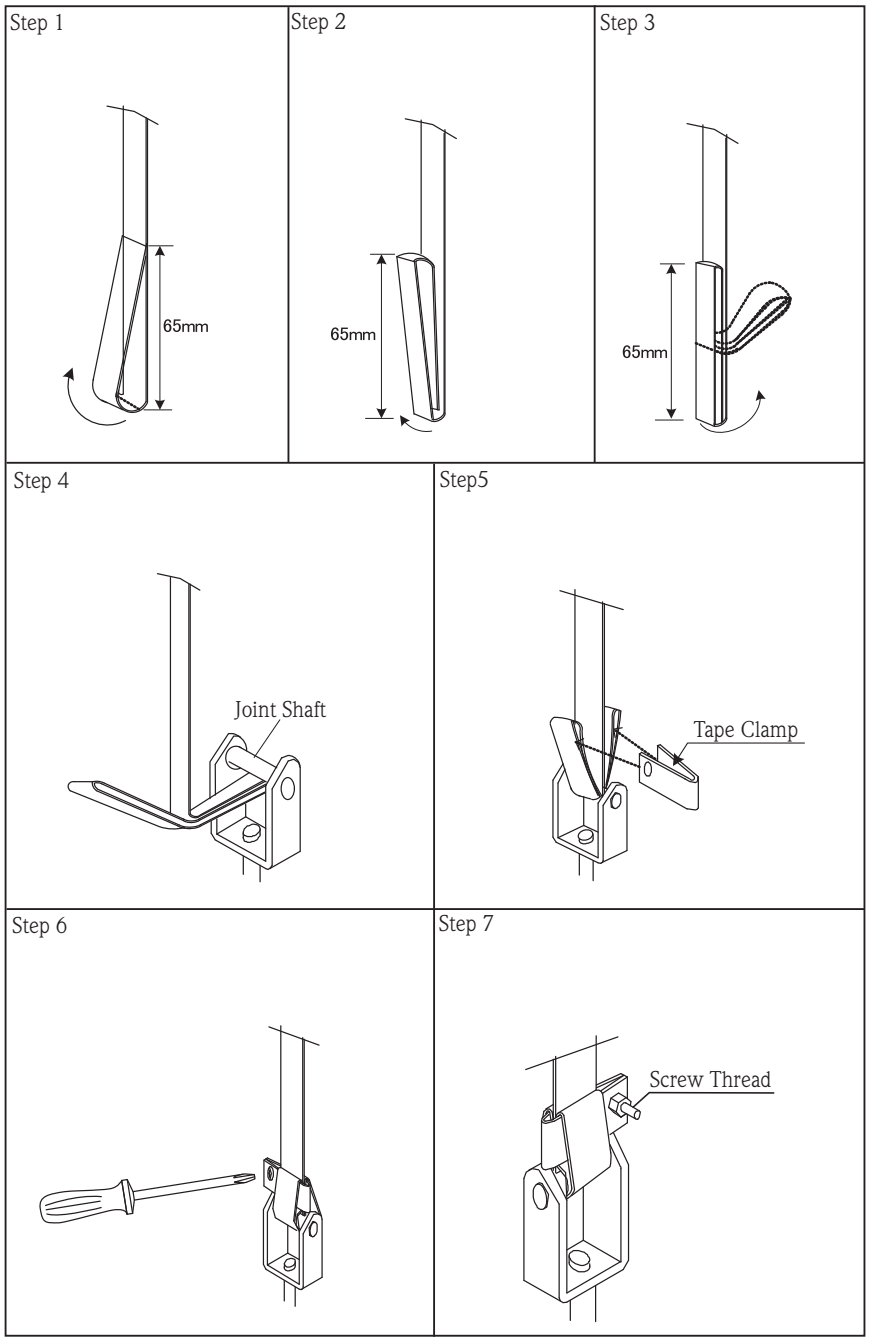


Figure 30: Connection of Measuring Tape to Float

3.11.3 Measuring Tape Installation at Floating Roof Tank

Installation Procedure

1. Insert the end of the measuring wire into the tank through the 90° sheave elbow.
2. Attach the other end of the measuring tape to the tank.
3. Connect the measuring wire to the float.
4. Connect the measuring wire to the measuring tape on the top of the tank and feed the measuring tape to LT.
5. Confirm that there is no kink in the measuring wire.
6. Replace the sheave elbow cover.

This completes the measuring tape installation at floating roof tank.

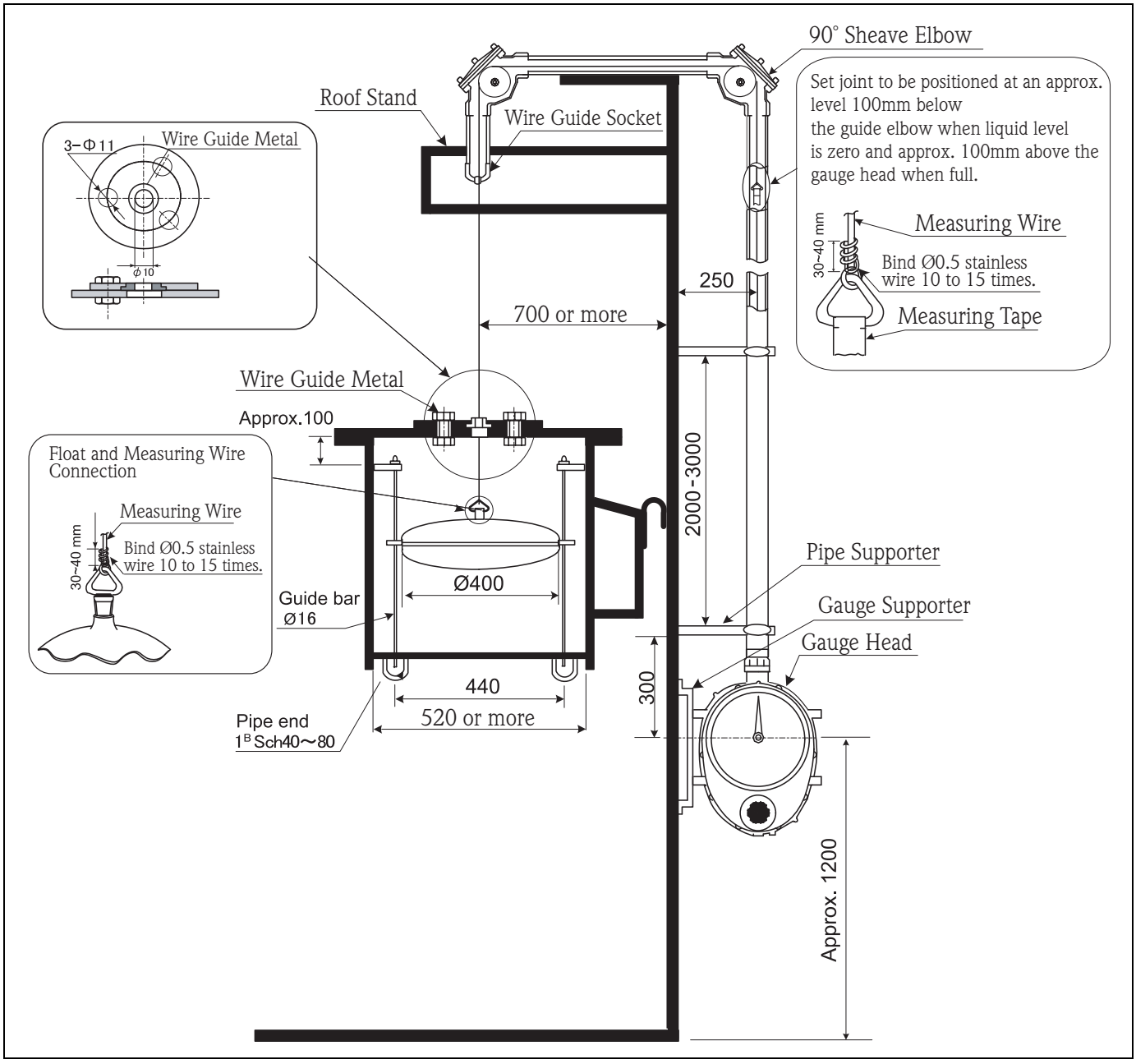


Figure 31: Measuring Wire

3.11.4 Installation of Measuring Tape at Medium/High Pressure Tank

Note!

- Do not bend or damage the measuring tape.
- Be sure to keep the measuring tape from twisting inside of the tank or pipe.
- There are small holes at intervals of 20mm along half of the entire length of measuring tape. Attach the measuring tape to LT so that the side with the holes are wound by LT.
- Check to make sure the measuring tape does not come off the sheave elbow roller. Inspect the measuring tape after installation.
- Secure the safety of workers to counteract the exteme dangers of poor footing when measuring wire is required to be inserted into 135° sheave elbows.
- Repairing the connection components between the float and measuring wires, once the tank is fill, can be very difficult. Be sure to inspect them thoroughly before filling.

Installation Procedure

1. Rotate the gate valve counter clockwise and open the gate valve completely, and then remove the sheave elbow cover and rear cover of LT.
   - Remove the gland with a gland fixing tool.
   - Remove the O-rings (2 pts.).
2. Remove the dust cover [1], tape guide [2], and lock screw [3].
3. Insert the non-perforated end of the measuring tape into the tank through the 90° sheave elbow (refer to Figure 34).
4. Insert the perforated and looped end of the measuring tape thorough the 135° sheave elbows to LT (refer to Figure 34).
5. Secure the inserted measuring tape to the tape drum [5] with a set screw [4] for the tape.
6. Pull the measuring tape inside the tank.
7. Cut the measuring tape off leaving approx. 1.5m.
8. Connect the measuring tape to the float.
   - Refer to "3.11.2 Connection of Measuring Tape to Float" for details on the connection of the measuring tape.
9. Confirm that there is no kink in the measuring tape.
10. Replace the sheave elbow cover.

This completes the installation procedure.

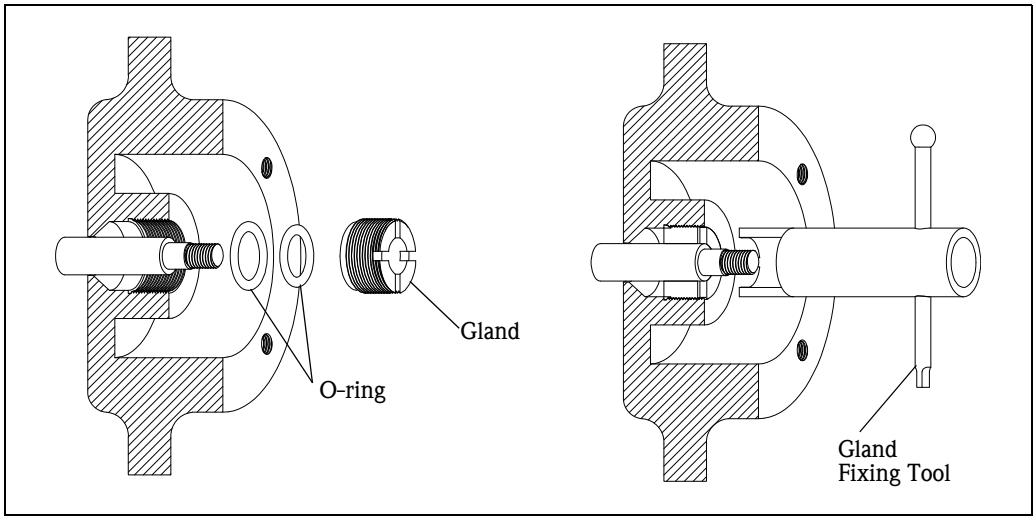


Figure 32: Gland Fixing Tool

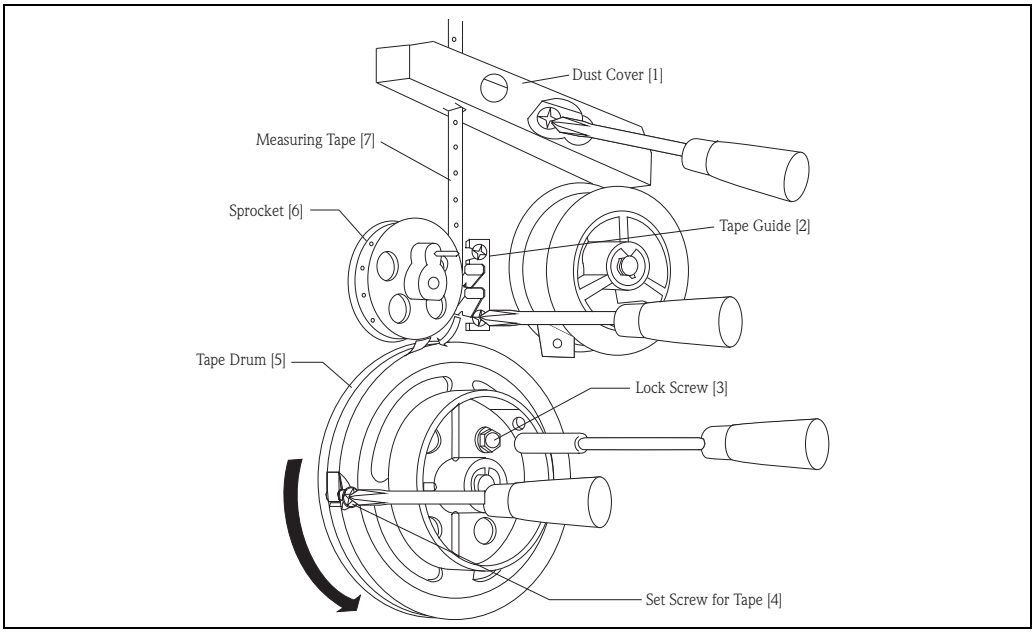


Figure 33: LT Parts Configuration

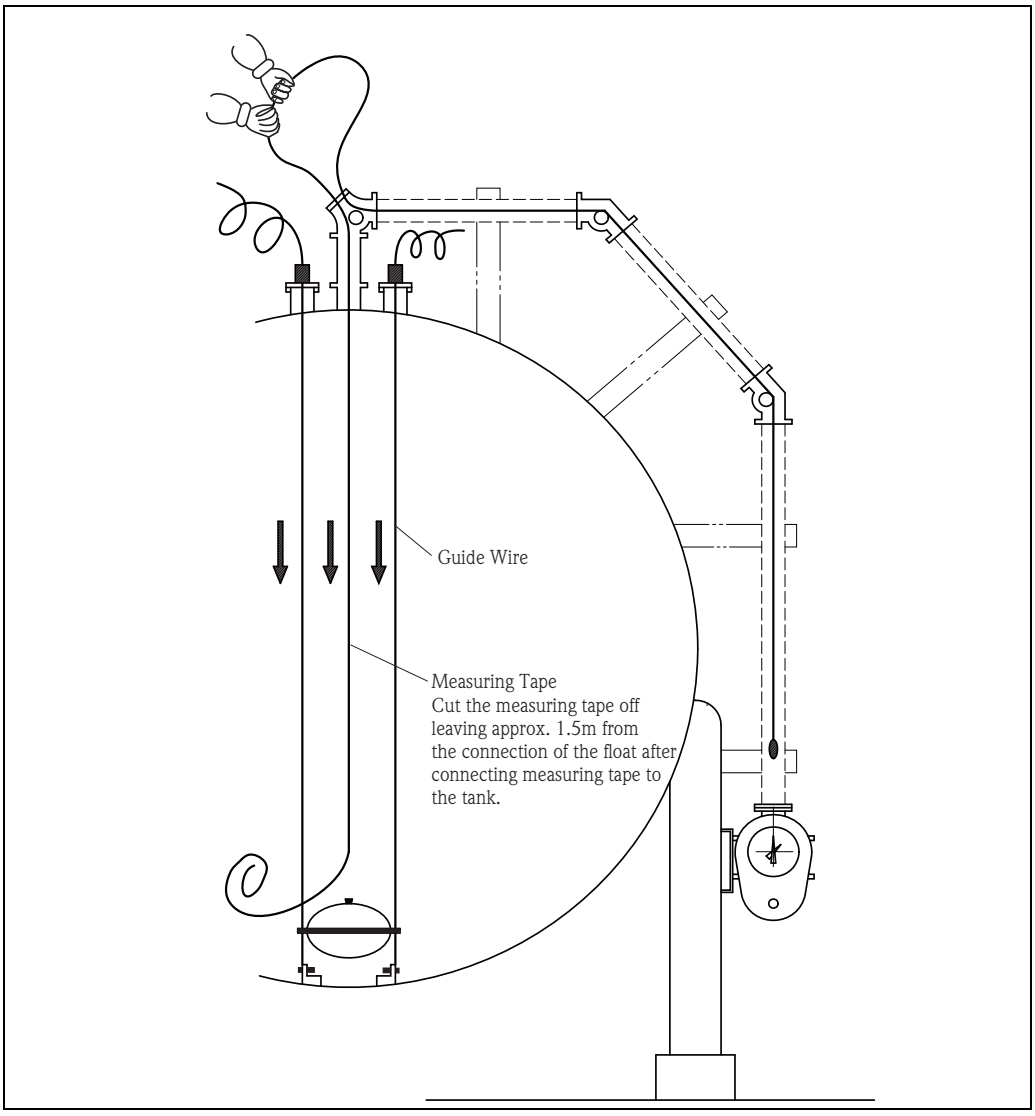


Figure 34: Measuring Tape Installation

3.11.5 Internal Parts Adjustment

Tape Guide Adjustment Procedure

1. Turn the LT tape drum [5] in the direction indicated by arrow to put tension on the measuring tape (refer to Figure 35).

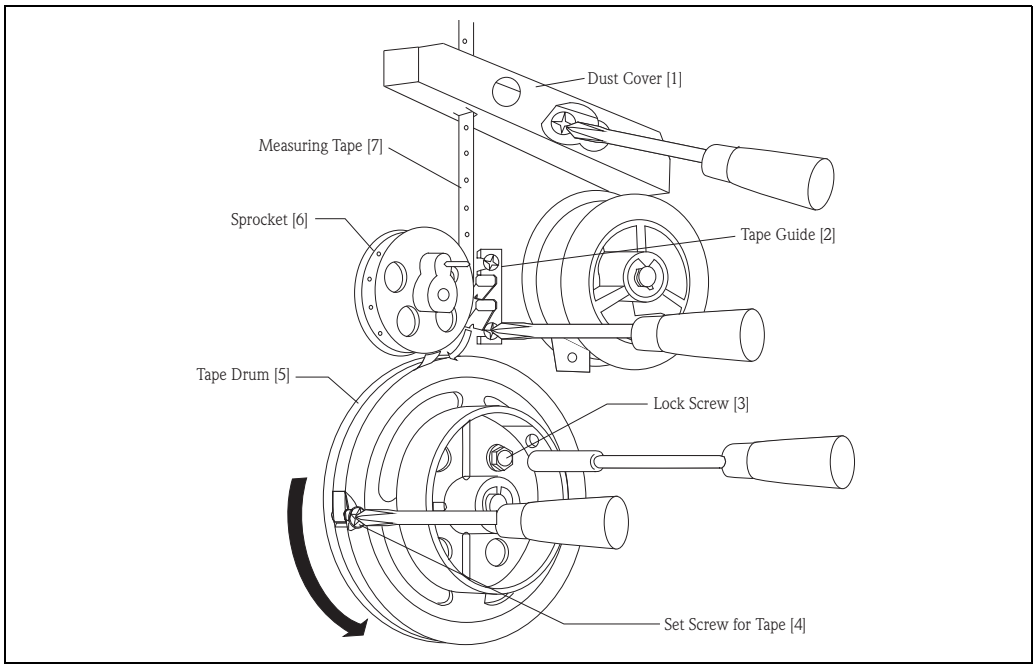


Figure 35: Tape Drum

2. After the measuring tape is properly set, adjust the two tape guide heads so that they are positioned at 2mm from the tape surface.
   - The measuring tape may come off the sprocket pins [6] since it moves abruptly with liquid waves. The tape guide prevents this.

This completed the tape guide adjustment procedure.

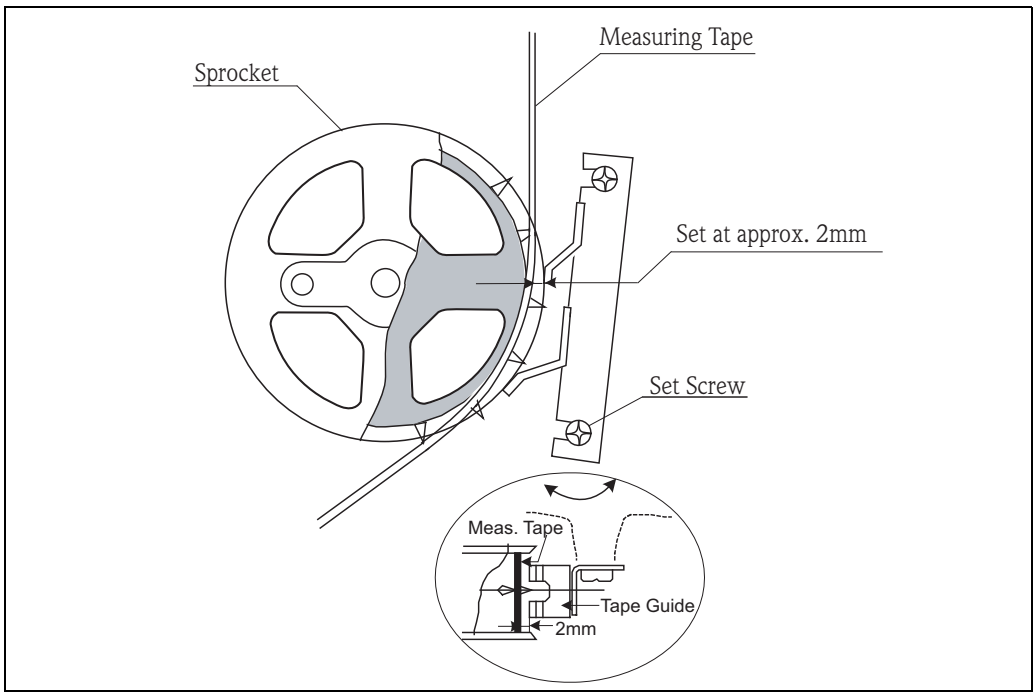


Figure 36: Tape Guide Adjustment

3.11.6 Setting Conster Drum

Setting Procedure
The conster drum should be set after the measuring tape has been installed.

Caution!

When winding the conster motor from the large drum to the small drum, keep a firm grip on the large drum until the spring is completely wound. Releasing it may result in injury due to the spring recoiling.

Note!

- The conster may separate from the track of the large conster drum, or disproportionate torque may result when the excessive force is applied, resulting in inaccurate readings. Handle with care.
- When winding the conster from the small conster drum to the large conster drum, keep firm grip on the large drum until the measuring tape is taut.

1. After confirming that the lock screw has been removed, secure the head of the conster to the large conster drum with the bolts and nuts.
2. Rotate the conster drum in the direction indicated by the figure below.
3. When fixing the conster drum, rotate the tape drum counter clockwise to tighten the tape.
4. When the tank is empty, roll the tape twice around a small conster drum and secure it with bolts.
   - Once the tank is fill, measure the surface level of the fluid and use the equation on the following page to determine the number of times the tape should be rolled. Roll the tape around a large conster drum the exact number of times required based on the calculation.
5. Replace the LT11 or LT12 rear cover.
6. Close the gland of LT14 or LT16 rear cover.

This completes the setting procedure.

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

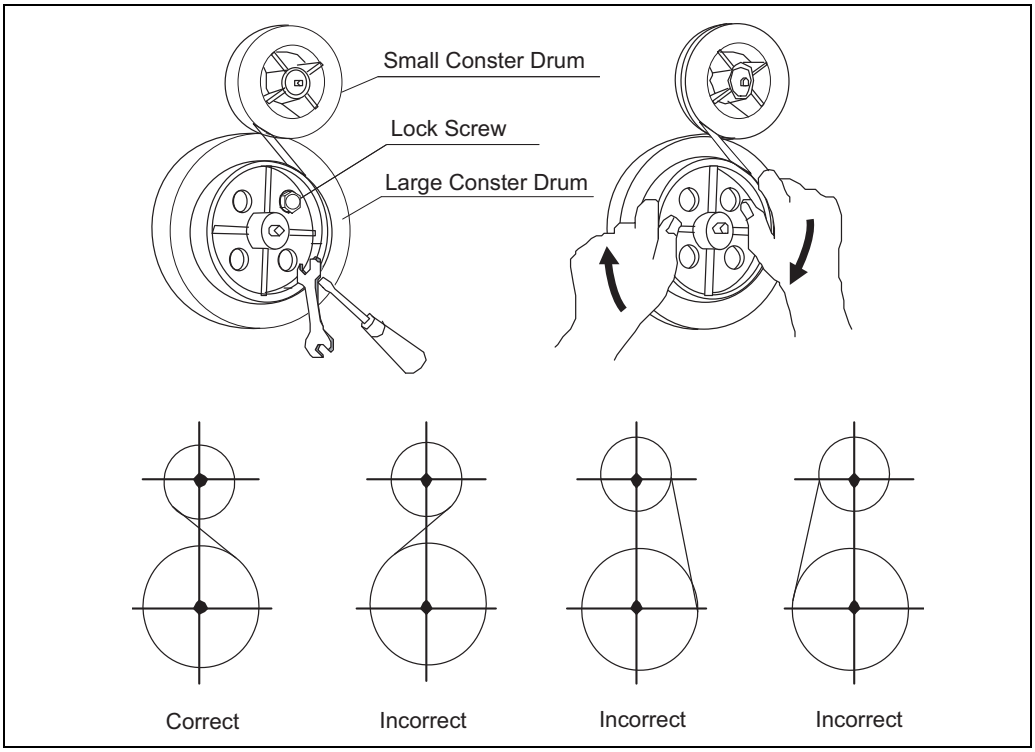


Figure 37: Conster Drum Setting

3.12 Liquid Sealant for Seal Pot

3.12.1 Filling Seal Pot with Liquid Sealant When Installing New LT

Liquid Sealant Filling Procedure

1. Install entire LT unit including the seal pot and float into the tank.
   - Parts of the drawing shown below may vary, depending on kit code selected by customers.
2. Hoist the float up and down manually to confirm that the dial (or counter) display changes accordingly.

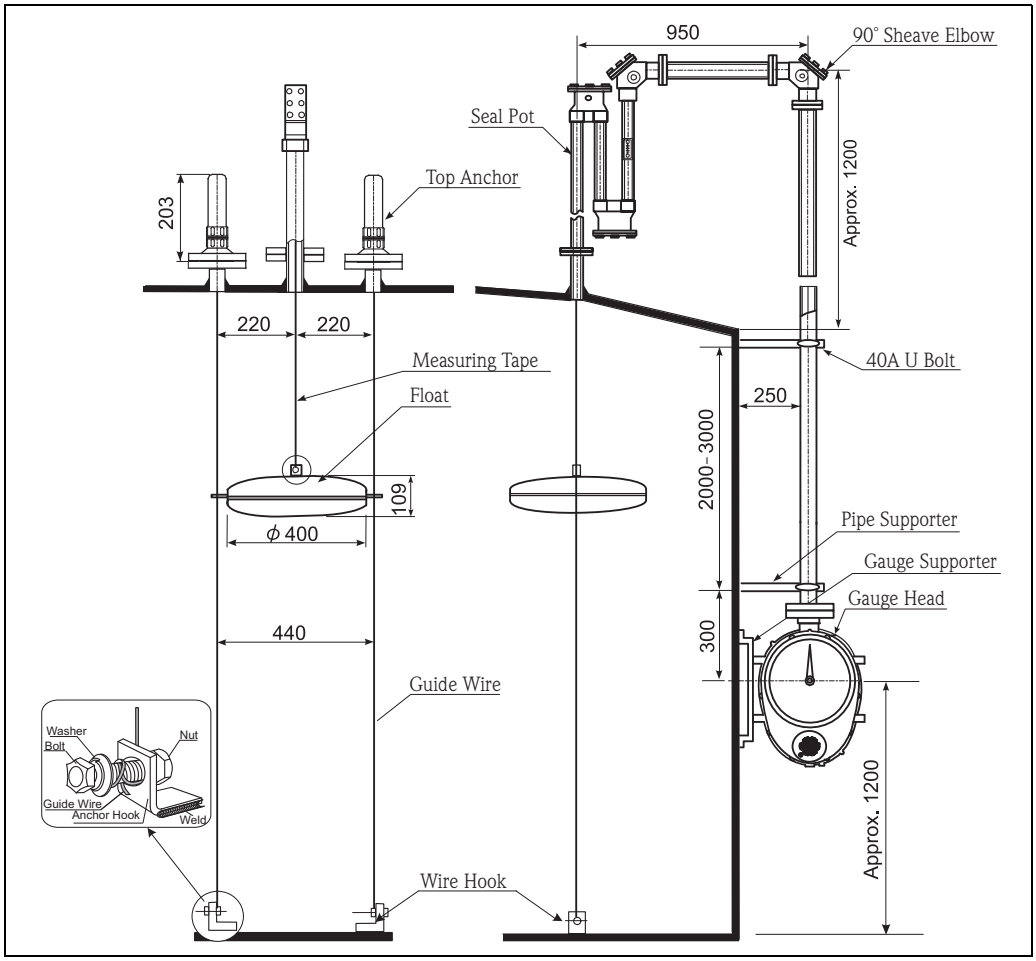


Figure 38: LT with Seal Pot

3. After LT operation check, remove the sheave elbow cover [1] and fill with liquid sealant (refer to Figure 39).

Note!
After administering liquid sealant and checking LT operation, the liquid sealant may leak into the tank through the measuring tape.

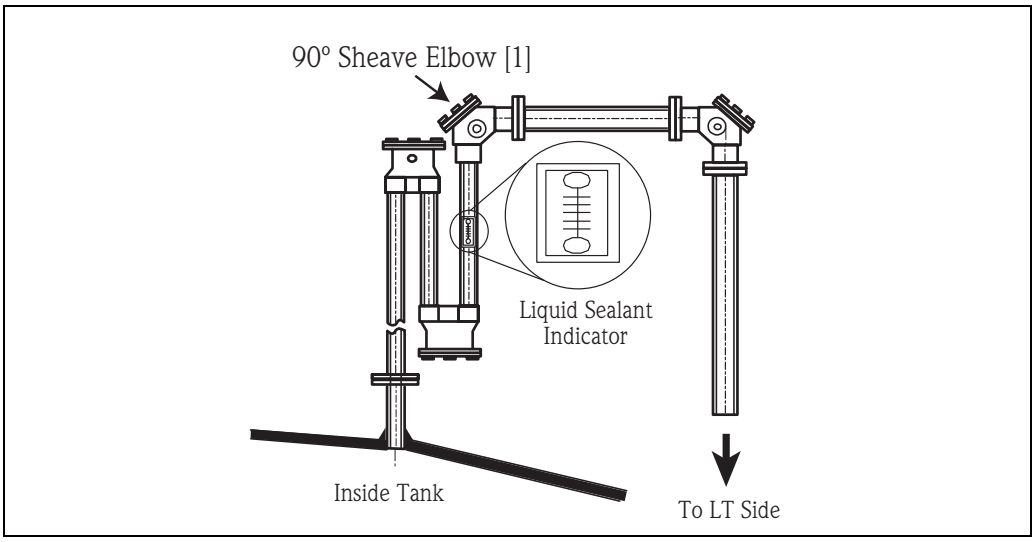


Figure 39: Filling Seal Pot with Liquid Sealant

4. Administer liquid sealant until it comes up to the center of the indicator.
5. Replace the sheave elbow cover.

This completes the liquid sealant filling procedure.

Note!
2 ℓ (liter) of liquid sealant is contained in the kit. When administering the proper amount of liquid sealant, a small amount will remain in the bottle. Do not dispose remaining liquid sealant. It is used as needed, following running LT.

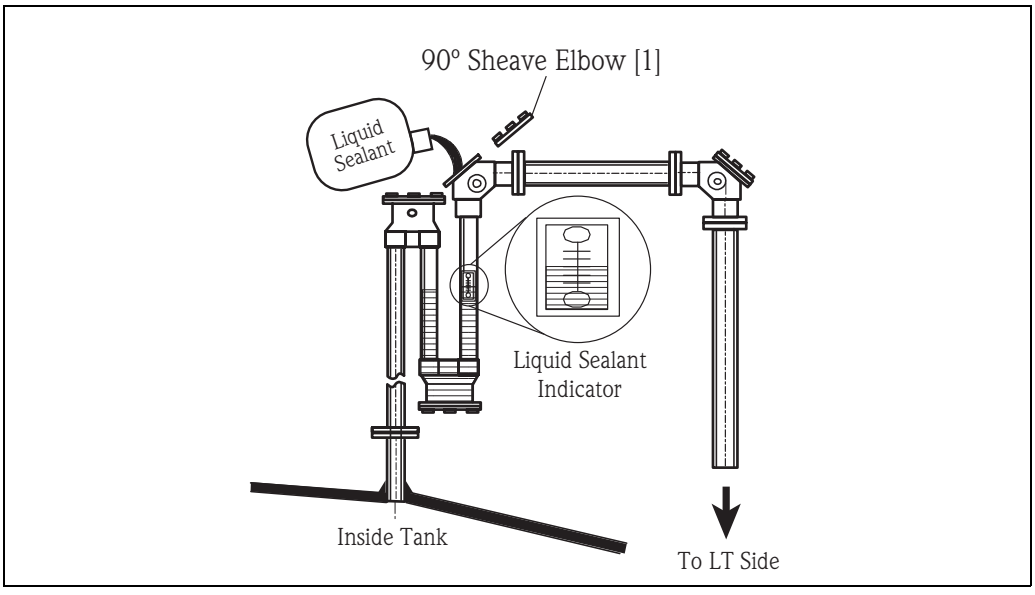


Figure 40: Amount of Liquid Sealant

Caution!
If the tank is run without liquid sealant, LT seals, O-rings, or sheave elbows may be damaged by gas contained the tank, and may cause LT to malfunction. Be sure to administer liquid sealant prior to tank operation.

3.12.2 Filing Seal Pot with Liquid Sealant for Installed LT

Liquid Sealant Filling Procedure

Caution!

- Do not allow used liquid sealant to contact hands or skin. If used liquid sealant mingles with liquid from the tank, it may be come a hazardous substance.
- Exercise caution against substance from containers which used to drain liquid sealant.

1. Prepare a container for 2 ℓ (liter) or more [6] and place under the sheave elbow outlet.
2. After confirming the safety of the vicinity around the tank, remove the seal pot drain bolt [5].
3. Drain the liquid sealant from the seal pot.
4. Remove the cover [3] of the 90° sheave elbow [2] or [4].
5. Pull the measuring tape to the side of LT using the 90° sheave elbow [2] or [4].
   - Do not pull on the measuring tape at the sheave elbow side. The liquid sealant may enter the tank.

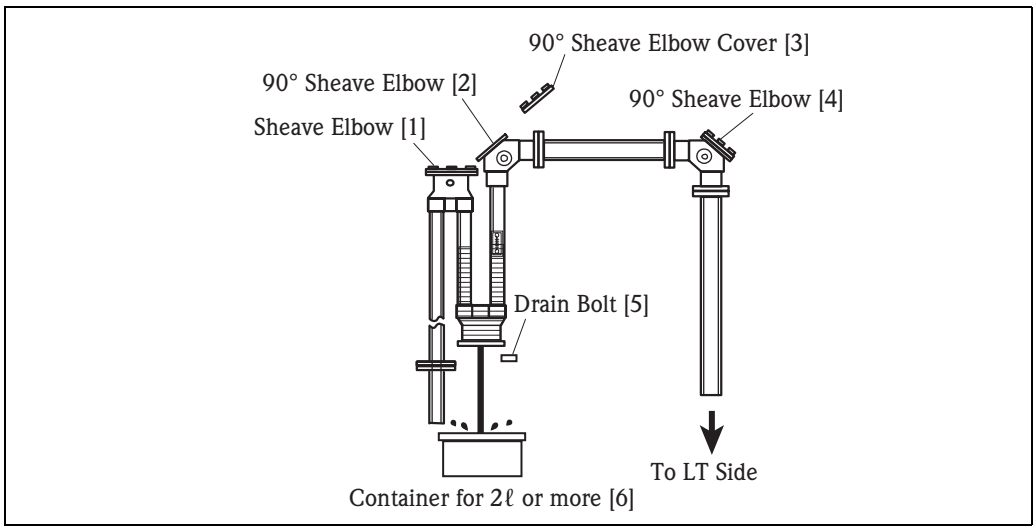


Figure 41: Draining Seal Liquid

6. Tighten the drain bolt and fill until liquid sealant reaches the center of the indicator on the seal pot side.
7. Replace the sheave elbow.

This completes the filling seal liquid procedure.

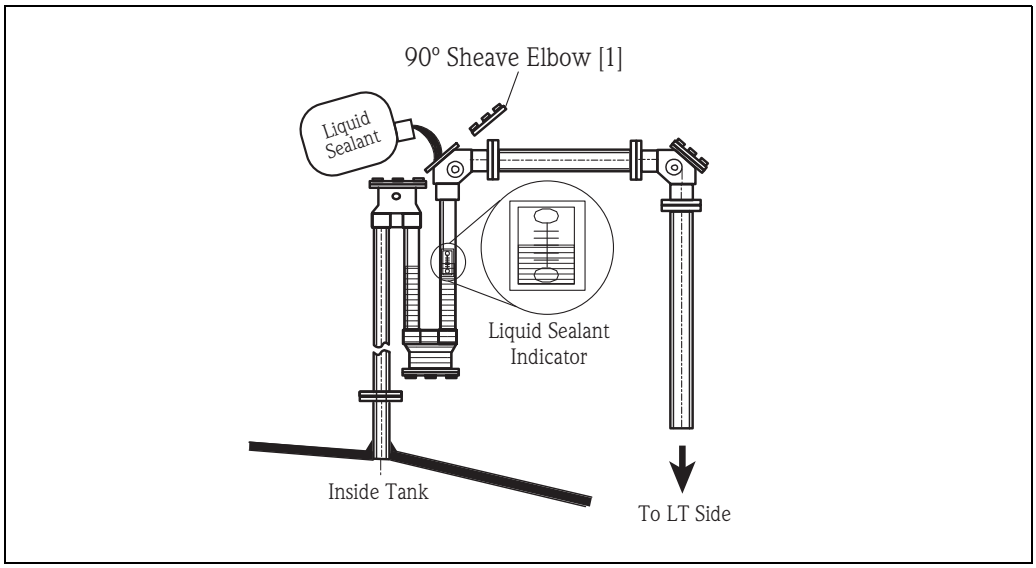


Figure 42: Filling Seal Liquid

4 Display

4.1 Dial Display

Pointer Setting and Scale Reading Procedure

Note!

When calibrating (pointer setting) to authorized value as calculated value or measured value, calibrating procedure will depend on which display type is used. Use the dial type display when tank height is 20m or less, and use the counter type display when tank height is 20m or more.

1. Remove the indication cover and loosen the cap nut.
   - The long indicator needle (white) can be turned freely, whereas the short one (green-yellow) can be freed by pulling it.
2. Align the short needle with inner scale (1mm/one scale), as it corresponds to lower value in liquid level.
3. Align the long needle with the outer scale.
   - As one scale notch corresponds to 100mm, the outer scale is aligned visually, according to the lower two digits in liquid level value.
4. After aligning the needles, tighten the cap nut firmly.
   - Long indicator needle (outer scale): 10000mm, 1000mm, 100mm values; Short indicator needle (inner scale): 10mm, 1mm values.

This completes the setting and reading procedure.

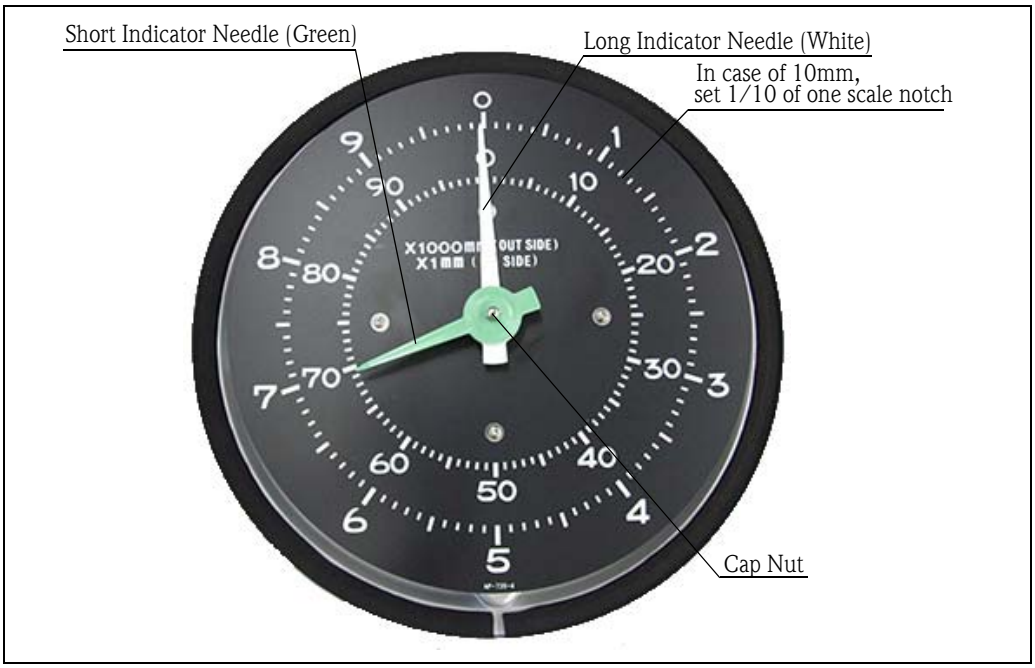


Figure 43: Dial Display

4.2 Counter Display

Counter Display Procedure

1. Remove the indicator cover.
2. Loosen the screw at the center of the scale plate.
   - The scale plate can rotate freely (1 scale notch is equivalent to 1mm.).
   - The counter changes one digit for every notch (100 mm) the scale plate moves.
3. Rotate the scale plate and align the numerical value of the counter to the three upper digits values of liquid level.
4. Align the scale plate to the pointer which corresponds to the two lower digit values in liquid level, then tighten the scale plate screw.
   - If the pointer is indicating a range of between 97 and 03 on the scale plate, as in the figure below, the counter will not change instantly. As it changes gradually, keeping constant the relation between the rotation of the scale plate and numerical change, the counter will display half values. Thus, in order to rule out incorrect reading, the counter window and parts of the scale plate are correlated by color.

This completes the counter display procedure.

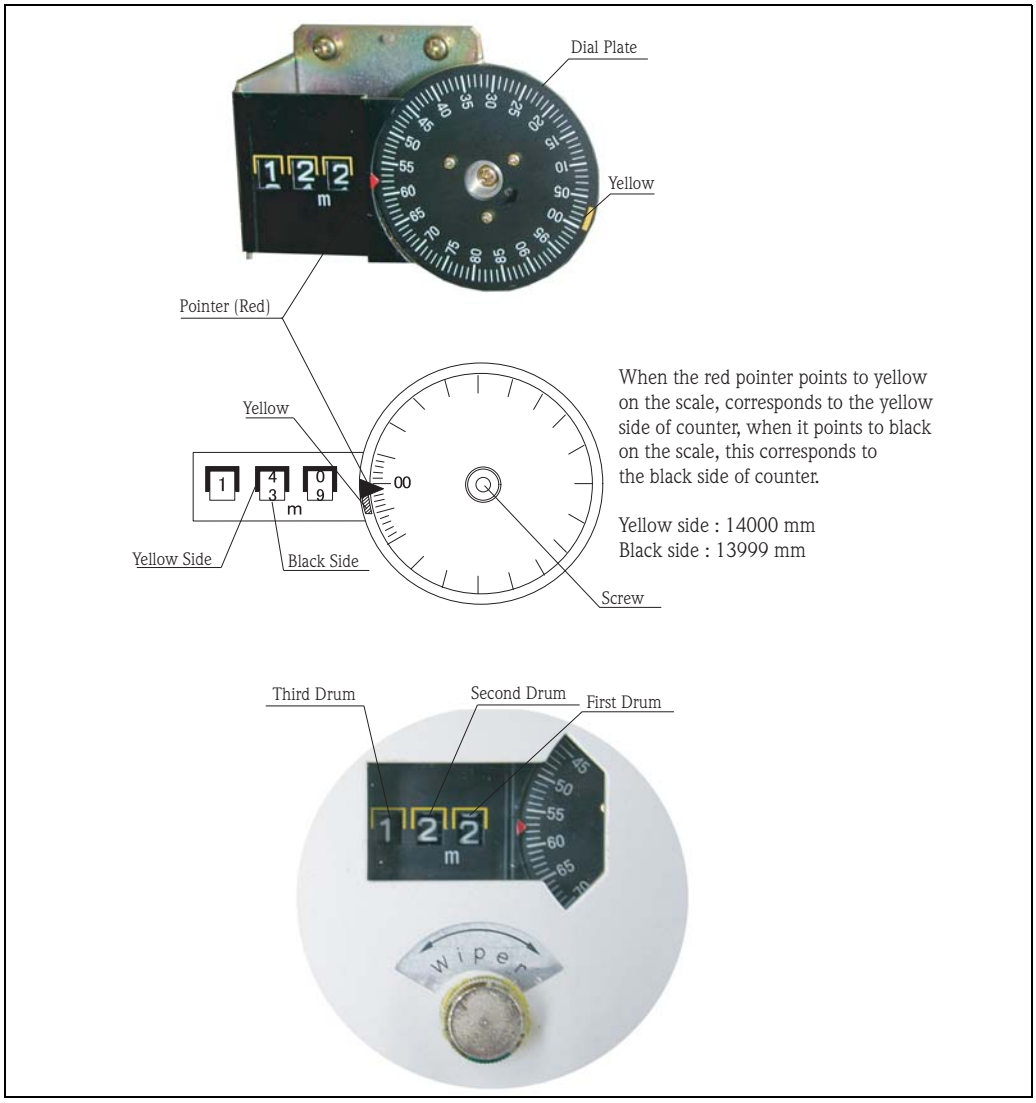


Figure 44: Counter Display

4.3 Indication Adjustment

Following are the three universal procedures for indicator adjustment:

- Fill the tank with actual liquid and calibrate the indicator to measured volume.
- With the tank empty, calibrate the indicator using formulaic calculations.
- Fill the tank with water and calibrate the indicator to measured volume.

4.3.1 Calibration Using Actual Measuring Liquid

In order to obtain a reliable value, measure the liquid level two or three times, using a measuring tape which has been officially tested accurate to within ±0.3 mm/m (±1.2mm/10 m). Calibrate to the values only after accurate data has been gathered.

4.3.2 Calibration through Calculation for Empty Tank

1. When the tank is empty, calculate the liquid level L*f* using the following formula and set indicator to the determined value.
2. When liquid reaches to the value of L*f*, the float gains buoyancy and LT will show proper liquid level.

1

$$Lf = \{ Hf + \frac{(W-w) - Q \times \rho}{A \times \rho} \} \times 10$$

2

$$Lf = 10 + \left\{ \left(\frac{5.65}{\rho} - 7.64 \right) \right\} \times 10$$

Assign specific density to the formula above.

LT14/LT16

Lf: When a float start to float, level height (mm)
W: Float Weight: 8300g
A: Cross Section Area of Float Cylindrical Part (cm^2): 1256.64cm^2
Hf: Half of Float Height (mm): 100mm
w: Measuring Tape Hoisting Force in Conster (g): 1200g
ρ : Density of Actual Liquid
Q: Half of Float Volume (cm^3): 9600cm^3

Note!
When float is installed in a spherical tank, where it will tend to deviate off center, find Lx in the formula below and add it to the product of L*f* in formula 2 above.

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

Lx: Correction Amount of Liquid Level Indication by Deviation Caused by Float Installation (cm)
D: Diameter of Spherical Tank (cm)
S: Deviation Distance from Center of Tank to Center of Float (cm)

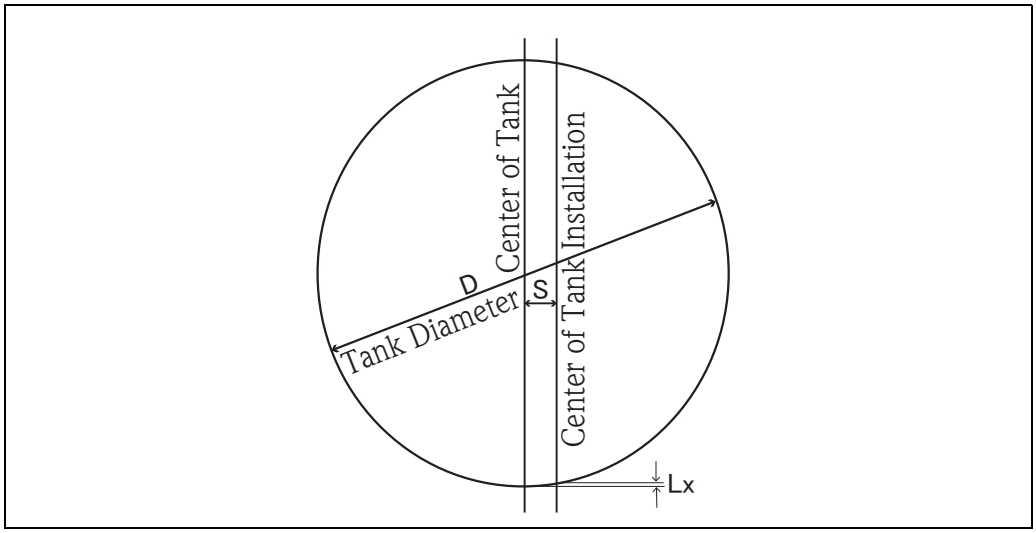


Figure 45: Setting Indicator of Spherical Tank

4.3.3 Calibration Water Filling Procedure

When LT installation is complete, the water filling test is generally performed. Since measuring for level is usually more difficult with other liquids, calibrating to water is recommended. The indicator will be calibrated one again when the tank is filled with a commodity liquid. Using the following formula, calculate the difference between where the float gains buoyancy in both water and commodity liquid. Then correct the indicator value with water in the tank (refer to Graphs 1 and 2) before filling it with a commodity liquid.

$$L_B = \frac{W-w}{A}\left(\frac{1}{\rho} - 1\right) \times 10$$

$$L_B = 5.65\left(\frac{1}{\rho} - 1\right) \times 10$$

LT14/LT16

L_B: When filling water, Indicator corrective value (mm)

W : Float Weight (g):8300g

A : Aross-sectional area of float cylindrical part (cm2):1256.64

Hf : Half of float height (cm):10cm

w : Measuring tape hoising force in conster (g):1200g

ρ: Density of actual liquid (g/cm^3)

Q : Half of float volume (cm3): 9600cm^3

Note!

After setting the LT indicator to the measured value for water, determine L_B in the formula above. If the value of L_B is a positive integer, add that value to the determined indicator value. If the value of L is a negative integer, subtract that value from the determined indicator value. This will be the final indicator value.

Ø400 Float

Calculating Formula for LT14/LT16

Lf : When a float start to float, level height (mm)
W : Float weight (g)
A : Cross-sectional area of float cylindrical part (cm^2)
Hf : Half of float height (cm)
w : Measuring tape hoisting force in conster (g)
ρ : Density of actual liquid (g/cm^3)
Q : Half of float volume (cm^3)
LB : When filling water, indicator corrective value (mm)

① when tank is empty

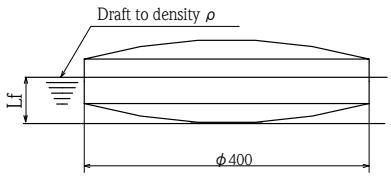
$$Lf = \{ Hf + \frac{(W-w) - Q \times \rho}{A \times \rho} \} \times 10$$

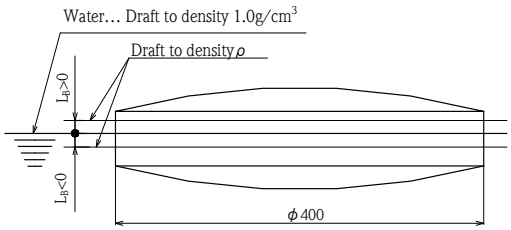
$$= \{ 5.45 + \frac{(W-1200) - 5260\,\rho}{1256.64\ \rho} \} \times 10$$

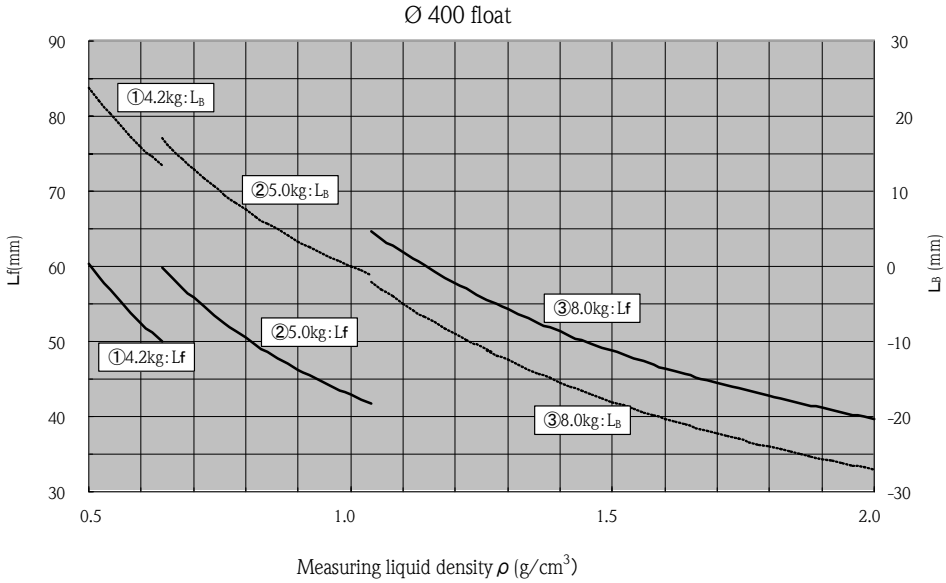
② When putting water in tank

$$L_B = \frac{W-w}{A} \left(\frac{1}{\rho} - 1 \right) \times 10$$

$$= \frac{W-1200}{1256.64} \left(\frac{1}{\rho} - 1 \right) \times 10$$







Graph 1

Figure 46: Indicator Value during Filing Water (Ø400 Float)

ø140 float

Calculating Formula for LT14/LT16

Lf : When a float start to float, level height (mm)
W : Float weight (g)
A : Cross-sectional area of float cylindrical part (cm^2)
Hf : Half of float height (cm)
w : Measuring tape hoisting force in conster (g)
ρ : Density of actual liquid (g/cm^3)
Q : Half of float volume (cm^3)
LB : When filling water, indicator corrective value (mm)

① when tank is empty

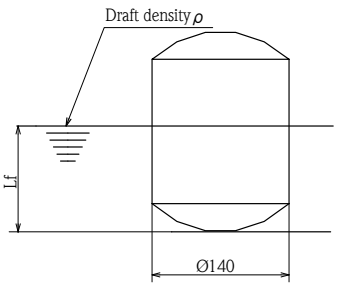
$$Lf = \{ Hf + \frac{(W-w) - Q \times \rho}{A \times \rho} \} \times 10$$

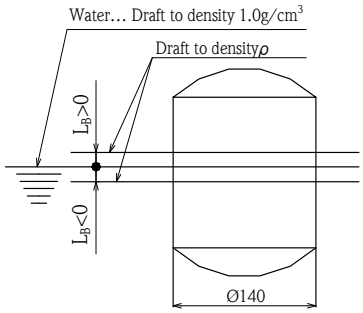
$$= \{ 10 + \frac{(W-1200) - 1330.6\rho}{153.94\ \rho} \} \times 10$$

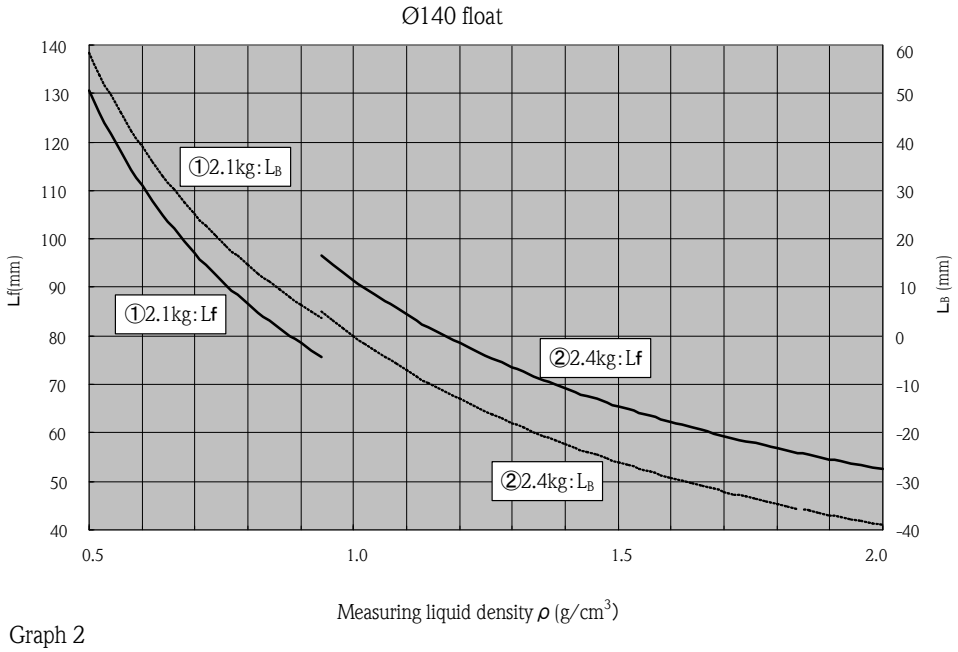
② When putting water in tank

$$L_B = \frac{W-w}{A} \left(\frac{1}{\rho} - 1\right) \times 10$$

$$= \frac{W-1200}{153.94} \left(\frac{1}{\rho} - 1\right) \times 10$$







Graph 2

Figure 47: Indicator Value during Filing Water (Ø140 Float)

4.3.4 Correction Curve of Indicator by Density Variation of LT14/LT16

If the liquid is altered from a relative density of 0.74g/cm^3 to 0.6g/cm^3, for example, the correction value will show +18mm as demonstrated by Figure 43. Thus, an adjustment of +18mm to the actual value is needed.

Note!
Install the indicator cover so that the plastic pipe is on the bottom.

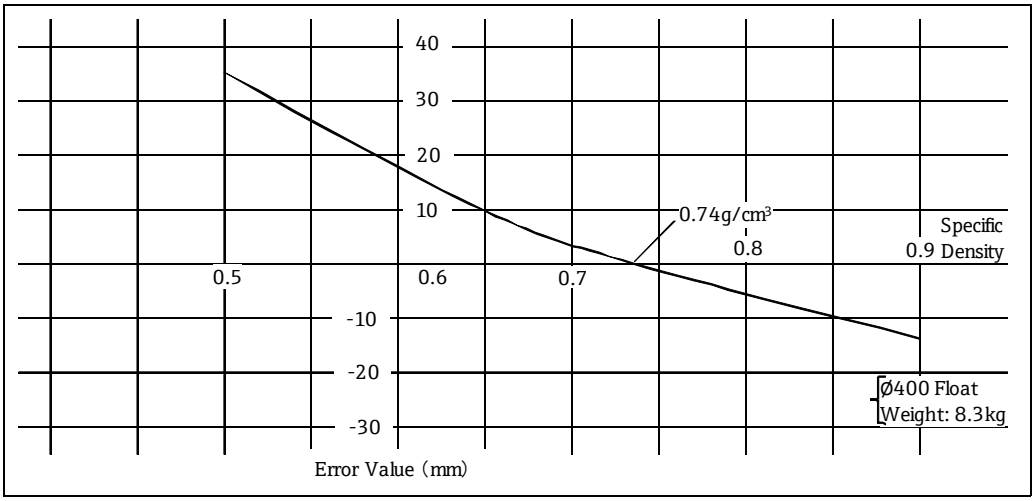


Figure 48: Correction Curve of Indicator by Density Variation

4.3.5 LT startup and Handling Precautions for Water and Airtightness Test

If misshapes occur, such as the damage to measuring tape while inside spherical tanks (i.e. tanks for liquefied gas), tank operation and recovery costs can be extensive. It has been our experience, that most issues involving measuring tape failures arise during operation or in initial operation of the tank. To prevent such incidents, be sure to complete the following procedures. By taking these preventive steps, misshapes can be avoided early on.

1. For high pressure tanks, be sure to keep the plug gate valve open and set the tank level gauge to measurement mode. Failure to open the valve may result in measuring tape failure.
   - If the valve is not open while filling tank with water, drain the water or remove the sheave elbow cover. Then, stop the measuring tape by hands, open the valve gradually and reel the measuring tape to LT.
2. For the water test, open the water-feed valve partially and supply water to a depth of 500 to 1000mm.
3. Large amount of water may damage the measuring tape. If the float is in close proximity to an inlet, install the wave guard so float is unaffected.
4. If test for airtightness is performed while opening the gate valve, make sure the following components are firmly tightened.
   - Drain plug on the bottom of LT
   - Rear cover bolts
   - Transmitter connection gland
   - Sheave elbow covers

   If these items are not secure, large volumes of air may discharge from the system, causing vibrations that will damage the measuring tape.
5. When opening LT upon completion of airtightness check test, confirm that the inner tank is either at atmospheric pressure or that the gate valve is closed before opening LT.
   - Do not open LT or sheave elbow covers to abruptly discharge compress ion built up by the airtightness check test. This will damage the measuring tape.
6. Be sure to open the gate valve when filling tank with commodity liquids such as liquefied gas.
   - Closing the gate valve must be restricted almost exclusively to the emergencies or to period of maintaining liquid level.

5 Operation

5.1 Check Handle

This is used in order to check that a gauge operates properly.

Note!

- Checking gauge performance using the check handle, only after filling the tank with liquid.
- The check handle is not a float hoisting handle. Do not forcibly hoist the float using the check handle.
- Refer to "5.2 Handling of Hoisting Handle" for details on using the hoisting handle.

Check Handle Using Procedure

1. Push the check handle, attached to the bottom of LT, inside LT.
2. Push while rotating the check handle to the right.
3. Rotate the check handle to the left and release, when indicator is approx. 4 to 5mm over scale.
4. Check the LT indicator.

This completes the check handle using procedure.

Figure 49: Check Handle

5.2 Hoist Unit (LT1101/LT1201)

The hoist handle is used to hoist up float when not in use. This helps to add life to LT when utilized for tanks with a stirrer and/or for tanks containing corrosive liquid.

Note!

- Do not release grip on hoist handle, when hoisting or lowering the float. Doing so may cause float to fall resulting in severe damage to float.
- When lowering the float, do not continue rotating handle after it reaches liquid surface.
- When handle reaches the A position, shown in Figure 45, the float is freed from the handle. Remove the handle while float is in use.

Hoist Up Procedure

1. Secure the handle [4] to the knob [3], using the wing bolt [2].
2. Push the knob while pulling the handle [5]. Release the handle when the knob is pushed into position B.
3. After confirming that the knob is secure in position B, rotate the handle counter clockwise for one rotation, within 2 seconds.
4. To stop in the middle of hoisting, push the stopper [1] to the deepest possible depth and secure the win bolt [6].
5. Put the handle back slowly and push the stopper against LT body.
   - The float will not fall by releasing handle.
   - Remove the handle when hoist operation is complete.

This completes the hoist procedure.

Hoist Down Procedure

1. Insert the handle into the knob and fix it as shown below, rotate it counter clockwise, and then loosen the win bolt [6]. Secure the stopper with the win bolt after returning the stopper to original position.
2. Rotate the handle clockwise.
   - When the float reaches the liquid surface, the handle decreases suddenly and the LT indicator will stop. Do not rotate the handle any further.
3. After completion of lowering float, pull the knob, pulling the handle [5], and release the knob when the knob is in the condition A.
4. Remove the handle when lowering operation is complete.

This completes the lowering procedure.

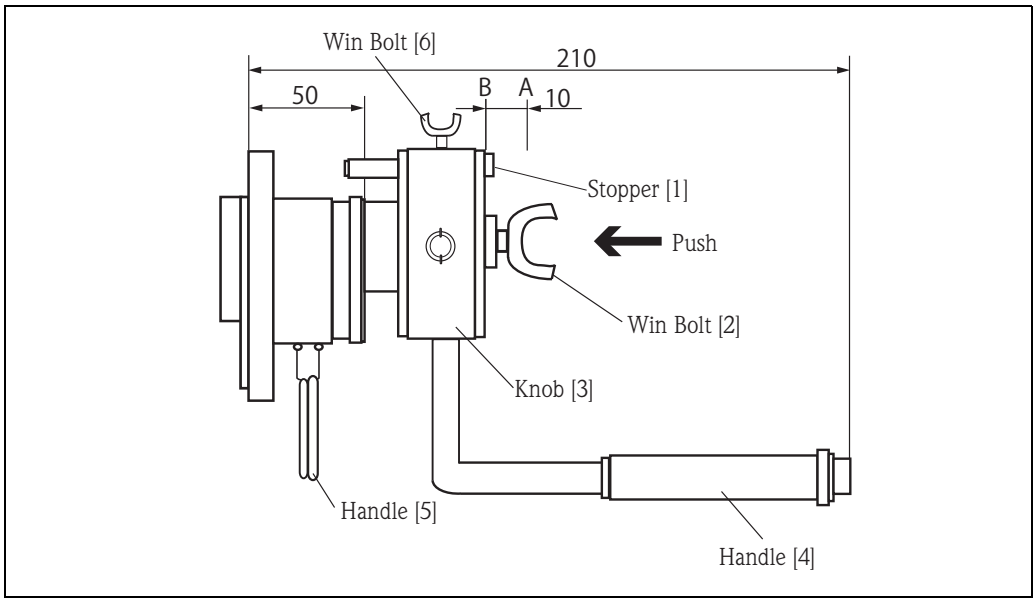


Figure 50: Hoist Unit for LT1101/LT1201

5.3 Hoist Unit (LT14/LT16)

The hoist handle is used to hoist up float when not in use. This helps to add life to LT when utilized for tanks with a stirrer and/or for tanks containing corrosive liquid.

Note!

- Do not release grip on hoist handle, when hoisting or lowering the float. Doing so may cause float to fall resulting in severe damage to float. If the handle must be released when hoisting float, lock the handle first.
- Do not tilt the handle over 90 degrees or more toward its axis. This may cause the damage to the float, measuring tape, or conster.
- Do not continue rotating the handle after float reaches liquid surface.

Hoist Up and Down Procedure

1. Remove the lock chain [1].
2. Slowly rotate handle in smooth circles (refer to A to B in Figure 46).
   - The tape drum gear and the hoist shaft gear will begin to engage at 90 degrees.
3. Hoist or lower the float while rotating the handle in the position B.
   - After hoisting float, do not leave the hand. Be sure to secure it with the lock chain first (refer to C in Figure 46).
4. Remove the lock chain when lowering the float.
5. Rotate the handle to lower the float.
   - When the float reaches the liquid surface, the indicator or counter will stop at current liquid level.
6. After lowering float, rotate the handle 180 degrees against the shaft to enable liquid to be measured.
7. While the float in service, loop the lock chain 1 to 2 times around the crank handle and place the chain hock on the loop nearest the screw (refer to A in Figure 46).

This completes the hoist and lowering of float procedure.

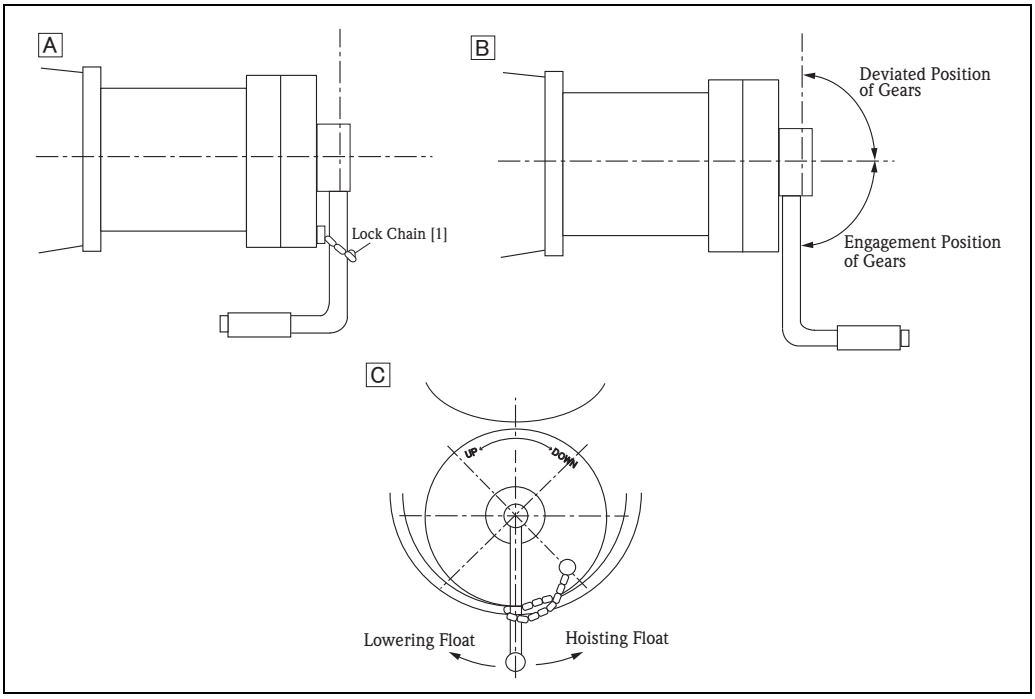


Figure 51: Hoist Handle (LT14/LT16)

6 Parts Replacement

6.1 Replacement of O-ring for Transmitter (LT14/LT16)

If gas begins leaking from the side of LT body, O-rings must be replaced.
The following steps must be performed carefully due to the tank being under pressure from within.

Replacement Procedure

1. Tighten the gate valve at the top of the tank.
2. Loosen the drain plug at the bottom of LT and gradually discharge all remaining pressure in the pipe.
3. Remove the transmitter if attached.
4. Remove the coupling from the side of LT and remove the O-rings (2 pts.) by using a gland fixing tool.
5. Inspect the other components. Replace O-rings and other wear items as necessary
6. Mount the coupling to LT and tighten the drain plug to replace the drain plug.
7. Open the gate valve gradually.
   - Opening the gate valve abruptly will release a sudden burst of air from the system, which may result in the damage to the measuring tape.

This completes the replacement procedure.

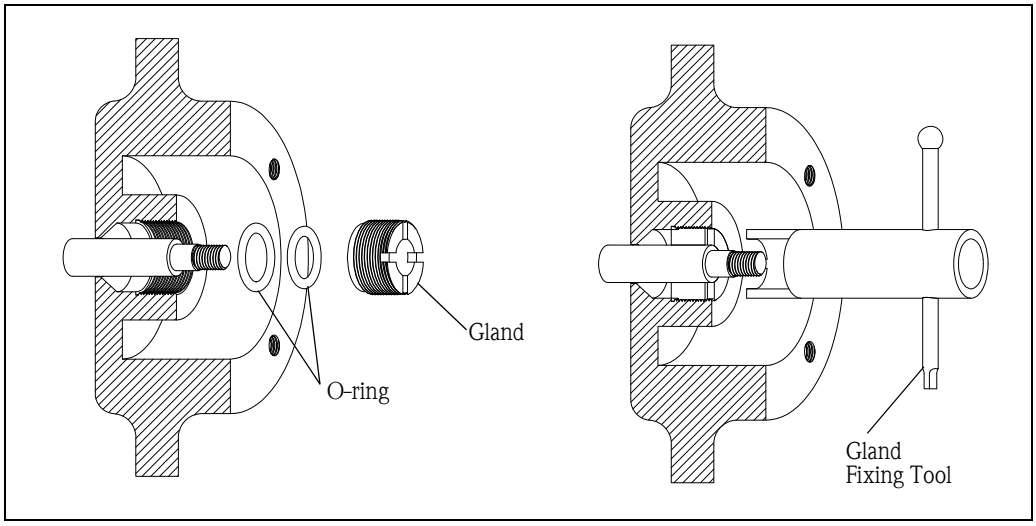


Figure 52: O-ring Replacement

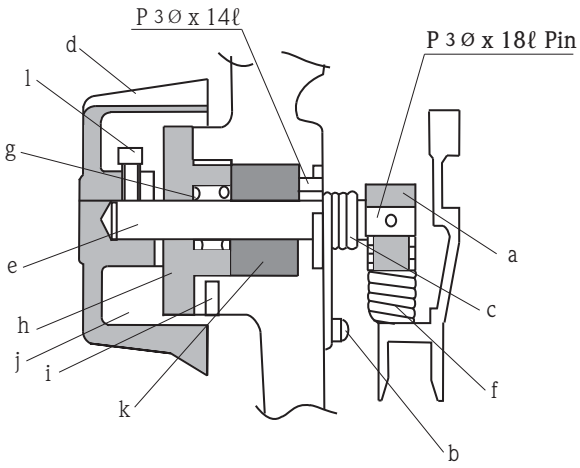
6.2 Drive Checker Replacement

The drive check system is essential to confirming LT operation and employed frequently, causing inevitable wear and tear, but is designed to be easily repaired and serviced.

Replacement Procedure

1. Remove the LT rear cover and the tape drum.
2. Loosen the socket head cap screw [1] of the check handle [d] and remove the check handle [d].
3. Remove the set screw [j] and then remove the gland clamp [h], using the gland fixing tool.
4. Remove the seal metal [i].
5. Pull the check shaft [e] out toward the tape drum.
6. After completing parts replacement, reverse the procedure above to attach the parts.

This completes the replacement procedure.



Parts No.	Parts Name
a	Check Boss
b	Spring Set Screw
c	Check Spring
d	Check Handle
e	Check Shaft
f	Spring
g	Gland Spring
h	Gland Clamp
i	Seal Metal
j	Set Screw
k	Collar
l	Socket Head Cap Screw

Figure 53: Parts Name of Drive Check Unit

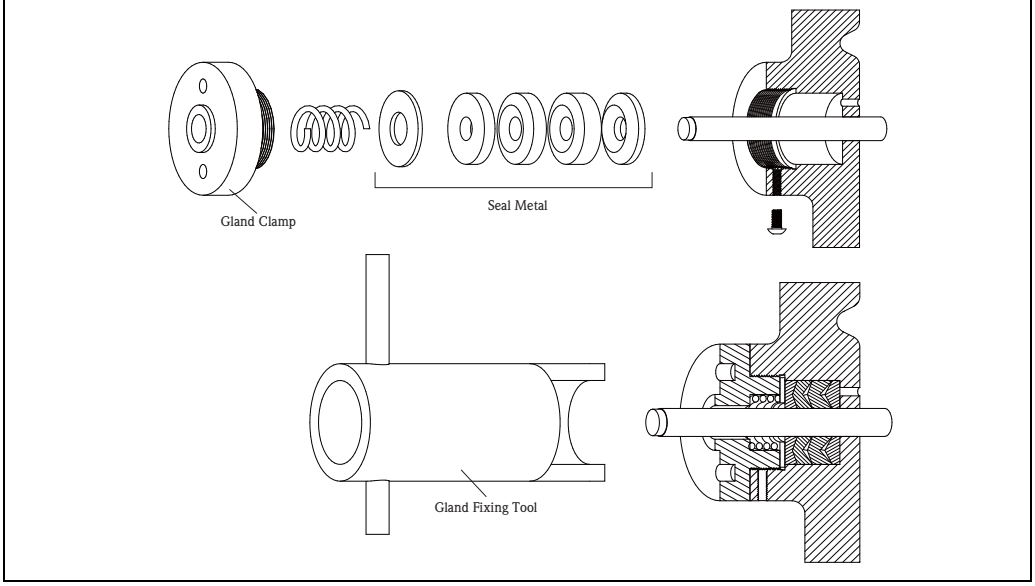


Figure 54: Drive Check Unit

7 Maintenance

7.1 Precaution prior to Maintenance

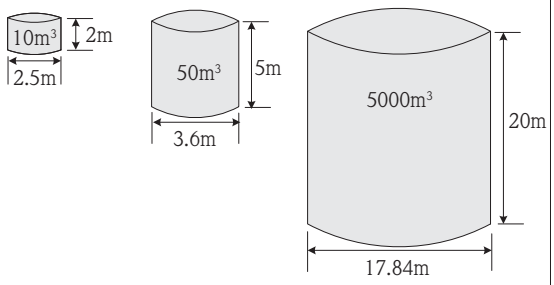
Caution!

- Use due vigilance when working with flammable liquid tanks. Allow flammable liquids plenty of time to diffuse before pumping or transferring to tank (refer to the table below).
- Be sure to wear antistatic clothing, gloves, and safety shoes.
- Follow directions of the safety supervisor

Recommended Standing Time

Static Electricity Safety Guideline (National Institute of Industrial Safety)

Conductivity of charging material (S/m)	Flammable liquid (example)	Volume of charging material (m^3)			
		10 or less	10 to 50	50 to 5000	5000 or greater
10^{-8} or greater	Acetic acid Ethanol Ethyl chloride Methanol Light oil	1 min. or less	1 min. or less	1 min. or less	2 min. or less
10^{-12} to 10^{-8}	Vinyl acetate Toluene Benzene Gasoline	2 min. or less	3 min. or less	10 min. or less	30 min. or less
10^{-14} to 10^{-12}	Methyl cyclohexane	4 min. or less	5 min. or less	60 min. or less	120 min. or less
10^{-14} or less	Carbon tetrachloride	10 min. or less	10 min. or less	120 min. or less	240 min. or less



7.2 Daily Inspection

LT does not require any inspections after it has been properly installed in a tank.

7.3 Periodical Inspection

Follow the table below to perform the periodical inspection.

Periodical Inspection Procedures

	Check Item	Check Procedure
Gauge Head (for all LT)	Corrosion check and cleaning of tape protective pipe	After opening the gauge head rear cover, check accumulation of rust. If necessary, remove rust by tapping the protective pipe with a wooden hammer.
	Check of reduction gear engagement and bearing	After removing the indicator cover, rotate the reduction gear to check engagement and confirm that backlash is within 1 mm of indication. Check the bearing.
	Friction on tape drum and sprocket	After opening the gauge head rear cover, check bearings of drums for corrosion or dust. Clean them as needed.
	Characteristic change of conster	Check the level gauge operation with the drive checker. If the measured value is not stable, clean the conster. If the level gauge is not recovered, replace the conster.
	Water drops and dimming on indicator window	Confirm the indicator cover is tightened firmly and there is no dust contamination on the gasket.
	Check of check handle	Confirm that the check handle returns its original position when pushing and releasing it.
Gauge Head (LT14/LT16)	Check of drive checker	Check the condition of the checker spring inside the gauge head and its performance.
	Check of magnet coupling	Replace the sprocket to strip the rust and remove the dust (1 to 2 times in a year).
	Check of O-ring leak	Check airtightness of LT with, using soap water.
Sheave Elbow	Sheave elbow friction	In sheave elbow, remove measuring tape from roller and check to rotate smoothly. Remove bearing and check friction. Remove dust from roller.

8 Troubleshooting

8.1 Failure Causes and Countermeasures

Condition of Malfunction	Possible Cause	Corrective Measure
Indication does not change at all	1. Breakage of measuring tape 2. Guide wire caught 3. Breakage of conster 4. Drive checker caught 5. Wear and tear of gear which is connected to the indication system 6. Improper setting of sprocket or measuring tape 7. Float sinking	1. Open the tank and replace the measuring tape. 2. After opening the tank, re-stretch the guide wire. 3. Replace the conster. 4. Open the rear cover of gauge head and repair or replace the conster. 5. Replace the entire gear unit of the indication system 6. Check the gear after opening rear cover of gauge head. 7. Replace the float after opening the tank
Frequent indication error	1. Deterioration of conster 2. Apply to items 2, 4, 5, 6 mentioned above. 3. Loosening of indicator pointer 4. Improper setting of tape guide 5. Kink or twist of measuring tape	1. Check variation of indication value and replace the conster if deteriorated. 2. Check the internal parts of the gauge head. 3. Check lock nut for the indicator pointer after opening indicator cover. 4. Check the gap between the sprocket and tape guide. 5. Pull measuring tape out and check after opening sheave elbow cover. The measuring tape can be repaired depending on the condition of it.
There is difference of value between the indication of measuring tape and the indicator of the display.	1. Some error found in the gauge head. 2. No error found in the gauge head.	1. Inspect the items mentioned above and have countermeasures. 2. Failure by measuring liquid 3. Negative influence by measuring technique 4. Negative influence by sludge deposition 5. Negative influence by strong wind 6. Error of measuring scale
Check handle can not rotate and return	1. Checker shaft has rusted. 2. Check driver spring is deteriorate.	1. Clean up the shaft and replace entire check handle unit. 2. Replace the spring.
Drive checker does not work.	1. Loosening of set screw of check handle 2. Breakage of check driver spring 3. The spring gets stuck in the tape drum and can not move.	1. Tighten the set screw. 2. Replace the entire check unit. 3. Repair the check unit or replace the entire unit.
Gas leakage (LT14/LT16)	1. Airtight leakage at the junction part of the rear cover 2. Airtight leakage of penetration part of the drive checker unit	1. Replace the packing or apply the seal end agent to the junction part. 2. Replace the seal metal.

8.2 Spare Parts

Spare parts are contained in kits. Spare parts for LT series which can be ordered from Endress+Hauser are shown with their order numbers in the diagram below. Contact Endress+Hauser service representatives for further assistance.

8.2.1 Gauge Head for LT11/LT12

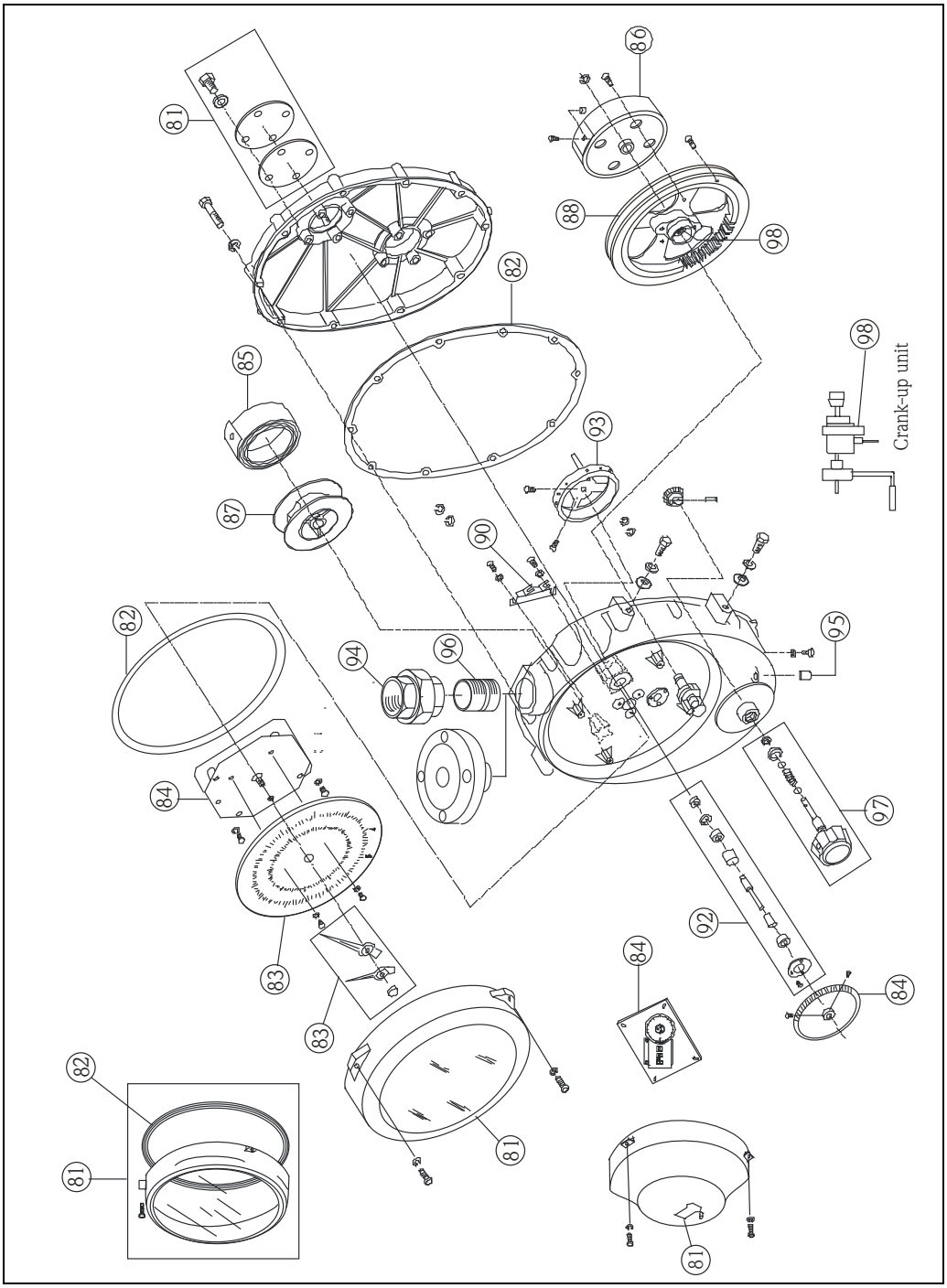


Figure 55: Gauge Head for LT11/LT12

Items	Parts No.	Parts Name	Items	Parts No.	Parts Name
81 Cover	017860-5221	Steel front cover assembly	85 Conster spring	52015582	Conster spring, 5m
	017860-5220	Cover counter LT1120/LT1220		017860-5033	Conster spring, 10m
	017860-5450	Front cover, plastic		017860-5035	Conster spring, 20m (range 16m, 20m)
	56004288	Blind cover assembly SS		017860-5036	Conster spring, 30m
82 Packing	56004465	Packing, rear cover, cork	86 Conster drum large plastic	017860-0106	Conster drum, large
	56004464	Packing, steal indicator cover	87 Conster drum small aluminum	017860-0107	conster drum 20m
	017860-0119	Packing, LT indicator cover, plastics		017860-0108	conster drum 30m
	70106017	Packing, rear cover, V6502, LT11/12/31/32	88 Tape drum	017860-5123	Tape drum, standard LT11
83 Indicator	017860-0220	Dial plate, 2.5m		017860-5124	Tape drum, crank up model LT11/12
	017860-0221	Dial plate, 5m	89 Tape drum bearing	52016945	Sintering bearing for tape drum
	017860-0222	Dial plate, 10m	90 Tape Negator	56004503	Negator spring, standard
	017860-0223	Dial plate, 16m	92 Sprocket shaft	017860-0111	Sprocket shaft assembly
	017860-0224	Dial plate, 20m	93 Sprocket	017860-0109	Sprocket wheel
	017860-0101	M & MM pointer assey., Level, Plastic	94 Union joint	017860-5440	Union joint steel 1-1/2
	56004406	M & MM pointer assembly, Volume, Aluminum	95 Drain plug	017860-0056	Drain plug 1/4 304
	71134097	M & MM pointer assembly, Level Aluminum	96 Gauge head nipple	70106005	Gauge head nipple SS LT11
84 Indicator gear assembly	017860-5401	Indication gear assembly, 2.5m	97 Check handle	017860-0113	Check unit assembly
	017860-5402	Indication gear assembly, 5m	98 Check handle crank up handle	017860-0206	Crank-up unit assembly
	017860-5403	Indication gear assembly, 10m			
	017860-5404	Indication gear assembly, 16m			
	017860-5405	Indication gear assembly, 20m			
	017860-5407	Counter assembly			
	017860-0001	Gear, d=97mm			

8.2.2 Gauge Head for LT14/LT16

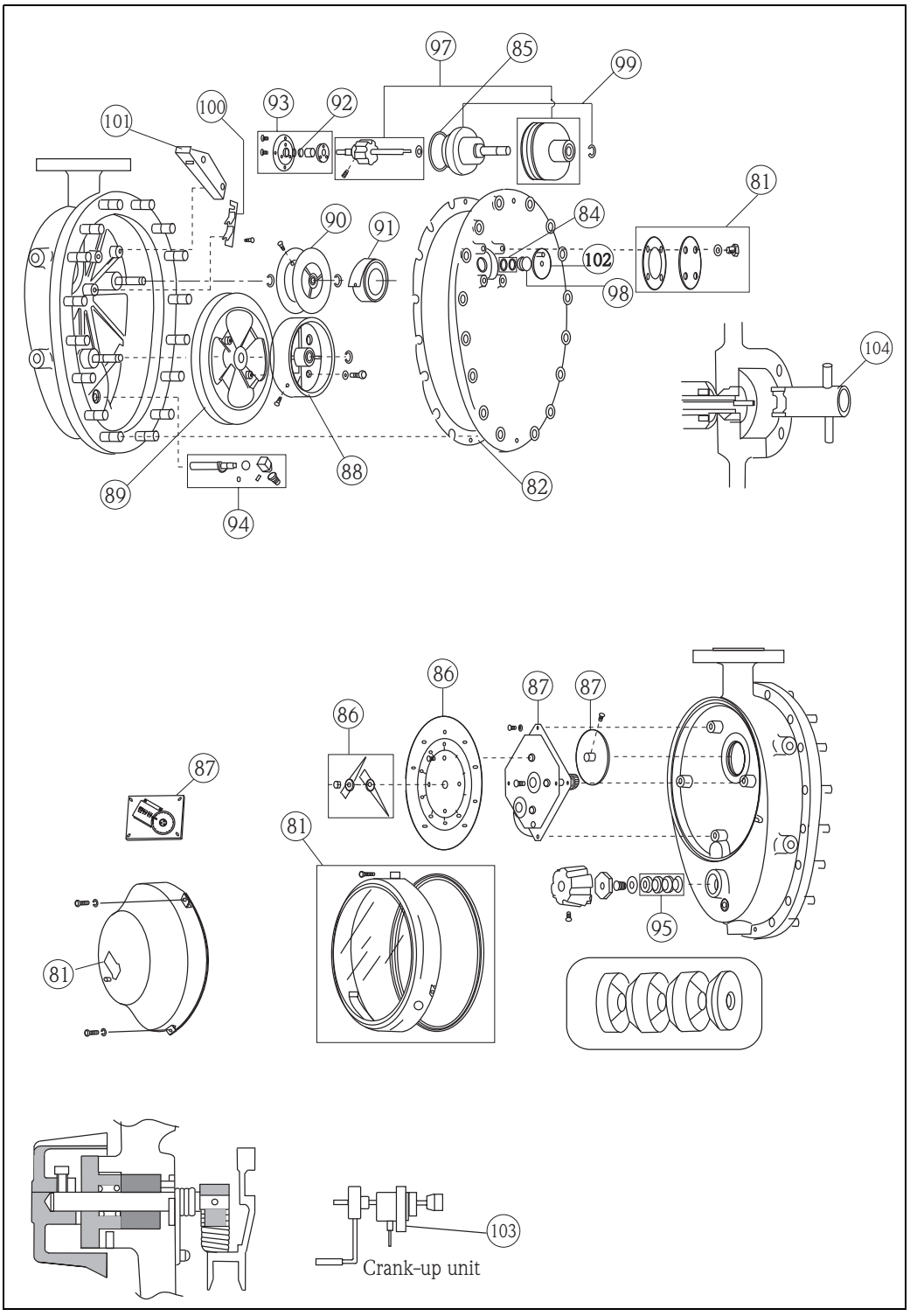


Figure 56: Gauge Head for LT14/LT16

Items	Parts No.	Parts Name	Items	Parts No.	Parts Name
81 Cover	017860-5222	Steel front cover assembly (LT1400/1600) Steel cover + glass window.	90 Conster drum small	017860-0107	Conster drum, 20m Drum, Aluminum casting
	56004288	Blind cover assembly SS D95xT1.5mm,Bolt,M10x16,washer,Packing.		017860-0108	Conster drum, 30m Drum, Aluminum casting
82 Packing rear cover	70103512	Packing, gauge head, LT16, 6502	91 Conster spring	52015582	Conster spring, 5m
	70103511	Packing, gauge head, LT14, 6502		017860-5033	Conster spring, 10m
84 O-ring PTFE small	017860-0319	Teflon o-ring Size: G4-10005. Material: PTFE. Part: Magnet coupling, small, LT14/16.		017860-5035	Conster spring, 20m (range 16m+20m)
85 O-ring PTFE large	017860-0320	Teflon O-ring Size: G4-10006. Part: Magnet coupling, large, LT14/16.		017860-5036	Conster spring, 30m
86 Indicator	017860-0220	Dial plate, 2.5m	92 Oil seal	017871-1227	Oil seal
	017860-0221	Dial plate, 5m	93 Bearing assembly	017860-0316	Bearing assembly
	017860-0222	Dial plate, 10m	94 Check shaft	56004299	Check shaft, medium/high pressure LT16
	017860-0223	Dial plate, 16m		017860-0322	Check shaft assembly
	017860-0224	Dial plate, 20m	95 Seal metal	017860-0326	Seal metal
	017860-0101	M & MM pointer assy., Level, Plastic	97 Sprocket magnet	70106492	Sprocket + Magnet set LT14, NBR (LPG)
87 Indicator gear train	017860-5401	Indication gear assembly, 2.5m		70106493	Sprocket + Magnet set LT14, CR (Ammonia)
	017860-5402	Indication gear assembly, 5m		70106490	Sprocket + Magnet set LT16, NBR (LPG)
	017860-5403	Indication gear assembly, 10m		70106491	Sprocket + Magnet set LT16, CR (Ammonia)
	017860-5404	Indication gear assembly, 16m	98 Gland holder	017860-0318	Gland holder
	017860-5405	Indication gear assembly, 20m	99 Magnet cover	56004407	Magnet cover LT14/34
	017860-5407	Counter assembly For 30m range.		017860-0311	Magnet cover, LT16/36
	017860-0001	Gear, d=97mm	100 Tape holder	56004503	Negater spring,Standard With screw, washer
88 Conster drum large	017860-0401	Conster drum, large, LT14/LT16	101 Dust protector	017860-0213	Dust protector
89 Tape drum	70106622	Tape drum, LT14/16 w/o hoist up	102 Coupling	017871-1232	Coupling,transmitter,LT14,LT16 Alu plate, with Nut,M4,washer,O-ring Stud,M10x37/17x10L,Nut,M10,Wasser,x4
	70106495	Tape drum, LT14/16 with hoist up	103 Check handle	56004390	Hoisting handle assembly
			104 Tool	017860-0004	Gland tightening tool

8.2.3 Sheave Elbow for LT11/LT12/LT14/LT16

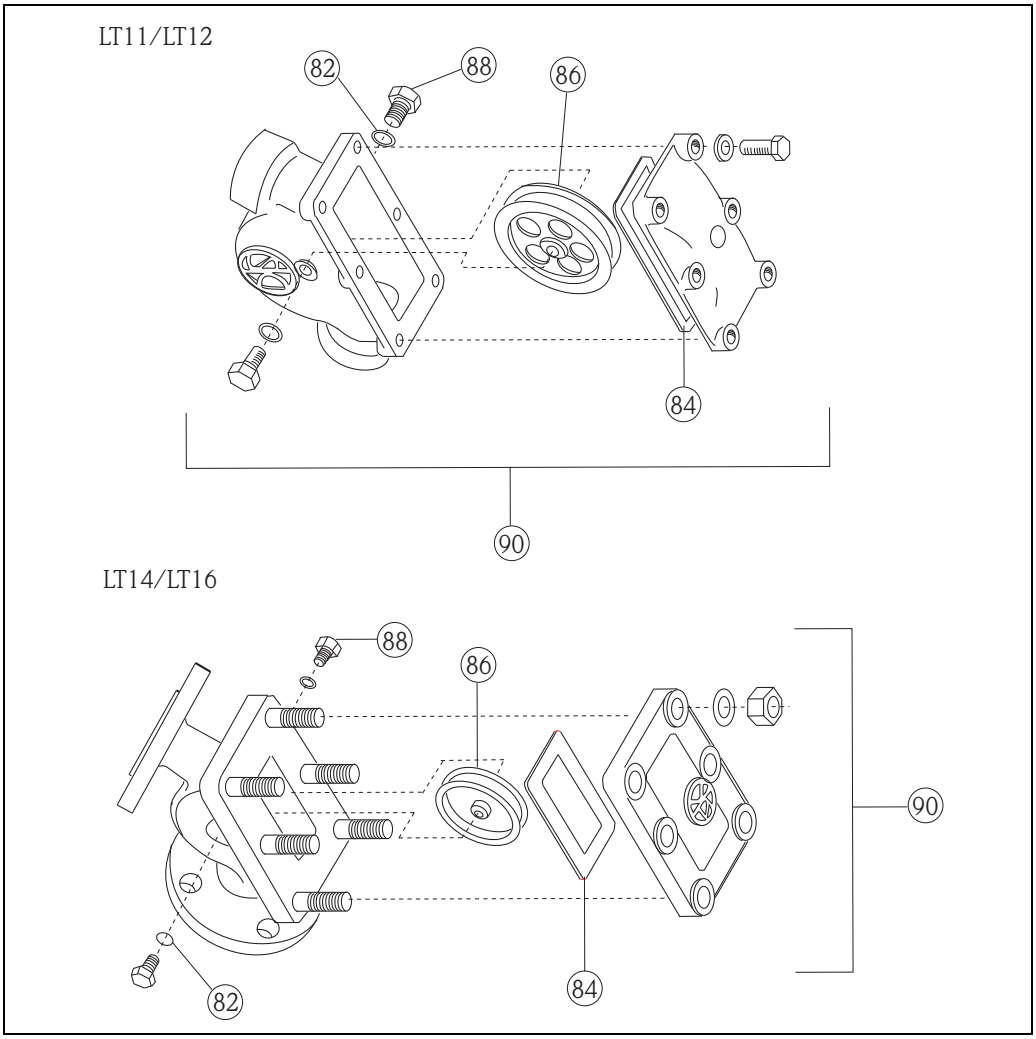


Figure 57: Sheave Elbows

Items	Parts No.	Parts Name	Items	Parts No.	Parts Name
82 O-ring	017860-0709	O-ring, > bearing, P8, LT11/12/31/32	88 Sheave elbow bearing	017860-1259	SUS316 bearing, O-ring, X2, LT11/12
	017860-0707	O-ring, bearing Teflon, LT16		017860-0706	Steel bearing (for LT-1600)
84 Packing	017860-0710	Packing, hiker cork (LT11/LT12)	90 Sheave elbow complete	017860-0018	Sheave elbow / alu/ ANSI316 roller 150#
	70106014	Packing, elbow middle pressure V6502		017860-0482	Sheave elbow alu/ SUS316, roller SUS316, 1-1/2
	70103509	Sheave elbow packing (LT16/6502)		017860-5445	Sheave elbow/ alu/ SS316 roller/1-1/2
	017860-0714	Packing, Teflon LT16		017860-0020	Sheave elbow casting steel 300# LT1600
86 Sheave elbow roller	017860-0704	SS316L roller		017860-0022	Sh.elbow 135dg, cast steel 300# LT1600
	017860-0705	SS316L roller (for LT-1600)			

8.2.4 Float and Measuring Tape for LT11/LT12/LT14/LT16

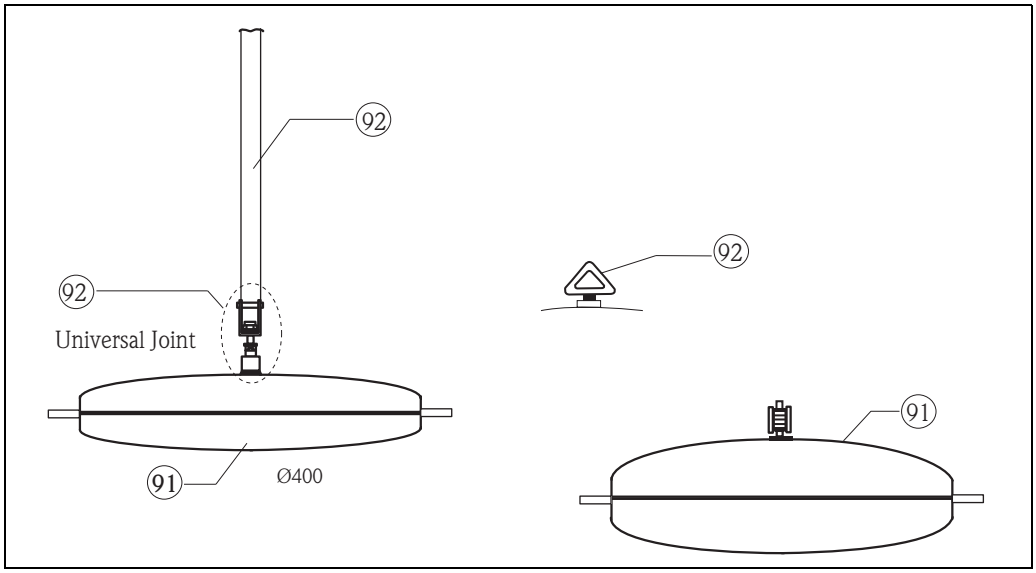


Figure 58: Float and Measuring Tape

Items	Parts No.	Parts Name	Items	Parts No.	Parts Name
91 Float	017860-7003	Float LF400 316 5kg	92 Measuring tape	017860-0007	Measuring tape, FRT 10m 1.6mm 316
	017860-7010	Float LF400 316 8kg		017860-0008	Measuring tape, FRT 10m 1.6mm 316 PTFE coated
	017860-7001	Float HF-400, 316		017860-5309	Measuring tape, FRT 20m
	017860-0016	Magnetic float 316		017860-0011	Measuring tape, FRT 20m 1.6mm 316
92 Measuring tape	56004412	Measuring tape, CRT 5m		017860-0012	Measuring tape, FRT 20m 1.6mm 316 PTFE coated
	017860-5302	Measuring tape, CRT 10m/ST 5m (L=24m)		017860-5310	Measuring tape, FRT 30m
	017860-5304	Measuring tape, CRT 20m/ST 16m (L=45m)		017860-0013	Measuring tape, FRT 30m 1.6mm 316
	017860-5305	Measuring tape, CRT 30m/ST 20m (L=65m)		017860-0014	Measuring tape, FRT 30m 1.6mm 316 PTFE coated
	017860-5210	Measuring tape, BT 30m		017860-0210	Universal joint
	017860-5306	Measuring tape, FRT 5m, L=7m		017860-0211	Triangle joint
	017860-0005	Measuring tape, FRT 5m 1.6mm wire, L=7m			
	017860-0006	Measuring tape, FRT 5m 1.6mm PTFE coated, L=7m			
	017860-5307	Measuring tape, FRT 10m L=12m			

8.2.5 Top Anchor for LT11/LT12/LT14/LT16

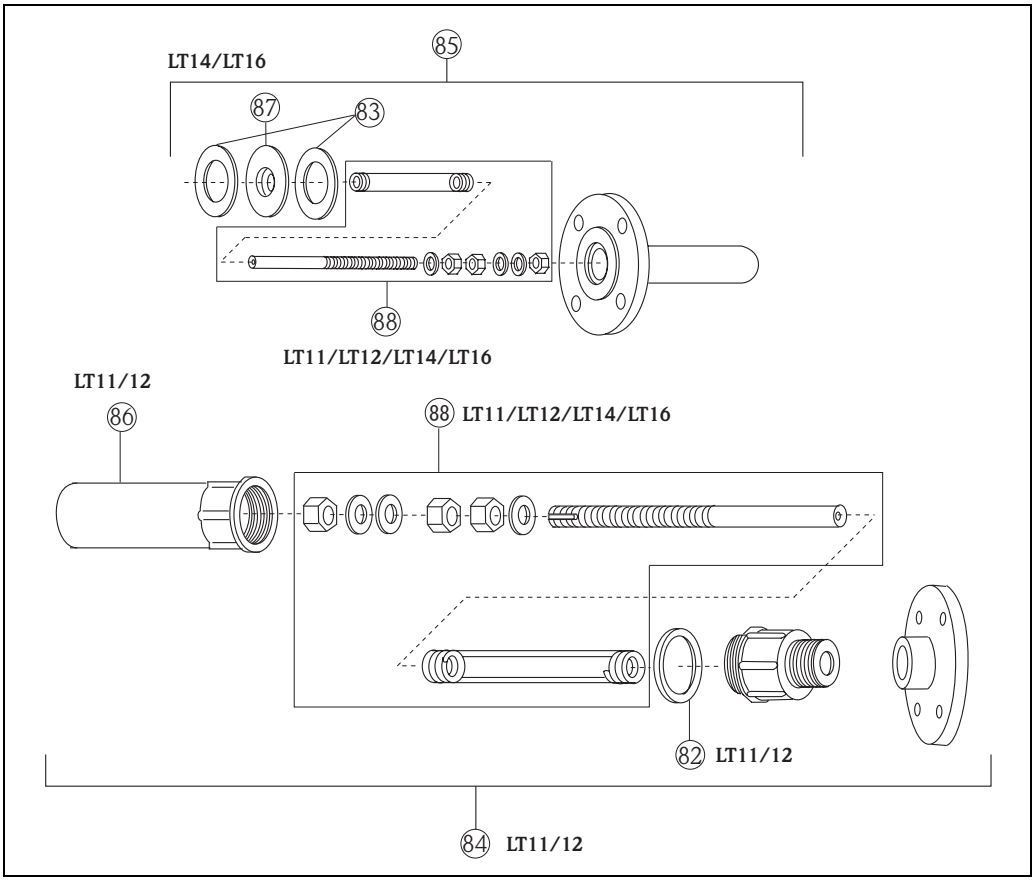


Figure 59: Top Anchor

Items	Parts No.	Parts Name	Items	Parts No.	Parts Name
82 Packing T-anchor low pressure	017860-0031	Packing, T-anchor, thread, Cork	85 Top anchor middle/high pressure	017860-0027	T-anchor cast st.shaft 300# 1.5" LT1600
83 Packing T-anchor middle/high pres.	70106003	Packing, t-anchor, JIS 10K, V6502	86 Top anchor housing	017860-0030	Housing Alu, 1" threaded
	70106012	Packing, t-anchor, ANSI 300lbs, V6502	87 Top anchor washer	70106494	Washer, T-anchor ANSI 150, SS304, D82
84 Top anchor low pressure	017860-0058	Top anchor, SUSI316 Weld-fixing		017860-5333	Spring holder, SS304,Hi,Press.
	017860-5471	Top anchor, Alu+316 shaft / spring, R1	88 Top anchor shaft	017860-0808	SS304 shaft
	017860-0820	Top anchor, SUS316 threaded R1			
	017860-0025	Top anchor, Alu, 316 shaft 150# 1.5"			
	017860-0026	Top anchor, 316 threaded 150# 1.5"			

8.2.6 Seal Pot for LT11/LT12, Measuring Wire, and Guide Wire for LT11/LT12/LT14/LT16

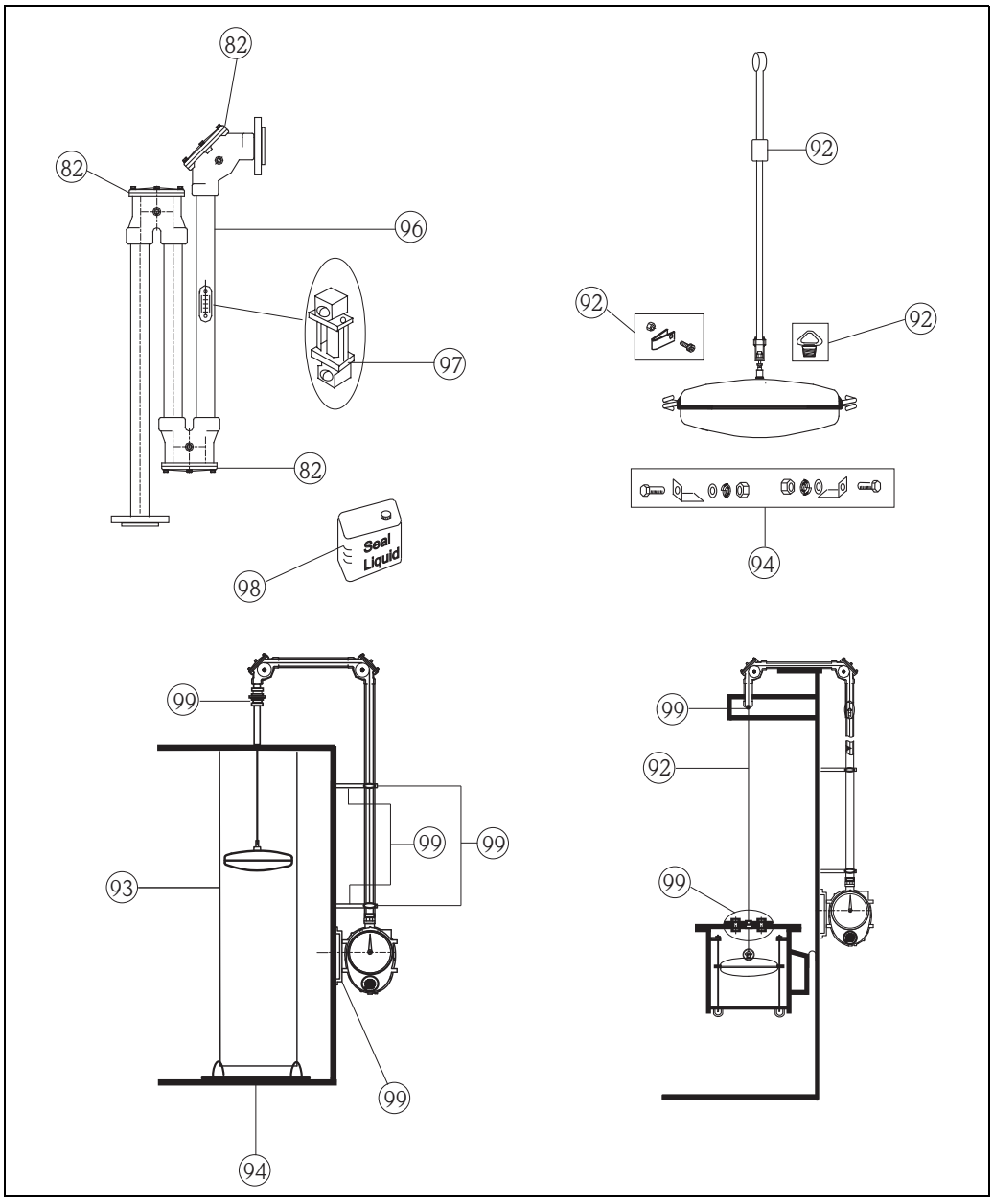


Figure 60: Seal Pot, Measuring Wire, and Guide Wire

Items	Parts No.	Parts Name	Items	Parts No.	Parts Name
82 Packing	70106015	Packing, elbow, low pressure, Cork	94 Anchor	017860-5441	Bottom anchor, SS400, bolt, nut steel
86 Sheave elbow roller	71134090	Seal pot, elbow roller, PVC		017860-5442	Bottom anchor, 316, bolt, nut steel
88 Sheave elbow bearing	71134091	Bearing x2, > seal pot, elbow roller		52016951	Bottom anchor, 316, bolt, nut PVC
92 Measuring wire & tape	017860-5501	Measuring wire, 316 5m		52016949	Bottom anchor, SS400, bolt, nut PVC
	017860-5502	Measuring wire, 316 10m	96 U seal pot	52017103	Seal pot, SGP/AC4A, Rp1-1/2
	017860-5503	Measuring wire, 316 16m		52017110	Seal pot, 316/316 Rp1-1/2
	017860-5504	Measuring wire, 316 20m		52017104	Seal pot, SGP//AC4A JIS 10K 40A RF
	017860-5505	Measuring wire, 316 30m		52017111	Seal pot, 316/316 JIS 10K 40A RF
	017860-5506	Measuring wire, PFA coated, 5m		52017100	Seal pot, PVC/PVC JIS 10K 40A FF
	017860-5507	Measuring wire, PFA coated, 10m		56004354	Cover elbow Alu, packing, plug
	017860-5508	Measuring wire, PFA coated, 16m		017860-0720	Oil gauge KL60
	017860-5509	Measuring wire, PFA coated, 20m		017860-5452	Seal liquid, paraffin, 2 liter
	017860-5510	Measuring wire, PFA coated, 30m	99 Accessory	071860-0045	Pipe support, steel
	56004310	Measuring wire, PFA coated, 60m		071860-0046	U-bolts for pipe support
	017860-5430	Tape clamp		071860-5420	Gauge bracket, steel
	017860-5432	Wire connector, triangle		071860-0044	Socket, 1-1/2 ANSI316
	017860-5431	Tape connector, square		017860-0721	Wire guide socket, FRT installation
93 Guide wire, hook, anchor	017860-5516	Guide wire, strand, 316, 14m			
	017860-5517	Guide wire, strand, 316, 24m			
	017860-5518	Guide wire, strand, 316, 36m			
	017860-5519	Guide wire, strand, 316, 44m			
	017860-5520	Guide wire, strand, 316, 64m			
	56004312	Guide wire, strand, 316, 124m			
	71134089	Guide wire, Strand, 316, 20m			
	017860-5464	Guide wire, Strand, PFA coated, 14m			
	017860-0047	Guide wire, Strand, PFA coated, 24m			
	017860-0048	Guide wire, Strand, PFA coated, 36m			
	017860-0049	Guide wire, Strand, PFA coated, 44m			
	017860-0050	Guide wire, Strand, PFA coated, 64m			
	56004314	Guide wire, Strand, PFA coated, 124m			
	017860-5521	Guide wire, solid, 316, 14m			
	017860-5522	Guide wire, solid, 316, 24m			
	017860-5523	Guide wire, solid, 316, 36m			
	017860-5524	Guide wire, solid, 316, 44m			
	017860-5525	Guide wire, solid, 316, 64m			

8.2.7 Gate Valve for LT14/LT16

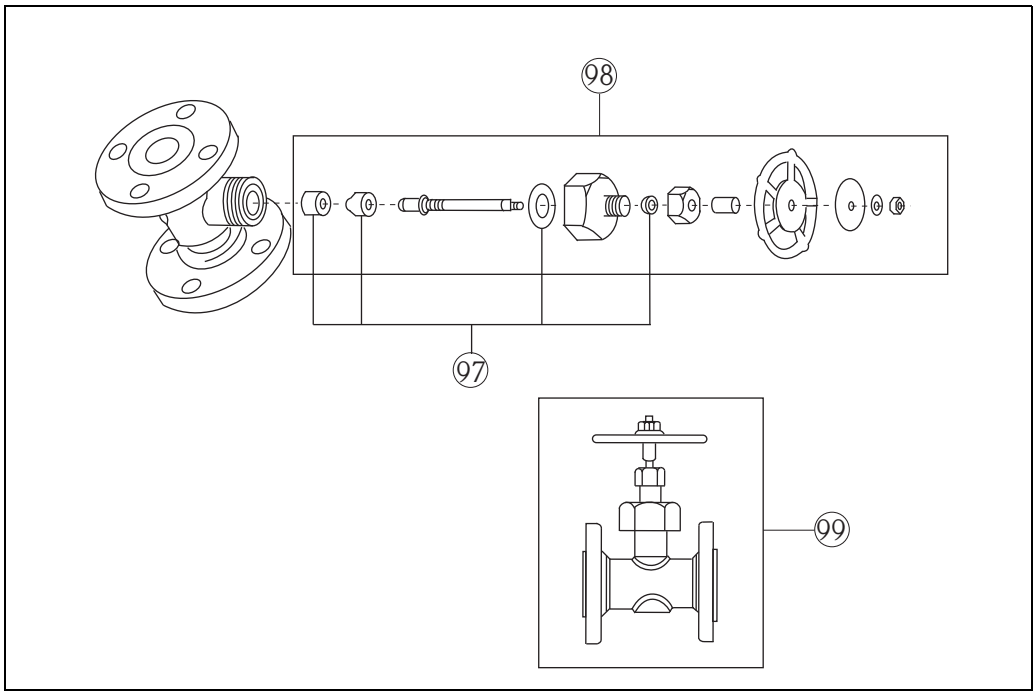


Figure 61: Gate Valve

Items	Parts No.	Parts Name
97 Accessory plug gate valve part	017860-0663	Teflon part assembly
98 Accessory plug gate valve handle	017860-5117	Handle assembly
99 Accessory plug gate valve	017860-0032	Valve Alum. housing, 150# 1-1/2" flanged ANSI 150lbs,RF,AC4CT6
	017860-0033	St.steel casting SCS13 150# 1.5" flanged ANSI 150lbs,RF,SCS13
	017860-0034	St.steel casting SCS13 300# 1.5" flanged ANSI 300lbs,RF,SCS13
	56004467	Plug gate valve housing Alu JIS JIS,10K,40A,RF,AC4CT6
	56004468	Plug gate valve housing SS JIS JIS,10K,40A,RF,SCS13.

8.3 Return

The following procedure must be performed before returning LT series to Endress+Hauser e.g. for repair or calibration.

- Remove all residue. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is corrosive, poisonous, carcinogenic, radioactive, or otherwise hazardous.
- Always enclose a duly completed "Declaration of Hazardous Material and De-contamination" form (a copy of the “Declaration of Hazardous Material and De-contamination” is included at the end of this operating manual). Only then can Endress+Hauser transport, examine, and repair a returned device.
- Enclose special handling instructions if necessary, for example a safety data sheet as per EN 91/155/EEC.

Additionally specify:

- An exact description of the application
- The chemical and physical characteristics of the instrument
- A short description of the error that occurred
- Operating time of the device

8.4 Disposal

In case of disposal, separate the various components according to their materials.

8.5 Contact Addresses of Endress+Hauser

The addresses of Endress+Hauser are given on the back cover of this operating manual. If you have any questions, do not hesitate to contact Endress+Hauser representative.

9 Technical Data

Items	Product Root	Measuring Range/Specification
Measuring Range	LT11/LT12/LT14/LT16	0 - 2.5, 5, 10, 16, 20, 30m
Accuracy	LT11/LT12/LT14/LT16	±2mm (Under the condition of; specific Density: 1g/cm^3,measuring range; 10m)
	LT11Application (060)...005,008	±30mm (Under the condition of; specific Density: 1g/cm^3,measuring range; 10m)
Maximum Operating Pressure	LT11 threaded type for low pressure	19.61kPa (0.2kgf/cm^2)
	LT12 flange type for low pressure	19.61kPa (0.2kgf/cm^2)
	LT14 flange type for medium pressure	98.07kPa (1kgf/cm^2)
	LT16 flange type for high pressure	2.45MPa (25kgf/cm2), *2.0MPa (in case of SUS304 bolt)
Operating Temperature Limits	LT11/LT12	Wetted parts: -200....+200°C Gauge head: -20....+70°C
	LT14/LT16	Wetted parts: -45~+80°C Gauge head: -20~+70°C
Display	LT11 threaded, low pressure	Dial display: two pointers or Counter (min. readable scale:1mm) *30m (only counter display) (LT 1 1 2 ☐)
	LT12 flange, low pressure	Dial display: two pointers or Counter (min. readable scale:1mm) *30m (only counter display) (LT 1 2 2 ☐)
	LT14 flange, medium pressure	Dial display: two pointers or Counter (min. readable scale:1mm) *30m (only counter display) (LT 1 4 2 ☐)
	LT16 flange, high pressure	Dial display: two pointers or Counter (min. readable scale:1mm) *30m (only counter display) (LT 1 6 2 ☐)
Process Connection	LT11 threaded, low pressure	Thread JISB0203 Rp1-1/2, w/o union nut Thread JISB0203 Rc1-1/2, union nut, sleeve, SUS316 Thread ANSI NPT1-1/2, union nut, sleeve, SUS316 Thread JIS B0202 G1-1/2, union nut, sleeve, SUS316
	LT12 flange, low pressure flange spec./material	10K 40A RF, AC4A, flange JIS B2220 10K 40A RF, SUS316, flange JIS B2220 1-1/2 150lbs RF, AC4A, flange ANSI B16.5 1-1/2 150lbs RF, SUS316, flange ANSI B16.5 40A 150lbs RF, AC4A, flange JPI 7S-15 40A 150lbs RF, SUS316, flange JPI 7S-15
	LT14 (flange, medium pressure) Flange spec./material	10K 40A RF, AC4CT6, JIS flange B2220 10K 40A RF, SCS13, JIS flange B2220 1-1/2 150lbs RF, AC4CT6, ANSI flange B16.5 1-1/2 150lbs RF, SCS13, ANSI flange B16.5 40A 150lbs RF, AC4CT6, JPI flange 7S-15 40A 150lbs RF, SCS13, JPI flange 7S-15
	LT16 (flange, high pressure) Flange spec./Gauge material/ Bolt material	10K 40A RF, SCPL1,SNB7, JIS flange B2220 20K 40A RF, SCPL1,SNB7, JIS flange B2220 10K 40A RF, SCS13,SUS304, JIS flange B2220 20K 40A RF, SCS13,SUS304, JIS flange B2220 20K 40A RF, SCS13,SNB7, JIS flange B2220 1-1/2 150lbs RF, SCPL1,SNB7, ANSI flange B16.5 1-1/2 300lbs RF, SCPL1,SNB7, ANSI flange B16.5 1-1/2 150lbs RF, SCS13,SUS304, ANSI flange B16.5 1-1/2 300lbs RF, SCS13,SUS304, ANSI flange B16.5 1-1/2 300lbs RF, SCS13,SNB7, ANSI flange B16.5 40A 150lbs RF, SCPL1,SNB7, JPI flange 7S-15 40A 300lbs RF, SCPL1,SNB7, JPI flange 7S-15 40A 150lbs RF, SCS13,SUS304, JPI flange 7S-15 40A 300lbs RF, SCS13,SUS304, JPI flange 7S-15 40A 300lbs RF, SCS13,SNB7, JPI flange 7S-15

Items	Product Root	Measuring Range/Specification
Coupling (gauge head and display)	LT11 threaded, low pressure	Shaft (oil seal)
	LT12 flange, low pressure	Shaft (oil seal)
	LT14 (flange, medium pressure)	Pressure Bulkhead Magnet Coupling
	LT16 (flange, high pressure)	Pressure Bulkhead Magnet Coupling
Total Weight/ Painting Color	LT11 threaded, low pressure	Approx. 15kg, silver
	LT12 flange, low pressure	Approx. 15kg, silver
	LT14 (flange, medium pressure)	Approx. 22kg, silver
	LT16 (flange, high pressure)	Approx. 100kg, silver

Items	Ø400 (mm)	Weight	ρ : Liquid Ddensity (g/cm^3)
Float	Low Pressure	4.2kg	$0.5 \leq \rho < 0.65$
	Low Pressure	5.0 kg	$0.65 \leq \rho < 1.05$
	Low Pressure	8.0 kg	$1.05 \leq \rho < 2.0$
	High Pressure	8.3 kg	$0.5 \leq \rho < 0.7$
	Ø140 (mm)	**Weight**	**ρ : Liquid Ddensity (g/cm^3)**
	Low Pressure	2.1 kg	$0.5 \leq \rho < 0.94$
	Low Pressure	2.4 kg	$0.94 \leq \rho < 2.0$

Endress+Hauser

People for Process Automation

Declaration of Hazardous Material and De-Contamination

Erklärung zur Kontamination und Reinigung

RA No. ☐☐☐☐☐☐☐

Please reference the Return Authorization Number (RA#), obtained from Endress+Hauser, on all paperwork and mark the RA# clearly on the outside of the box. If this procedure is not followed, it may result in the refusal of the package at our facility.
Bitte geben Sie die von E+H mitgeteilte Rücklieferungsnummer (RA#) auf allen Lieferpapieren an und vermerken Sie diese auch außen auf der Verpackung. Nichtbeachtung dieser Anweisung führt zur Ablehnung ihrer Lieferung.

Because of legal regulations and for the safety of our employees and operating equipment, we need the "Declaration of Hazardous Material and De-Contamination", with your signature, before your order can be handled. Please make absolutely sure to attach it to the outside of the packaging.
Aufgrund der gesetzlichen Vorschriften und zum Schutz unserer Mitarbeiter und Betriebseinrichtungen, benötigen wir die unterschriebene "Erklärung zur Kontamination und Reinigung", bevor Ihr Auftrag bearbeitet werden kann. Bringen Sie diese unbedingt außen an der Verpackung an.

Type of instrument / sensor
Geräte-/Sensortyp _____

Serial number
Seriennummer _____

☐ **Used as SIL device in a Safety Instrumented System** / Einsatz als SIL Gerät in Schutzeinrichtungen

Process data/Prozessdaten
Temperature / Temperatur_____ [°F] _____ [°C]
Pressure / Druck _____ [psi] _____ [Pa]
Conductivity / Leitfähigkeit _____ [µS/cm]
Viscosity /Viskosität _____ [cp] _____ [mm²/s]

Medium and warnings
Warnhinweise zum Medium

	Medium /concentration Medium /Konzentration	Identification CAS No.	flammable entzündlich	toxic giftig	corrosive ätzend	harmful/ irritant gesundheits-schädlich/ reizend	other * sonstiges*	harmless unbedenklich
Process medium / Medium im Prozess								
Medium for process cleaning / Medium zur Prozessreinigung								
Returned part cleaned with / Medium zur Endreinigung								

* explosive; oxidising; dangerous for the environment; biological risk; radioactive
* explosive;brandfördernd; umweltgefährlich; biogefährlich; radioaktiv

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.
Zutreffendes ankreuzen; trifft einer der Warnhinweise zu, Sicherheitsdatenblatt und ggf. spezielle Handhabungsvorschriften beilegen.

Descriptio n of failure / Fehlerbeschreibung _____

_____

_____

Company data / Angaben zum Absender

Company /Firma _____

_____

Address / Adresse

_____

_____

Phone number of contact person / Telefon-Nr. Ansprechpartner:

_____

Fax / E-Mail _____

Your order No. / Ihre Auftragsnr. _____

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge.We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."
"Wir bestätigen, die vorliegende Erklärung nach unserem besten Wissen wahrheitsgetreu und vollständig ausgefüllt zu haben. Wir bestätigen weiter, dass die zurückgesandten Teile sorgfältig gereinigt wurden und nach unserem besten Wissen frei von Rückständen in gefahrbringender Menge sind."

_____ (place, date / Ort, Datum)

_____ Name, dept./Abt. (please print /bitte Druckschrift)

_____ Signature / Unterschrift

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Fuefuki-shi Yamanashi,
406-0846 Japan

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