Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating Instructions

Float Tank Gauge LT1100/1200

BA1002N/08/en/05.08
70105556

Endress+Hauser

People for Process Automation

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1 Safety instructions

1.1 Designated use

The Float Tank Gauge LT1100/1200 have been developed for use 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.
Typical application:
- Level indication of petroleum products such as crude oil, kerosene, light and heavy oil, vegetable oil, palm oil, seed oil and animal oil.
- Highly viscous liquid such as asphalt
- Certain chemicals (corrosive/toxic vapor can be sealed using liquid seal pot)

1.2 Installation, commissioning and operation

- Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility.
- Personnel must absolutely and without fail read and understand this Operating Instructions before carrying out its instructions.
- The instrument may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed without fail.
- The installer must make sure that the measuring system is correctly wired according to the wiring diagrams. The measuring system is to be grounded.
- Please observe all provisions valid for your country and pertaining to the opening and repairing of electrical devices.

Caution!

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

1.3 Return

The following procedures must be carried out before the instruments is sent to Endress+Hauser for repair:
- Always enclose a duly completed "Declaration of Contamination" form. Only then can Endress +Hauser transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example, safety data sheet as per EN 91/155/EEC.
- Remove all residue which may be present. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is dangerous to health, e.g. corrosive, poisonous, carcinogenic, radioactive, etc.

A copy of the "**Declaration of Contamination**" is included at the end of this operating manual.

Caution!

- No instrument should be sent back for repair without all dangerous material being completely removed first, e.g. in scratches or diffused through plastic.
- Incomplete cleaning of the instrument may result in waste disposal or cause harm to personnel (burns, etc.). Any costs arising from this will be charged to the operator of the instrument.

1.4 Disposal

In case of disposal, please separate the different components according to their material consistency.

1.5 Notes on safety conventions and symbols

In order to highlight safety-relevant or alternative operating procedures in the manual, the following conventions have been used, each indicated by a corresponding symbol in the margin.

Safety conventions	
	Warning! A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the instrument
	Caution! Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument
	Note! A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned

2 Identification

2.1 Device designation

2.1.1 Nameplate

The following technical data are given on the instrument nameplate:

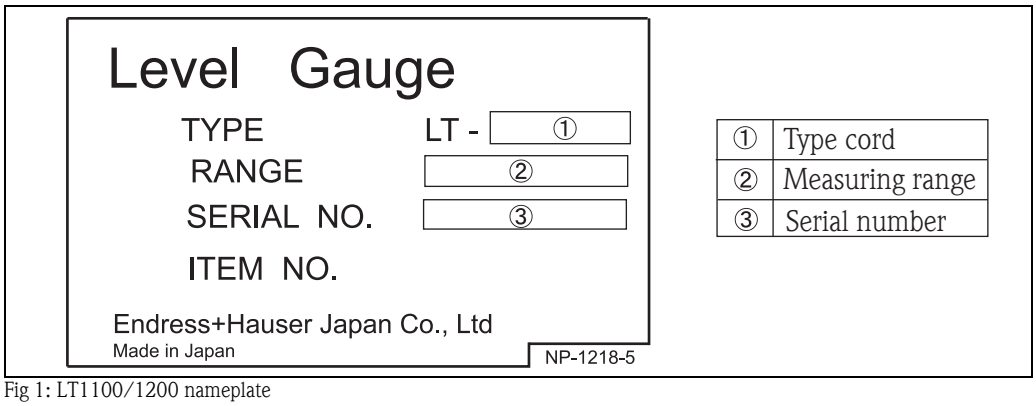


Fig 1: LT1100/1200 nameplate

2.2 Product structure

2.2.1 LT1100 (LT11)

010	**Display:**						
	1	Dial 2 pointers					
	2	Numeric (mechanical counter)					
	5	Dial 2 pointers, up side down					
	9	Special version					
020		**Crank Unit:**					
		0	Not selected				
		1	used				
		9	Special version				
030			**Function:**				
			0	Basic version			
			9	Special version			
040				**Process Connection:**			
				0	PS1-1/2", w/o union nut		
				A	PT1-1/2", union nut + sleeve, SUS316		
				B	NPT1-1/2", union nut + sleeve, SUS316		
				C	G(PF)1-1/2", union nut + sleeve, SUS316		
				9	Special version		
050					**Measuring Range:**		
					1	2.5m	
					2	5m	
					3	10m	
					4	16m	
					5	20m	
					6	30m (numeric display only)	
					9	Special measuring range	
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)
LT11-							Product designation (part 1)

070								**Float:**	
							1	4.2 kg , d = 400mm, lid. density 0.5≤ρ≤0.65	
							2	5.0 kg , d = 400mm, lid. density 0.65≤ρ≤1.05	
							3	8.0 kg , d = 400mm, lid. density 1.05≤ρ≤2.00	
							4	Not selected	
							5	2.1 kg , d = 140mm, lid. density 0.5≤ρ≤0.94	
							6	2.4 kg , d = 140mm, lid. density 0.94≤ρ≤2.00	
							9	Special version	
080								**Additional Option; Color:**	
							0	Basic version; Silver	
							C	No copper; Silver	
							D	Glass display cover; silver	
							J	No copper + glass display cover; Silver	
							9	Special version	
LT11-									Completed product designation

2.2.2 LT1200 (LT12)

010	**Display:**	
	1	Dial 2 pointers
	2	Numeric (mechanical counter)
	5	Dial 2 pointers, up side down
	9	Special version

020	**Crank Unit:**	
	0	Not selected
	1	Integrated in gauge head
	9	Special version

030	**Function:**	
	0	Basic version
	9	Special version

040	**Process Connection:**	
	1	flange JIS 10K 40A RF
	2	flange ANSI 1-1/2" 150lbs RF
	3	flange JPI 1-1/2" 150lbs RF
	A	flange JIS 10K 40A RF / SUS316
	B	flange ANSI 1-1/2" 150lbs RF / SUS316
	C	flange JPI 1-1/2" 150lbs RF / SUS316
	9	Special version

050	**Measuring Range:**	
	1	2.5m
	2	5m
	3	10m
	4	16m
	5	20m
	6	30m (numeric display only)
	9	Special measuring range

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 install + 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)

LT12-	Product designation (part 1)

070		**Float:**
	1	4.2 kg , d = 400mm, lid. density 0.5≤ρ≤0.65
	2	5.0 kg , d = 400mm, lid. density 0.65≤ρ≤1.05
	3	8.0 kg , d = 400mm, lid. density 1.05≤ρ≤2.00
	4	Not selected
	9	Special version

080		**Additional Option; Color:**
	0	Basic version; Silver
	C	No copper; Silver
	D	Glass display cover; silver
	J	No copper + glass display cover; Silver
	9	Special version

LT12-	Complete product designation

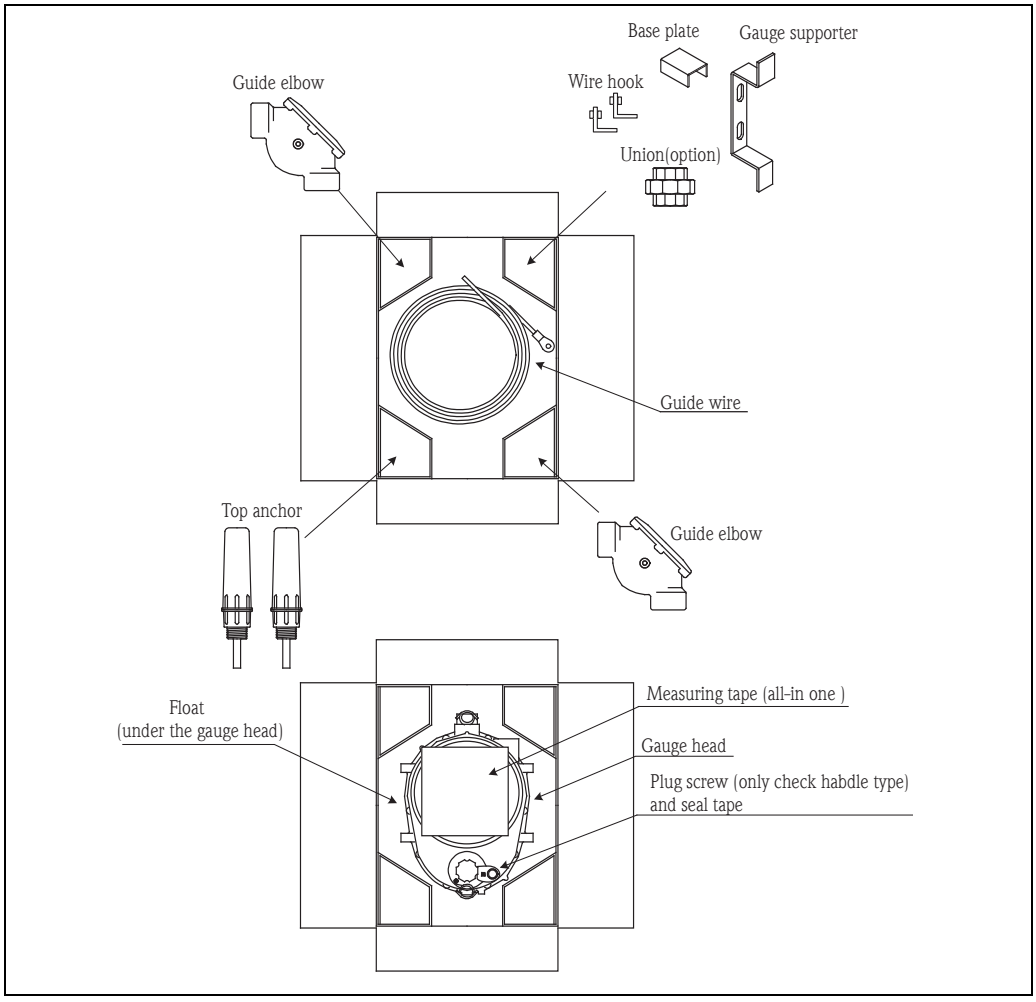
2.3 Scope of delivery

Following products is delivered as standard items.

Item	Unit	Item	Unit
Gauge head	1	Guide wire*	2
Measuring tape	1	Wire hook*	2
Float	1	union (option)	1
90 guide elbow*	2	Seal tape*	1
Top anchor*	2	Plug screw (only check handle type)*	1
Gauge supporter*	1		

*Delivered Items depend on your specification. Please refer to appropriate KIT code table on 21~28 page.

2.3.1 Typical packing layout in carton



Note!
In case of flange type, guide elbow is delivered by separate packing.

2.4 Supplied documentation

Document	Designation	Content/Remarks
BA 1002N	Operating Instruction	describes installation, commissioning operating and maintenance of the LT1100/1200.

2.5 CE marks, declaration of conformity

The instrument is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The instrument complies with the applicable standards and regulations in accordance with EN 50014 “Electrical apparatus for potentially explosive atmospheres-General requirements”. The instrument described in this manual thus complies with the statutory requirements of the EG directives. Endress+Hauser confirms the successful testing of the instrument by affixing to it the CE mark.

3 Installation

3.1 Incoming acceptance, transport, storage

3.1.1 Incoming acceptance

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

3.1.2 Transport

Follow the safety instructions and transport conditions for instruments of more than 18 kg.

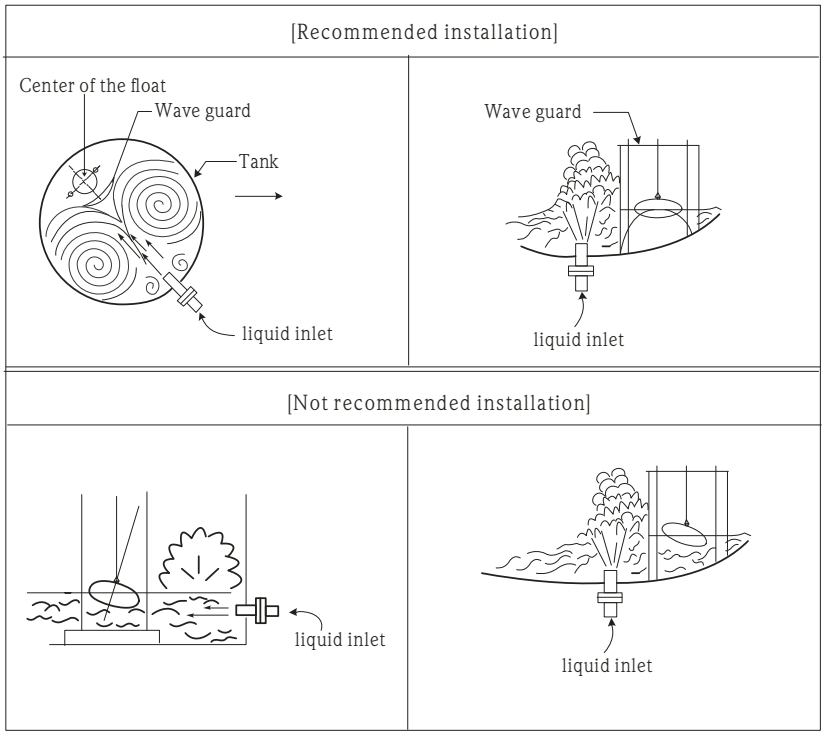
3.1.3 Storage

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

3.2 Installation location

Note!
The LT 1100/1200 gauge head should be installed in a place where it is easy to read the scale.

Caution!
Tank enough space between the liquid inlet, agitator, and the float. Make sure the fluid entering the tank will not hit the float directly.
If it is inevitable to install a float where it is facing the liquid inlet, setup a shield in front of the float so that the wave will not directly hit the float.

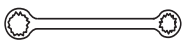
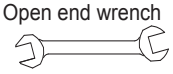
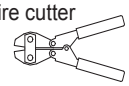
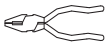
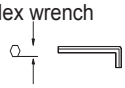
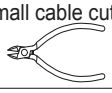
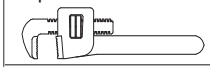


3.3 Installation tool

When installing LT1100/1200, please prepare the following tools.

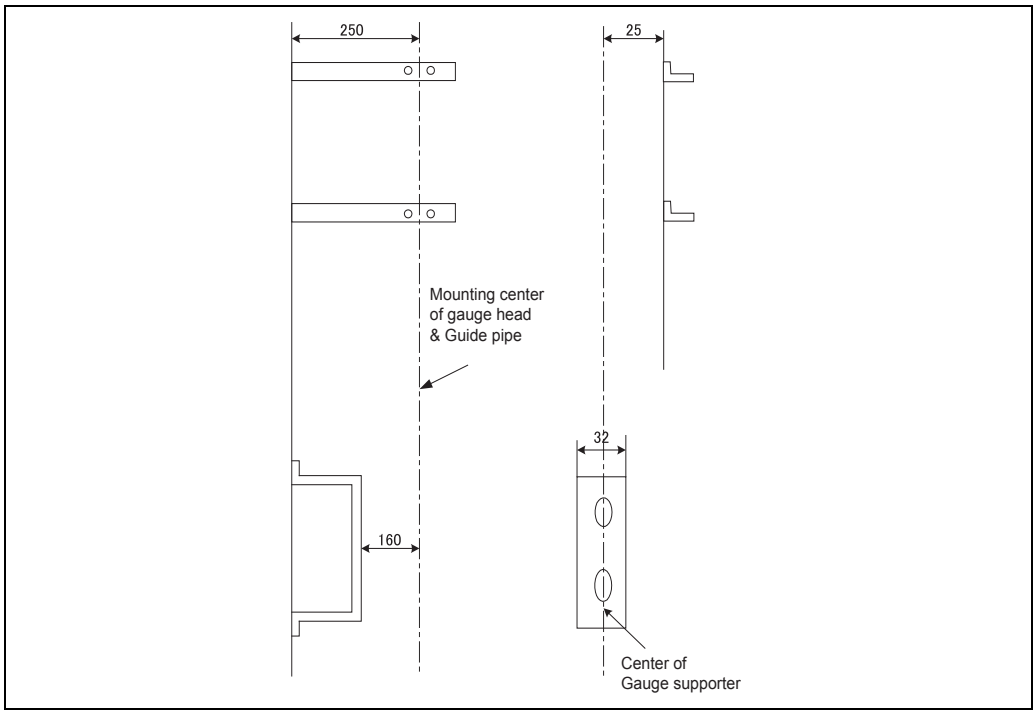
Recommended tool for the installation

● :Use on tank top
○ :Use at ground level
◎ :Use at both location
– :Not in use

Tool	Usage	LT1110 LT1120	LT1111 LT1121	LT1210 LT1220	LT1211 LT1221
Box end wrench 	13mm : Guide elbow lid removal & reinstall	●	●	●	●
	17mm : Gauge head installation	○	○	○	○
	21mm : ANSI flange installation, W 1/2 (bolt & nut) x2 24mm : JIS flange installation, M16 (bolt & nut) x2	—	—	◎	◎
Open end wrench 	19mm : Tighten guide wire bolt & nut (in top anchor), compressing tension spring	●	●	●	●
Water pump plyer 	Bigger than 250mm : Install Top anchor (threaded type LT1100)	●	●	—	—
Wire cutter 	Trim guide wire for the appropriate length	●	●	●	●
Weight 	M6 nut x2 - 4, use them for guiding installation messenger string, They must go through 14mm inner pipe diameter	○	○	○	○
Philips screw driver 	▪ Measuring tape clump tool installtion ▪ Tape drum lock screw removal (with crank handle option) ▪ Counter type display adjustment	○	○	○	○
Box end driver 	5.5mm : Measuring tape clump tool installtion Dial type display adjustment	○	○	○	○
	8mm : Removal & reinstall display cover	○	○	○	○
Plier 	Tightening measuring clump tool	○	○	○	○
Metal scissors 	Trim measuring tape	○	○	○	○
Hex wrench 	5mm : Blind plug installtion (check handle type)	○	—	○	—
Small cable cutter 	Cut Zip tight (crank handle option)	—	○	—	○
Pipe wrench 	Must be 600mm or more: Gauge head installation for guide pipe	○	○	—	—

3.4 Welding for Gauge supporter and pipe supporter

When weld Gauge supporter and pipe supporter, please refer to the below drawing.

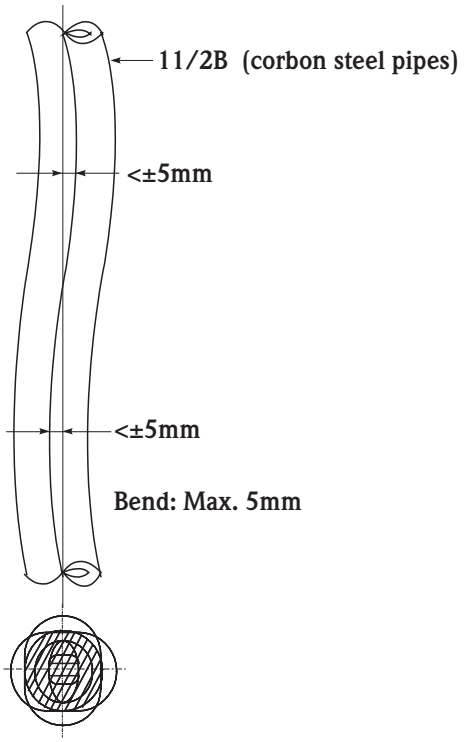


3.5 Guide Pipe

3.5.1 Guide pipe material and installation

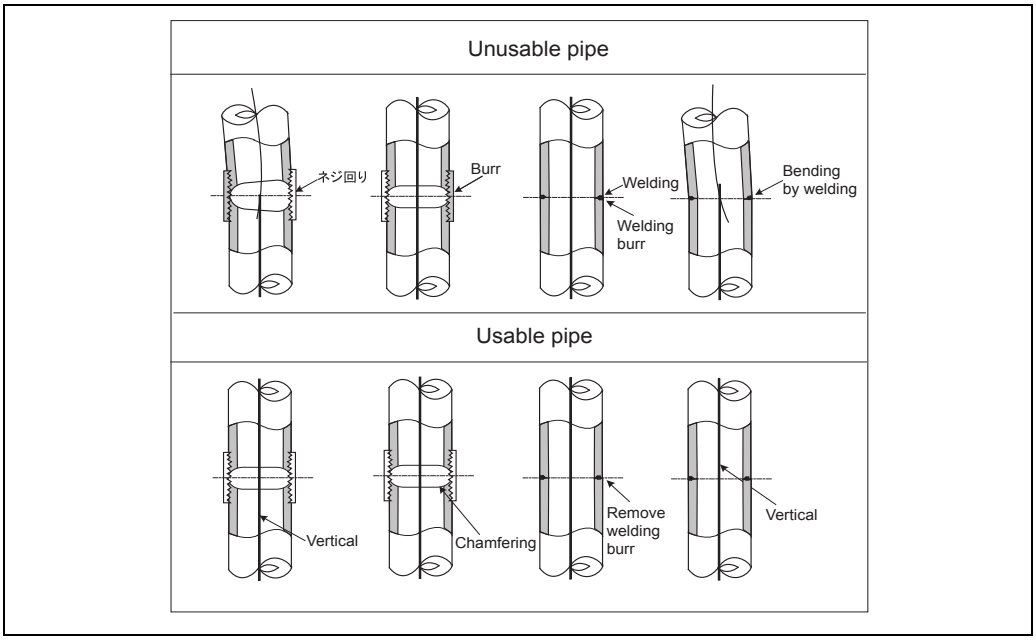
Pipe work would be required most of installation except some tank top or under ground applications. Basic pipe materials in three section (gauge head to elbow, elbow to elbow, and elbow to tank roof) and pipe support materials are normarlly out of Endress +Hauser's supply.

Caution!
- When choosing pipes, select either zinc plate or stenless steel material.
- If you are using on extremely corrosive substance, use either completed plating or adhesive lining.



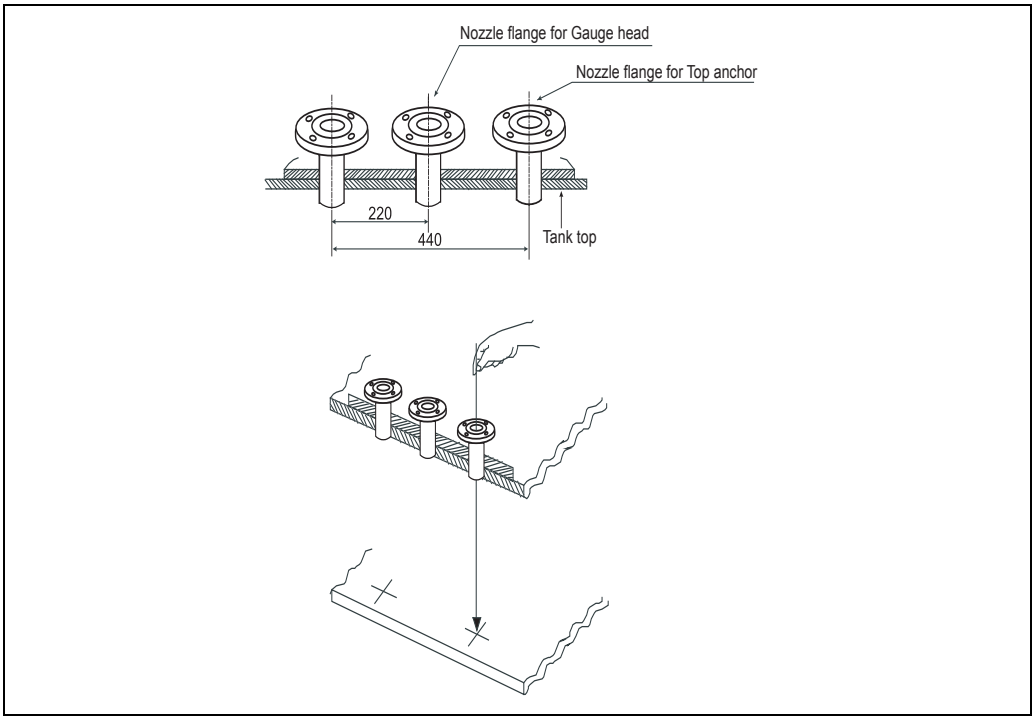
3.5.2 Guide Pipe connection

- Make sure to remove all the welding or cut off particles inside of the pipe.
- Use activated sealing, in order to maintain the airtight state in the locations such as flange connection points.



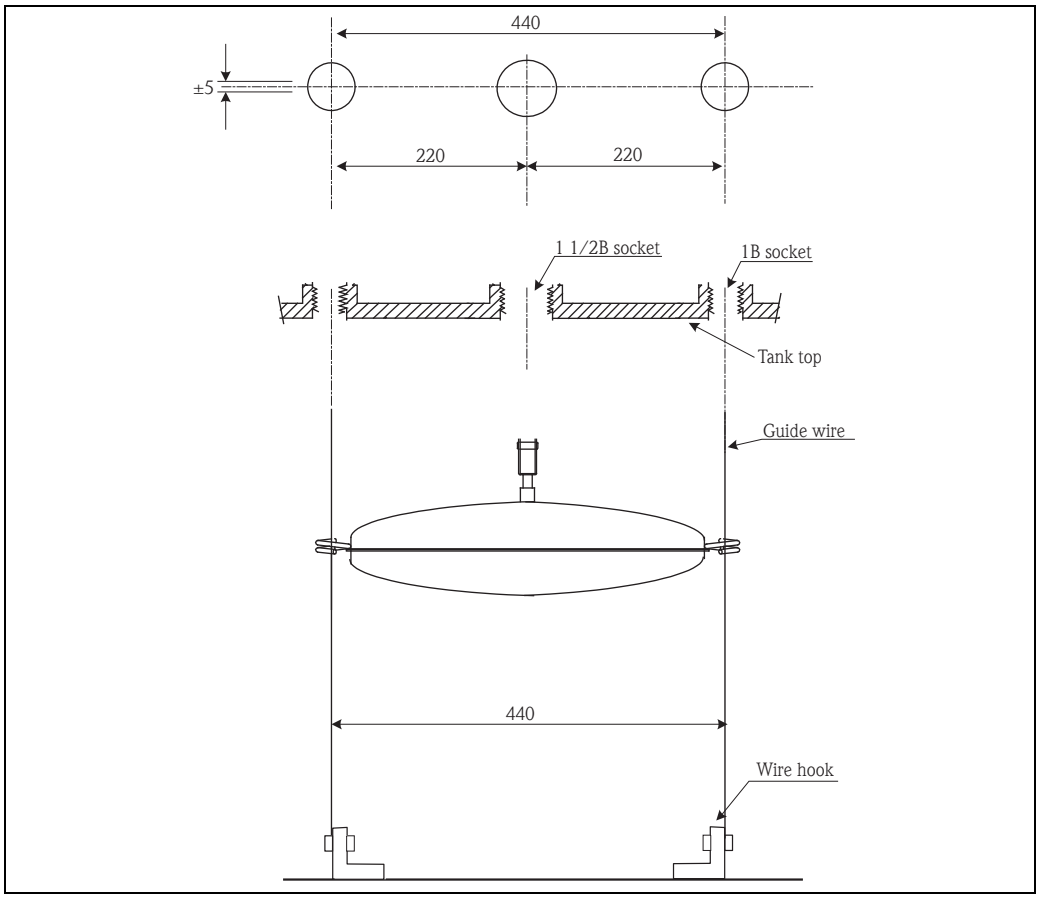
3.6 Top anchor, hook & base plate set up location

LT1200 (flange connection)



*In case of LT1100, process connection uses a socket instead of a flange.

LT1100 (threaded connection)



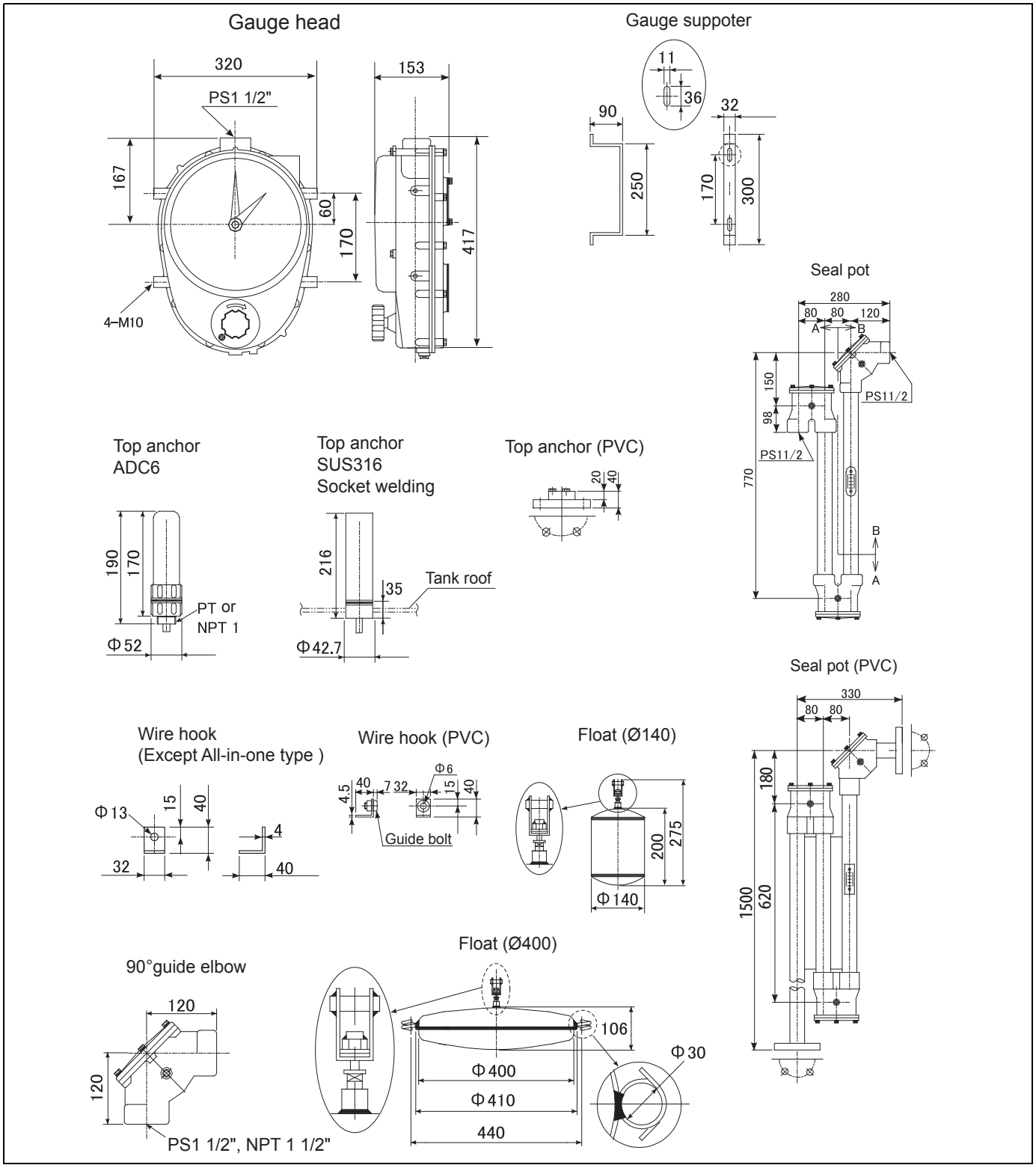
*In case of LT1200, process connection uses a flange instead of a socket.

3.7 Installation condition

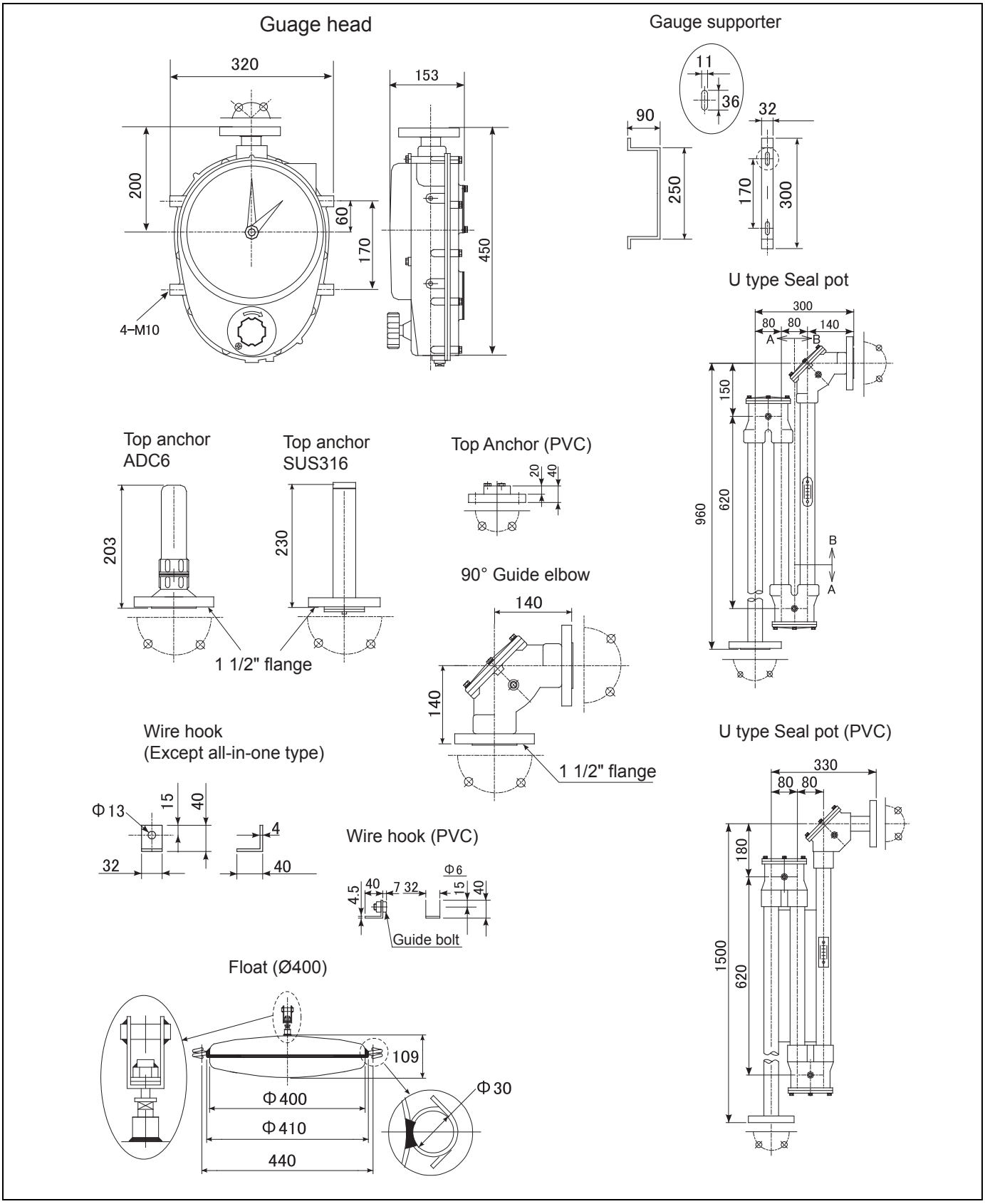
3.7.1 Dimensions,

3.7.1.1 LT1100 (threaded type)

Process connection for guide elbow and top anchor depends on specification of “Order information / process connection (gauge head)/ 040".
But the threaded connection is as follows. When selecting the threaded PS, PT, G(PF), guide elbow is PS, top anchor is PT. When selecting the threaded NPT, both guide elbow and top anchor are NPT.



3.7.1.2 LT1200 (low pressure flange type)

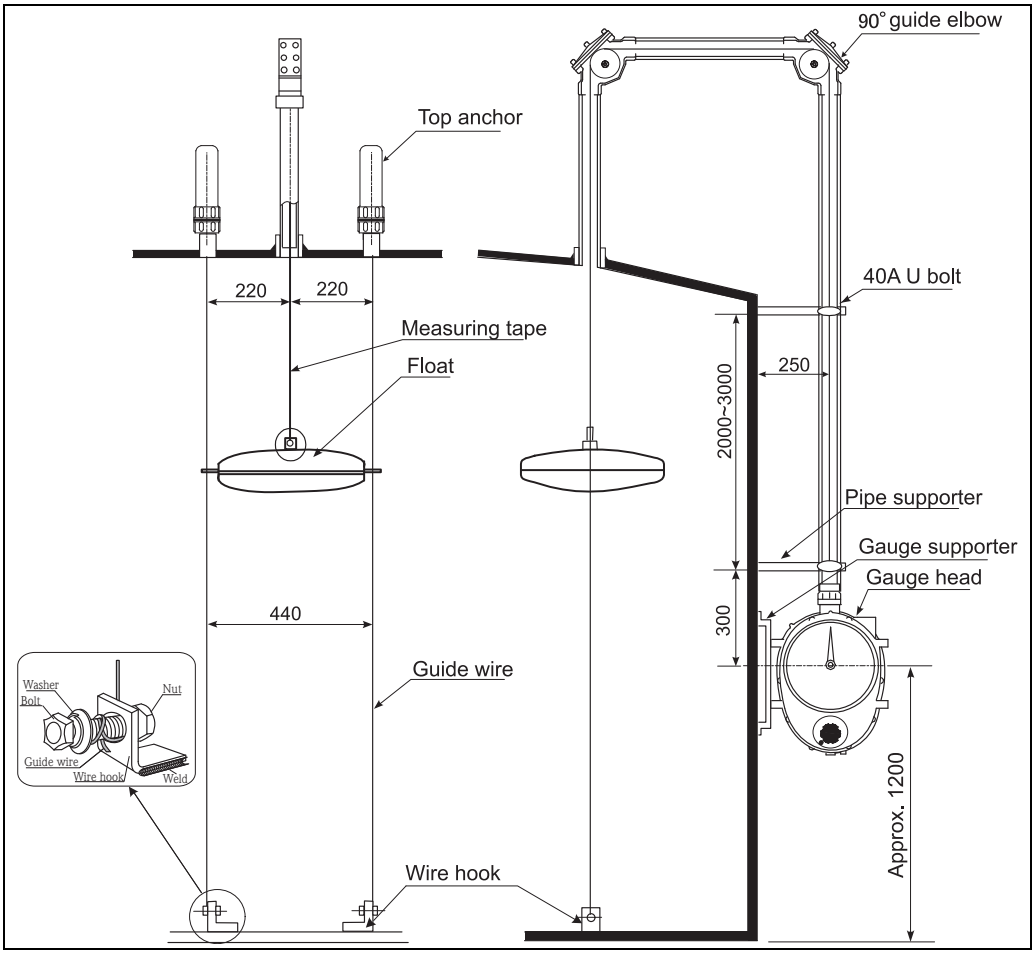


3.8 Installation reference drawing and Kit code

3.8.1 Coneroof tank (CRT)

In LT1200, Gauge head, Guide elbow and Top ancher are connected with flange.

Process connection for guide elbow and top anchor depends on specification of "Order information / process connection (gauge head) / 040".
But the threaded connection is as follows.
When selecting the threaded PS, PT or G(PF), guide elbow is PS and top anchor is PT.
When selecting the threaded NPT, both guide elbow and top anchor are NPT.



Application (060)

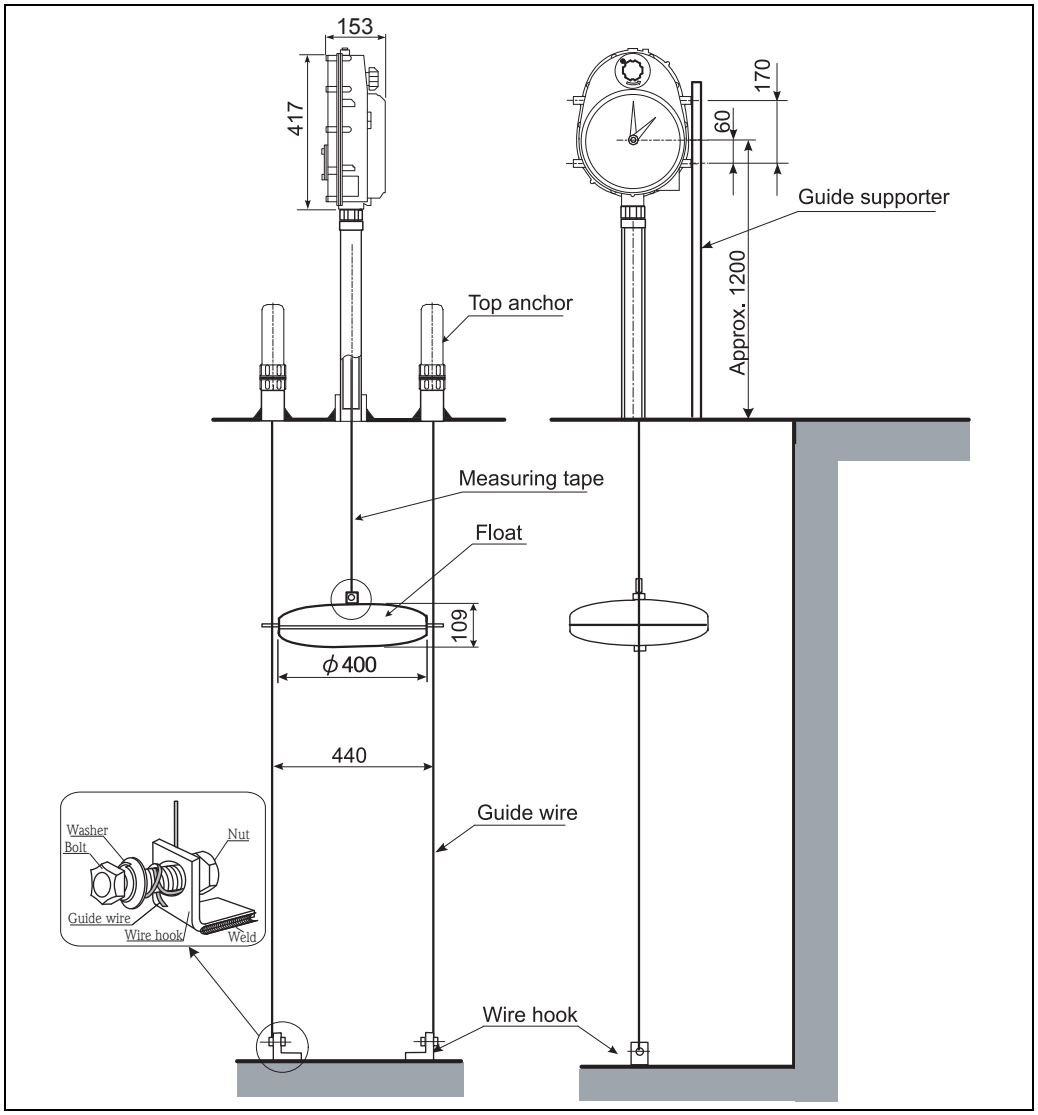
LT1100		Wetted parts : SS400	Wetted parts : SUS316	Wetted parts:SUS316, Top anchor:SUS316
Application	without Crank unit	A01	A04	A06
	with Crank unit	B01	B04	B06
	Guide wire	Single wire	Single wire	Single wire
Item		**Material/Qty**	**Material/Qty**	**Material/Qty**
Guage head (threaded 11/2")		Outer coating : ADC12/1	Outer coating : ADC12/1	Outer coating : ADC12/1
90°guide 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 coatingADC6 / Inner coating SUS316 (threaded1")/2	All SUS316 (Socket weld type)/2
Float Φ400		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
Wire hook		SS400/2	SUS316/2	SUS316/2

LT1200		Wetted parts : SS400	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/Qty**	**Material/Qty**	**Material/Qty**
Guage head (flange11/2")		Outer coating : ADC12/1	Outer coating : ADC12/1	Outer coating : ADC12/1
90°guide 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 Φ400		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
Wire hook		SS400/2	SUS316/2	SUS316/2

3.8.2 Tank top mount [Undergraund tank]

In LT1200, guide head and top anchor are connected with flange.

Process connection for top anchor depends on specification of "Order information / Process connection (gauge head) / 040".
But the threaded connection is as follows.
When selecting the threaded PS, PT or G(PF), top anchor is PT and when selecting the threaded NPT, top anchor is NPT.



Application (060)

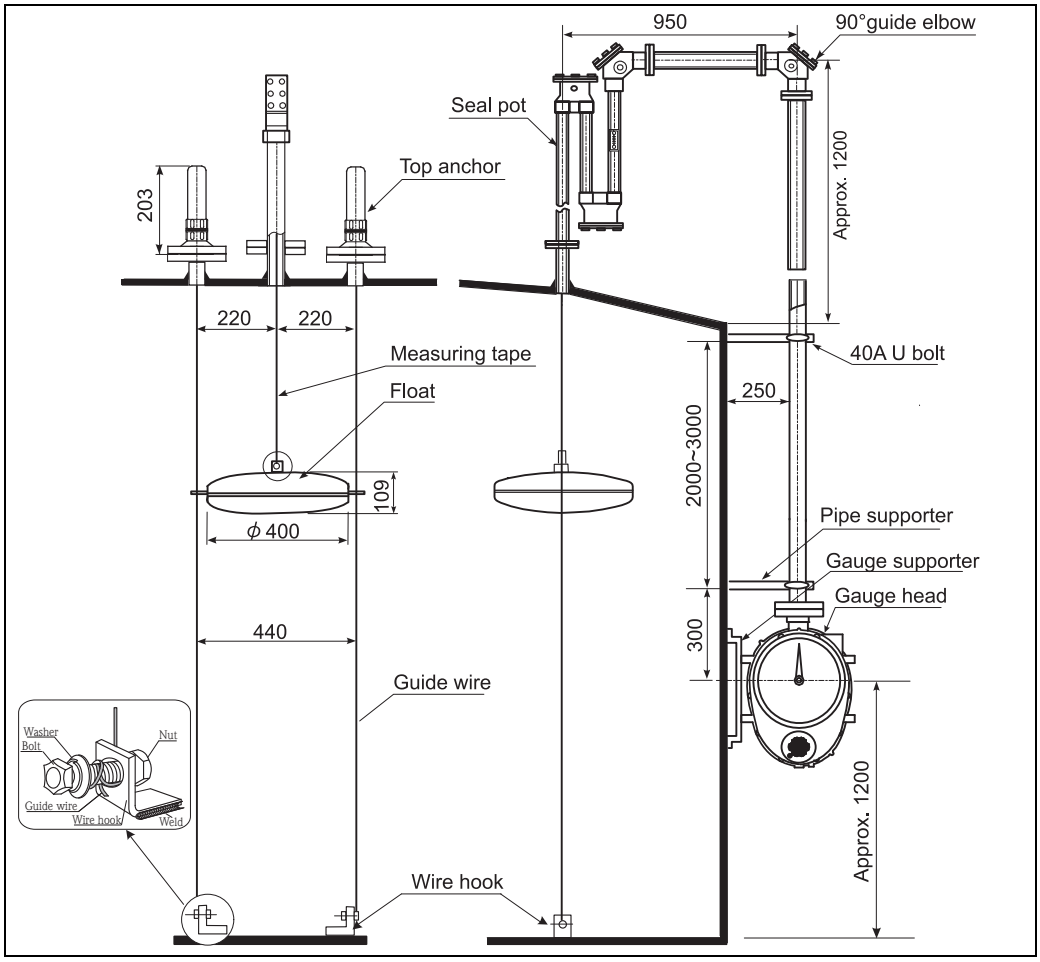
	LT1100	Wetted parts : SS400	Wetted parts:SUS316, Top anchor:SUS316
Application	without Crank unit	A07	A10
	with Crank unit	C07	C10
	Guide wire	Single wire	Single wire
Item		Material/Quantity	Material/Quantity
Guage head (threaded 11/2")		Outer coating : ADC12 (inverted mounting)/1	Outer coating : ADC12 (inverted mounting)/1
Top anchor		Outer coating : ADC6 /I nner coating : SUS316(threaded1")/2	All SUS316 (Socket weld type)/2
Float Φ400		SUS316/1	SUS316/1
Guide wire		SUS316/1	SUS316/1
Measuring tape		SUS316 (all hole) /1	SUS316 (all hole)/1
Wire hook		SS400	SUS316

	LT1200	Wetted parts : SS400	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 Φ400		SUS316/1	SUS316/1
Guide wire		SUS316/2	SUS316/2
Measuring tape		SUS316 (all hole)/1	SUS316 (all hole)/1
Wire hook		SS400	SUS316

3.8.3 Cone roof Tank with seal pot for CRT (LT1200 type)

In LT1100, gauge head, guide elbow, seal pot and top anchor are connected with threaded.

Process connection for guide elbow, seal pot and top anchor depends on specification of "Order information / process connection (gauge head) / 040".
But the threaded connection is as follows.
When selecting the threaded PS, PT or G(PF), both guide elbow and seal pot are PS, top anchor is PT. When selecting the threaded NPT, seal pot, guide elbow and top anchor are NPT.



Application (060)

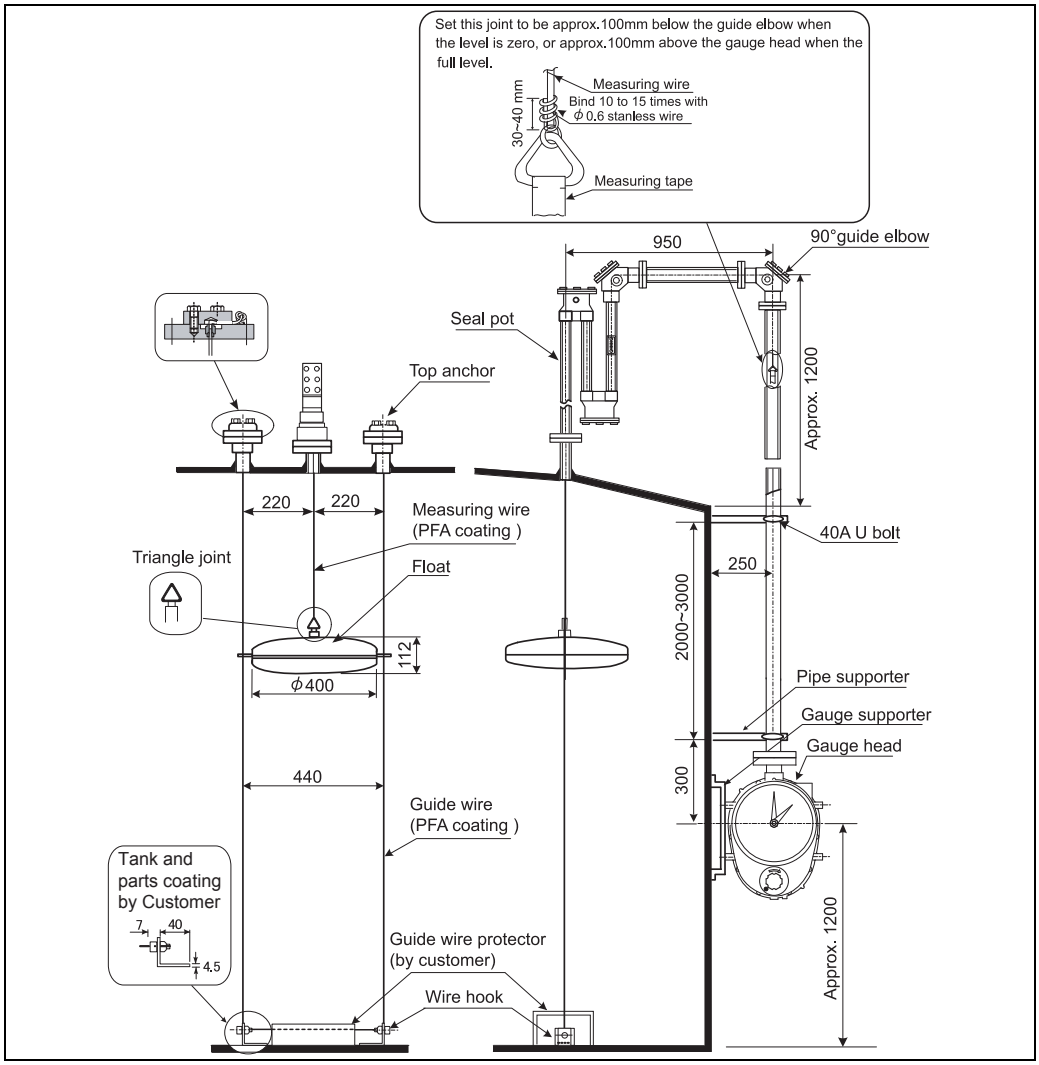
LT1100		Wetted parts: SS400	Wetted and gas parts: SUS316
Application	without Crank unit	A50	A54
	with Crank unit	B50	B54
	Guide wire	Single wire	Single wire
Item		Material/Quantity	Material/Quantity
Guage head (threaded1 1/2")		Outer coating : ADC12/1	Outer coating : ADC12/1
Seal pot (threaded1 1/2")		Outer coating : ADC, AC,SGP / Roller : SUS316L/2	Outer coating : SCS14, SUS316 / Roller : SUS316L/1
90°Guide 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 Φ400		SUS316/1	SUS316/1
Guide wire		SUS316/2	SUS316/2
Measuring tape		SUS316/1	SUS316/1
Gauge supporter		SS400/1	SS400/1
Wire hook		SS400/2	SUS316/2

LT1200		Wetted parts : SS400	Wetted and gas parts: SUS316
Application	without Crank unit	A55	A59
	with Crank unit	B55	B59
	Guide wire	Single wire	Single wire
Item		Material/Quantity	Material/Quantity
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°guide 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 Φ400		SUS316/1	SUS316/1
Guide wire		SUS316/2	SUS316/2
Measuring tape		SUS316/1	SUS316/1
Gauge supporter		SS400/1	SS400/1
Wire hook		SS400/2	SUS316/2

3.8.4 Cone roof Tank with seal pot PVC for CRT (LT1200 type)

In LT1100, gauge head, 90° guide elbow is connected with threaded, seal pot and top anchor are connected with flange.

Process connection for guide elbow, seal pot and top anchor depends on specification of "Order information / process connection (gauge head) / 040".
But the threaded connection is as follows.
When selecting the threaded PS, PT, or G(PF), guide elbow is PS. When selecting the threaded NPT, guide elbow is NPT.



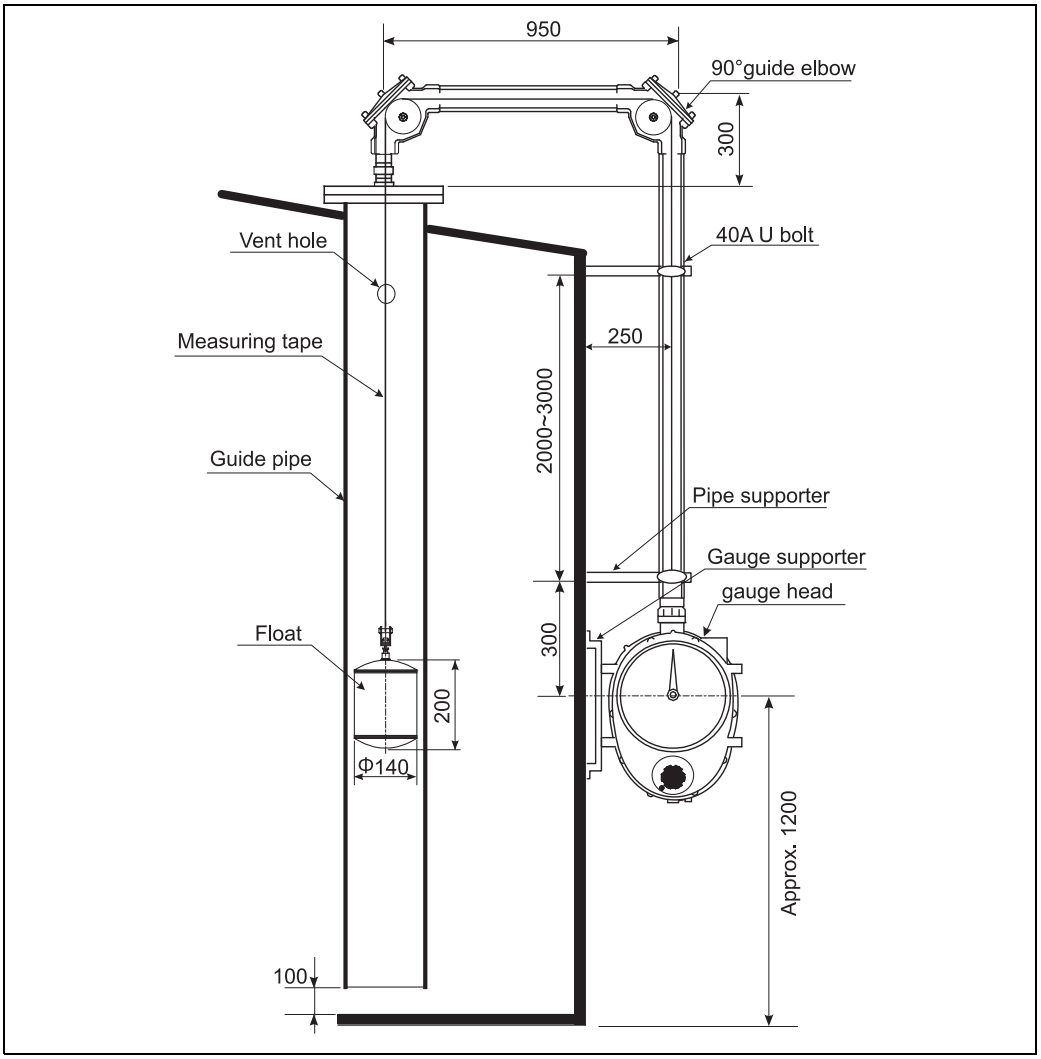
Application (060)

LT1100		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 (flange11/2")		Outer coating :PVC / Roller : PVC/1	Outer coating : PVC / Roller : PVC/1
90°guide elbow (threaded 1 1/2")		Outer coating : ADC6 / Roller : SUS316L/1	outer coating : ADC6 / Roller : SUS316L/1
Top anchor (flange11/2")		All PVC/2	All PVC/2
Float Φ400		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

LT1200		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 11/2")		Outer coating : ADC12/1	Outer coating : ADC12/1
Seal pot (flange 11/2")		Outer coating : PVC / Roller : PVC/1	Outer coating : PVC / Roller : PVC/1
90°guide elbow (flange 11/2")		Outer coating : ADC6 / Roller : SUS316L/1	Outer coating : ADC6 / Roller : SUS316L/1
Top ancher (flange 11/2")		All PVC/2	All PVC/2
Float Φ400		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

3.8.5 Compact cone roof Tank, guide pipe method max. 10m (LT1100)

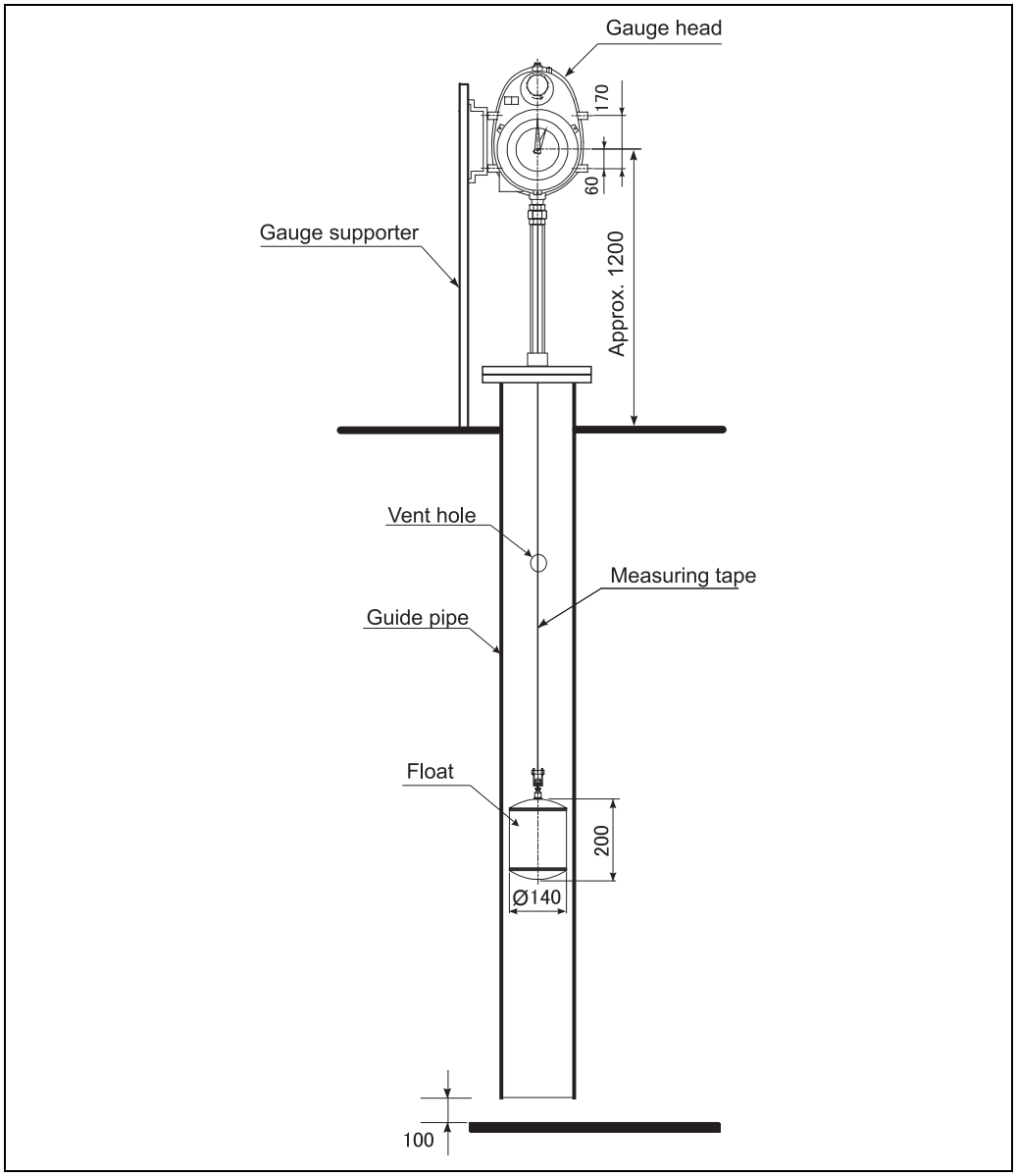
Process connection for guide elbow, depends on specification of "Order information / process connection (gauge head) / 040".
But the threaded connection is as follows.
When selecting the threaded PS, PT, or G(PF), guide elbow is PS. When selecting the threaded NPT, guide elbow is NPT.



Application (060)

Application	005
Item	Material/Quantity
Guage head (threaded 1 1/2")	Outer coating : ADC12/1
90°Guide elbow (threaded 1 1/2")	Outer coating : ADC6/Roller : SUS316L /2
Float Φ140	SUS316/1
Measuring tape	SUS316/1
Guage supporter	SS400/1

3.8.6 Tank top mount, guide pipe method max. 10m (LT1100)



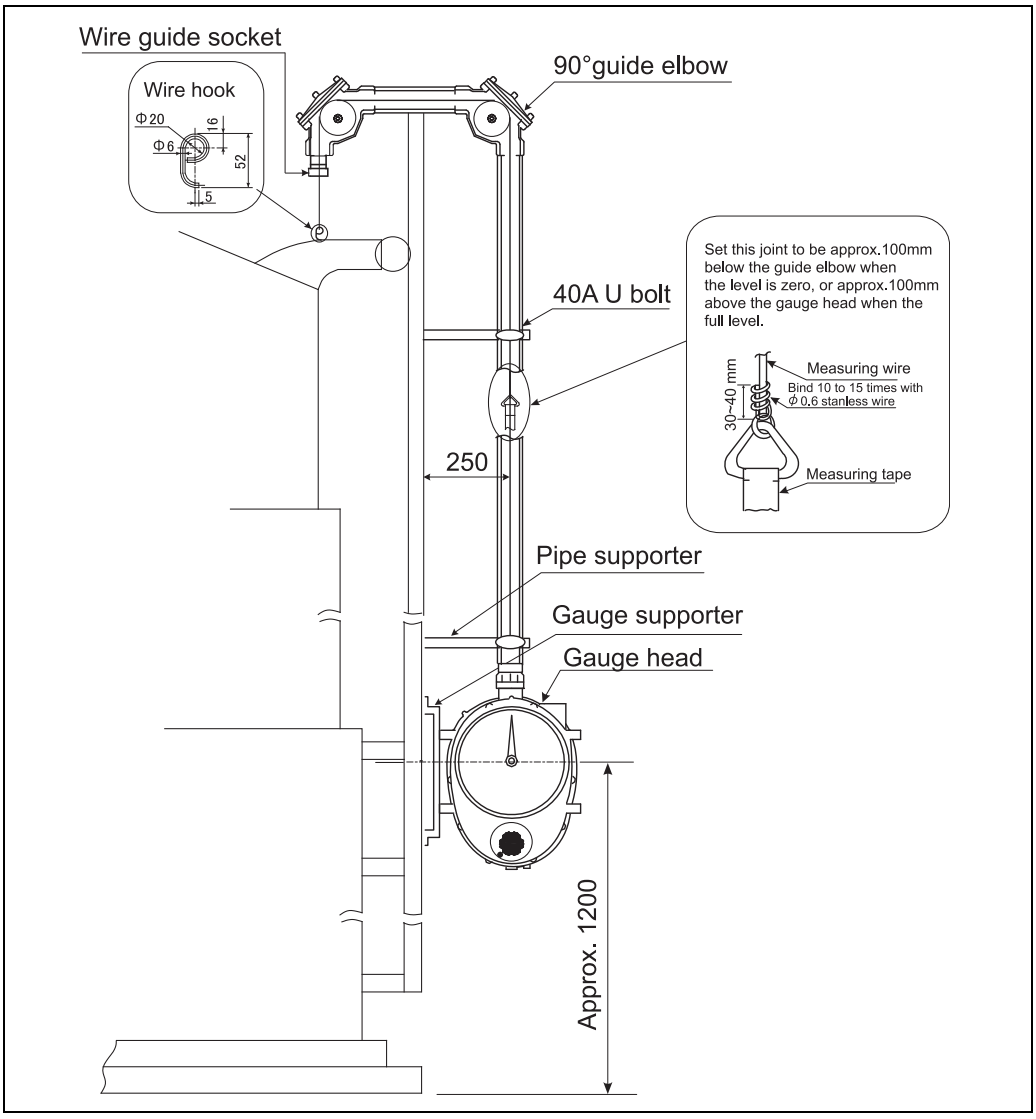
Applocation (060)

LT1100	Max.10m/Guide pipe
Application	**008**
Item	Material/Quantity
Guage head	Outer coating : ADC12 (inverted mounting)/1
Float Φ140	SUS316/1
Measuring tape	SUS316/1

3.8.7 Gas holder (LT1100)

In LT1200, guide head and 90°guide elbow are connected with flange.

Process connection for guide elbow depends on specification of “Order information / process connection (gauge head) / 040".
But the threaded connection is as follows.
When selecting the threaded PS, PT, G(PF), guide elbow is PS and when selecting the threaded NPT.



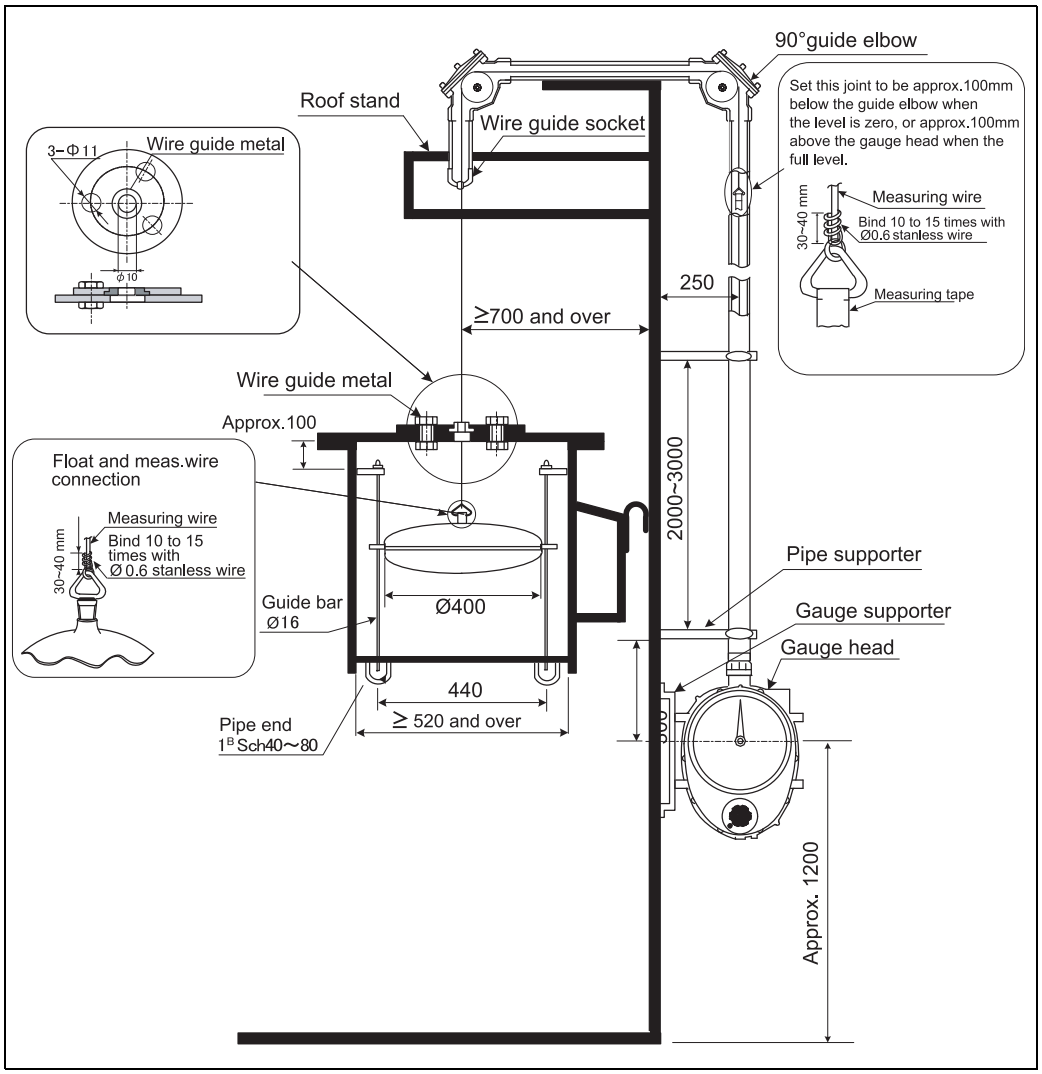
Applocation (060)

	LT1100	LT1200
Application	***251***	***252***
Item	Material/Quantity	Material/Quantity
Gauge head	Outer coating : ADC12/1	Outer coating : ADC12/1
90°guide 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

3.8.8 Floating roof Tank [FRT] (LT1100)

In LT1200, guide elbow are connected with flange.

Process connection for guide elbow depends on specification of "Order information / process connection (gauge head) / 040".
But the threaded connection is as follows.
When selecting the threaded PS, PT, G(PF), guide elbow is PS, when selecting the threaded NPT, guide elbow is NPT.



Applocation (060)

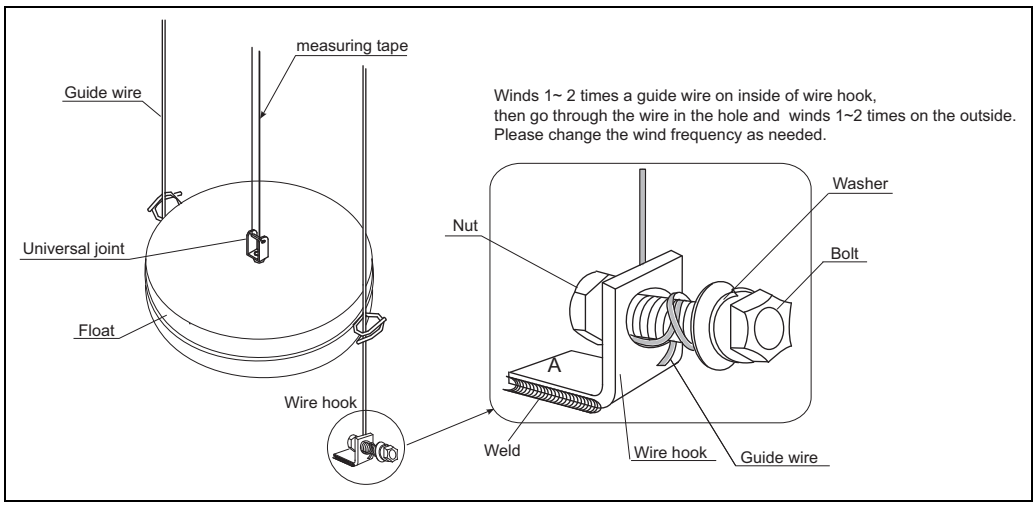
	LT1100	LT1200
Application	**261**	**262**
Item	Material/Quantity	Material/Quantity
Guage head	Outer coating : ADC12/1	Outer coating ADC12/1
90°guide elbow	Outer coating : ADC6/ Roller : SUS316L (threaded 1 1/2")/2	Outer coating : ADC6 / Roller : SUS316L (flange 1 1/2")/2
Float Φ400	SUS316/1	SUS316
Meas. 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 Installation

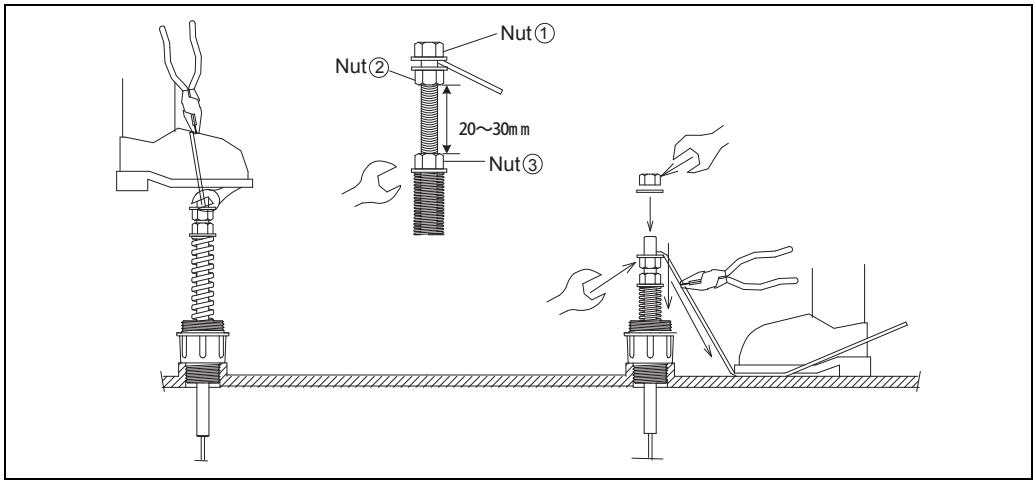
3.9.1 Guide wire installation

Note!
- Be careful not to bend the guide wire
- Two guide wires should be arranged parallel to each other and perpendicular to the tank floor.
- Since it is extremely difficult to repair the guide wire and guide hook in the bottom of the tank, please make sure to check the strength of those equipment thoroughly before filling the tank with the fluid.

1) First, open the cover of the guide knob located in the tank top. From the center opening of the guide knob, suspend the guide wire into the tank while the end of the guide wire is temporarily attached to the guide knob.
2) In the bottom of the tank, guide wire needs to be tightly secured to the wire hook using nuts and bolts. In this procedure, guide wire must go through the guide ring of the float before it is attached to the wire hook. After the connection is secured, cut off and bend the end of the guide wire in order to prevent it from tangling with the float.

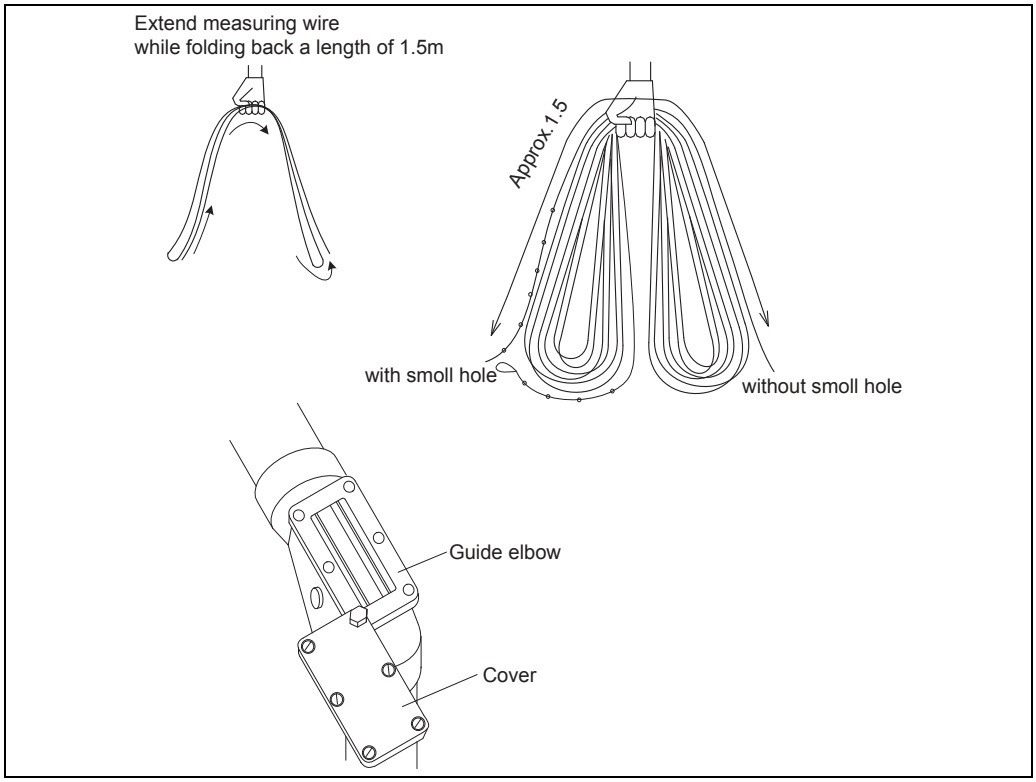


3) Again, as you extend the guide wire in the top of the tank, it needs to be stabilized as shown in the below Fig.
4) Guide wire's end should be bent alongside the main shaft, and cut it off leaving approx.100mm. The end of the wire needs to be fastened with nuts (1) and (2). At the end, close the nut (3), and let the spring work itself.



3.9.2

1)Extend measuring wire while folding back a length of 1.5 m wire not to twist.
2)Before you start this process, open the covers of guide elbow and gauge head.



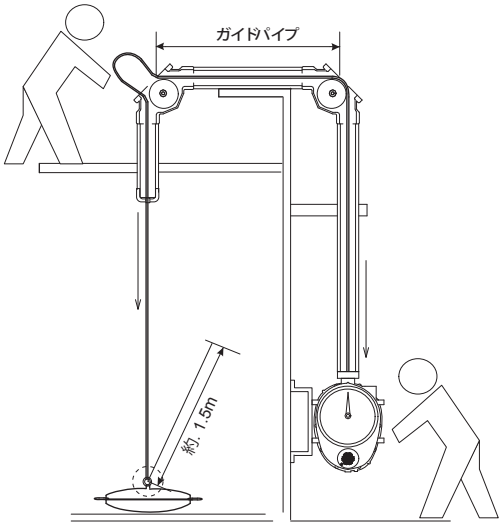
Note!

- Be careful not to bend or scratch the measuring tape.
- Be sure to watch out for the twisting of the measuring tape inside the tank or the pipe.
- During operation, check to make sure that the measuring tape and measuring wire do not go off the roller of the guide elbow. Inspection is necessary after the installation.
- Connection part between the float and the measuring tape is impossible to repair after the tank is filled with the fluid. So, please make sure to do a thorough inspection after the connection is finished.

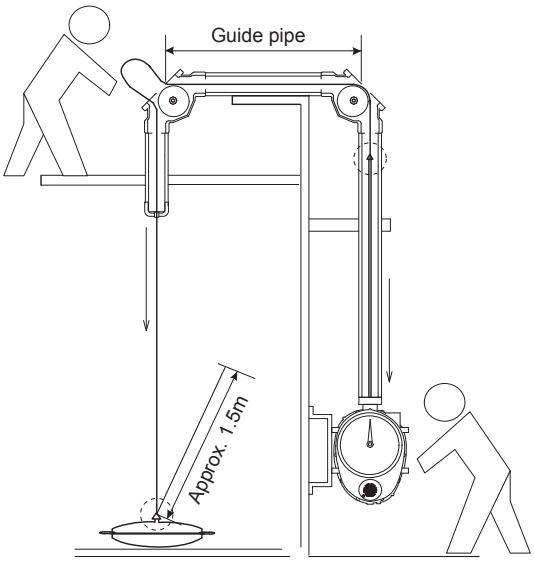
3.9.2.1 Cone-roof tank

1) First, insert the measuring tape (the end that does not have a small hole) into the tank from the guide elbow directly above the tank. Meanwhile, the other end of the measuring tape (the ring shaped side with a small hole) needs to go through the guide elbow just above the gauge head, and send it into the gauge head.
2) Then, pull the measuring tape inside the tank. Before connecting it to the float (as shown in Fig. 8-2) cut off the tape leaving about 1.5m in length.

Measuring tape



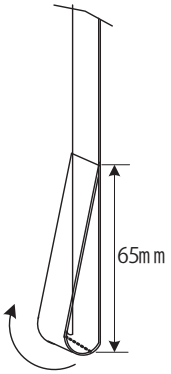
Measuring tape and Measuring wire



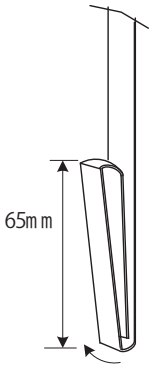
3) Next, roll the tape inside the gauge head toward the direction of the arrow (as shown in Fig. 10) and roll the extra length of the tape around the drum.
4) Sometimes, event such as fluid's outflow causes the measuring tape to suddenly move.
Such movement may cause the tape to slip off the sprocket pins, and the measurement may show some deviation from the most accurate value. In order to prevent this movement, there are two holders. After finishing the taping, follow Fig.10 to set the top part of the tape holders at approximately 2 mm from the surface of the measuring tape.

Connection with Measuring tape and float

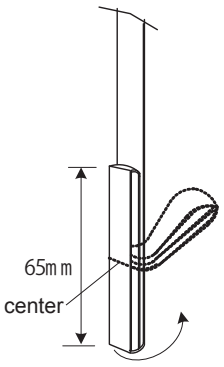
① Fold a measuring tape at approx. 65mm



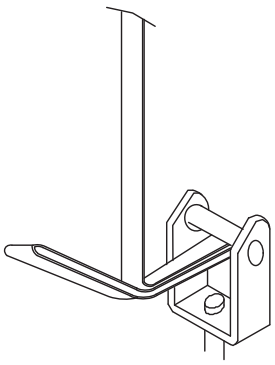
② Fold a measuring tape at approx.65mm again



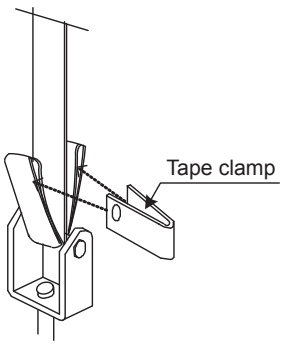
③ Fole from the center of foled measuring tape again



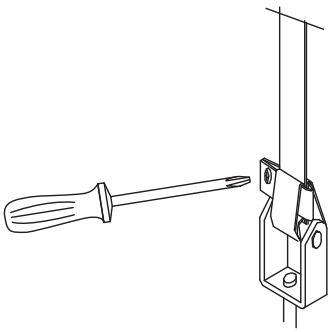
④ Pass holded measuring tape through joint shaft



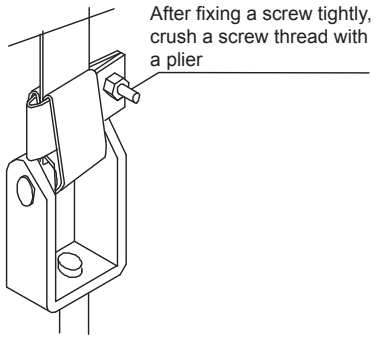
⑤ Pass tape clamp into holded measuring tape



⑥ Fix tape clamp with screw /nut.

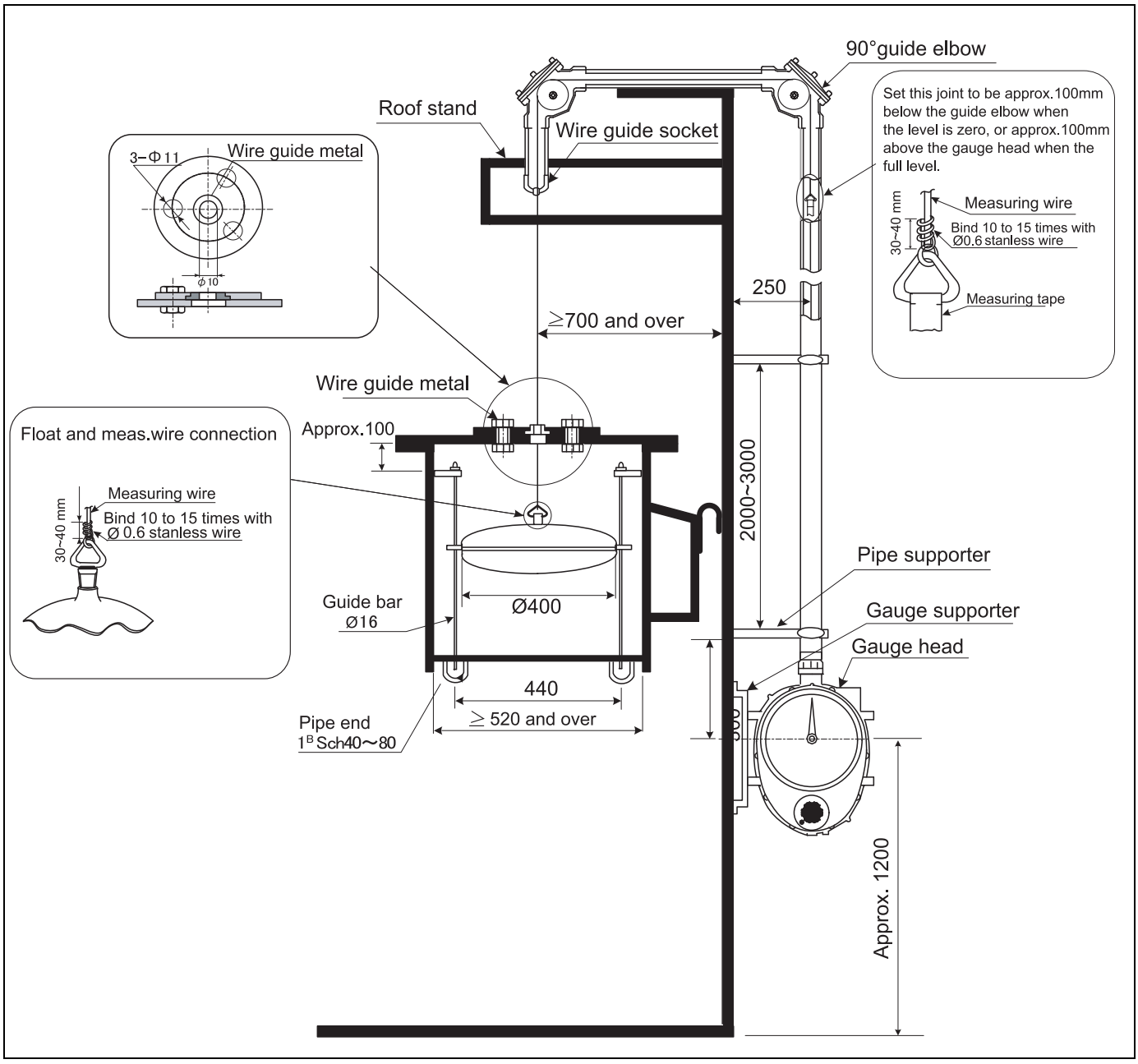


7 Fix tightly screw and nut of temporary fixture, hold and crush the extra screw thread with a pliers..



3.9.2.2 Floating-roof tank

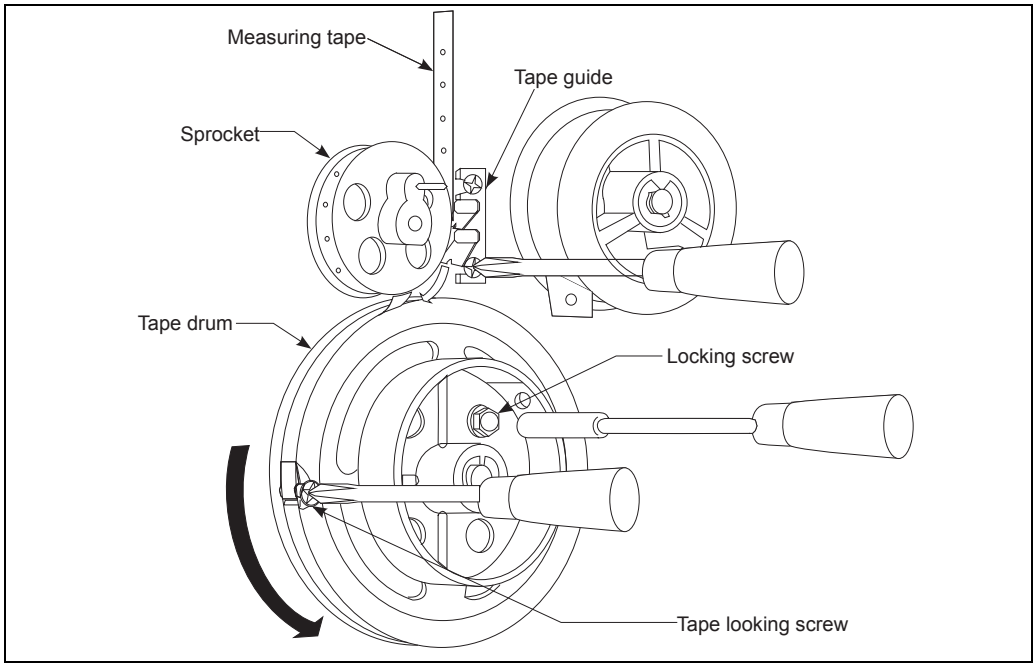
1) Pass one end of the measuring wire into the tank through the 90° sheave elbow (Located right above the gauge head) and that right above the tank.
2) Inside the tank, connect the measuring tape to the float in the manner. Again on the tank top, connect the measuring wire to the measuring tape and feed the measuring tape into the gauge head.



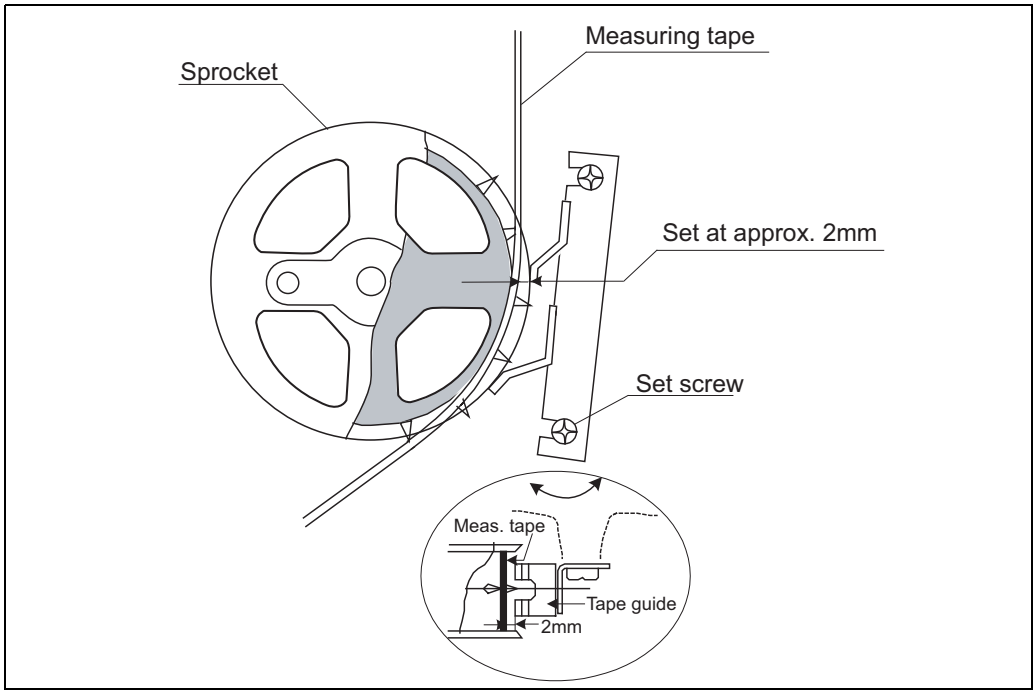
3.9.3 Internal adjustment

Tape guide

1) Again in the gauge head, turn the tape drum in the direction indicated by arrow in the bellow fig. to tense the measuring tape.



2) The measuring tape may be severity vibrated by surges and disengaged from the sprocket pins, resulting in deviation of level reading.
The tape gauge is provided to prevent such a trouble. After tape setting has been completed, set the tape guide at such a position that its two tips are located about 2mm from the measuring tape surface as shown in the below fig.



3.9.4 Setting conster drum

The conster drum should be set after the measuring tape has been stretched in position.

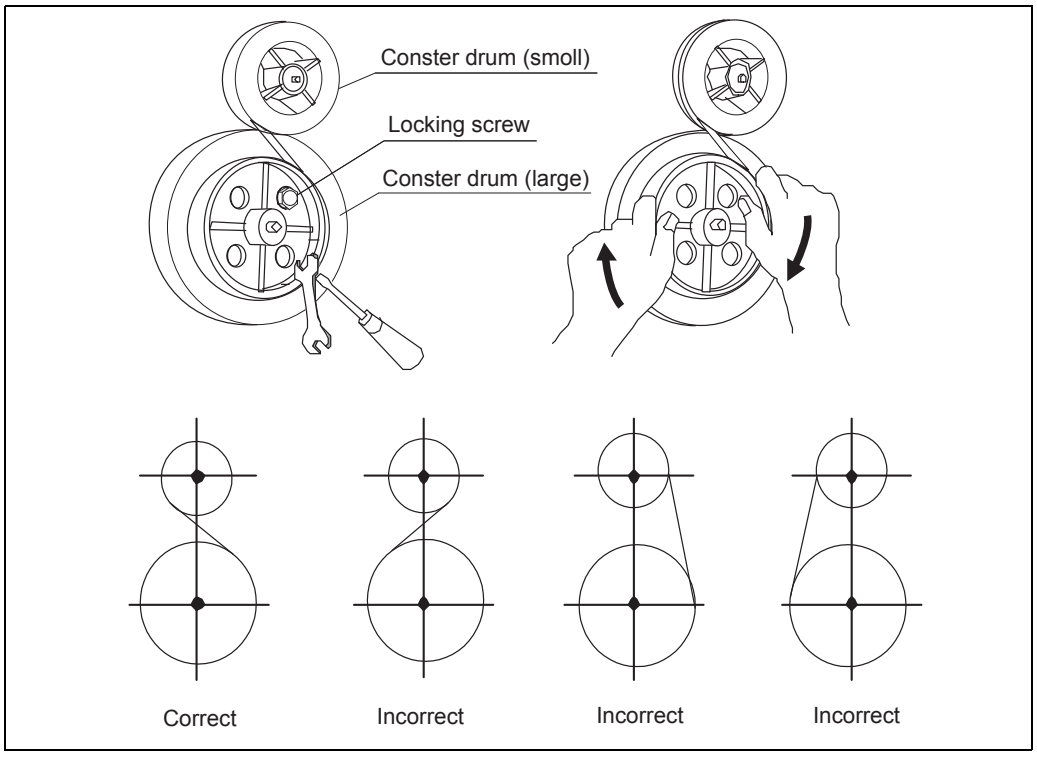
Caution!
When winding the conster spring motor from the large drum to the small drum, do not remove your hand from the large drum until the spring is completely wound.
You could be injured by the force of the spring.

Note!
To avoid inaccurate measurement, keep the following reminder:
Conster could lose its balance when it gets off the track of the large Conster drum or when the excessive force is applied it creates an unbalanced torque.

Caution!
At the stage to wide the conster spring motor from the small drum to the large drum, do not leave your hand from the large drum until the measuring tape is tensed finally.

1) As seen in the below fig., make sure that the screw is removed from the conster drum, then using the screws and nuts, attach the conster onto the large conster drum as described in below fig.
2) Rotate the Conster drum to the direction indicated in the below fig.
3) Before securing the large conster drum, rotate the tape drum counter clockwise to tighten the tape.
4) When the tank is empty, roll the tape twice onto a small Conster drum and secure it with bolts. When the fluid is in the tank, measure the surface level of the fluid and use the equation on the next page to figure out the number of times the tape needs to be rolled. Roll the tape onto a large Conster drum exact number of times it is required based on the calculation.

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



4 Display

4.1 Dial display

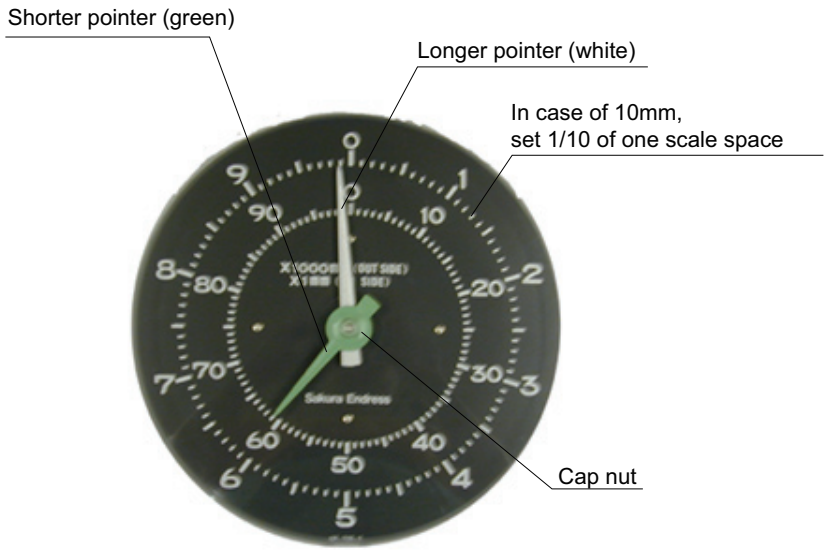
Pointer setting and how to scale readout

When calibrating (pointer setting) to authorized value as calculated value or measured value, there are differences between Dial display type and Counter display type. Usually, if tank height is up to 20mm, indicator is Dial display and if tank height is over 20mm, indicator is counter display.

After removing the cover from the indicator of the gauge head, loosen the cap nut. The longer pointer (white) can be turned freely, whereas the shorter one (yellowish green) can be freed by pulling it toward you.

1)First, set the shorter pointer at the division on inner diameter scale (1mm / one scale space) corresponding with the lower digits of the liquid level.

2)Then, set the longer pointer at the division on outer diameter scale (100mm / one scale space) corresponding with the upper digit(s) plus the lower digits of the liquid level (estimate by the eye). Longer pointer (outer diameter scale): 10000mm, 1000mm, 100mm digit Shorter pointer (inner diameter scale): 10mm, 1mm digit.



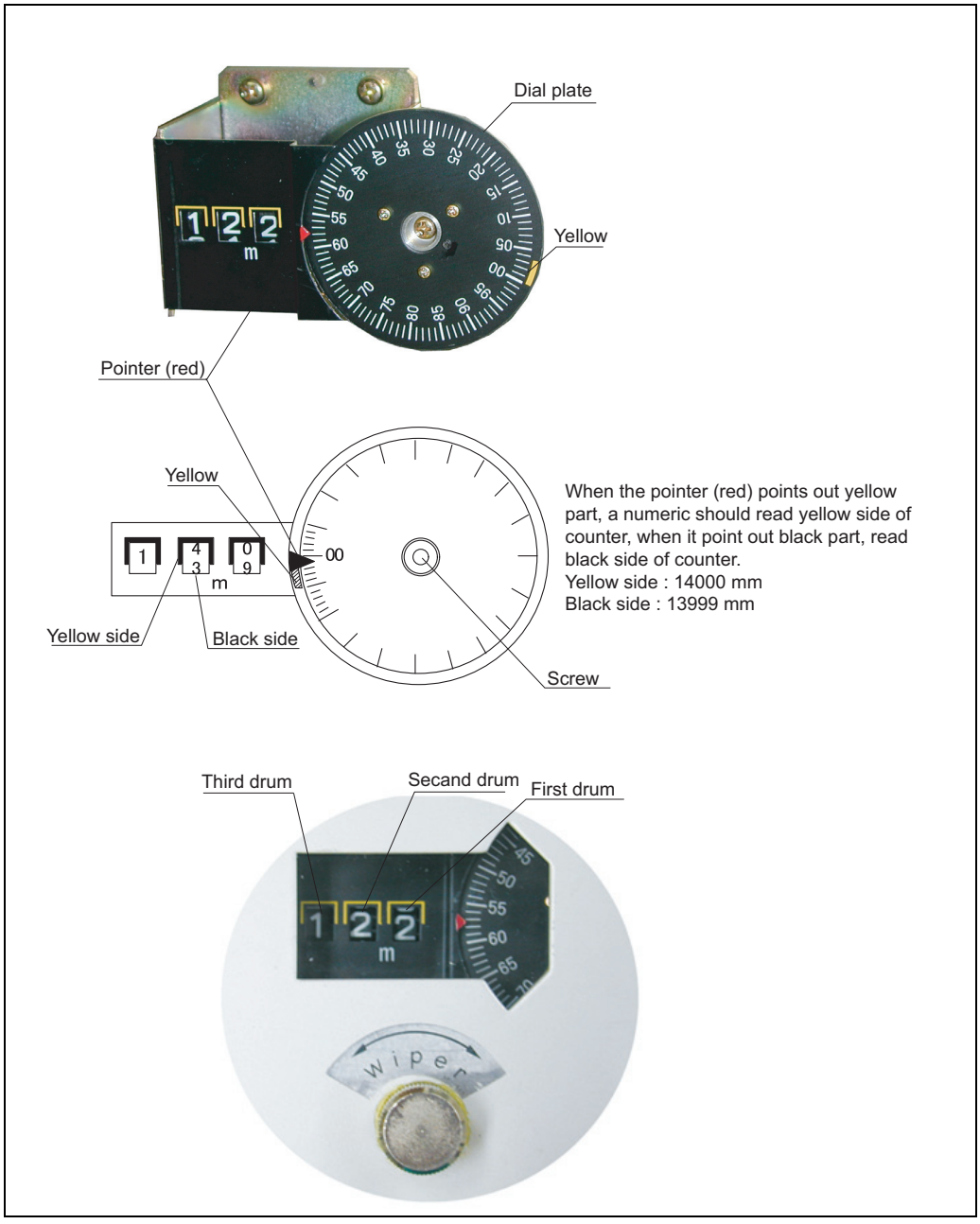
Scale plate of 10m

4.2 Counter display

After removing the cover from the indicator of the gauge head, loosen a screw of the center on a scale plate in order to be rotated the scale plate freely. The counter drum changes one position a numeral of the first drum every rotations (100 mm) of the scale plate.

1) Turning the scale plate, set the numerical value of counter drum to the three upper digits of the liquid level.
2) Set scale plate to the pointer corresponding with the two lower digits of the liquid level and tighten the screw on scale plate.

When the pointer is indicating the range of between 97 through 03 on the scale plate as following figure, numerical change on drum can not change momentarily.
As it changes gradually keeping constantly the relation between the rotation of scale plate and the numerical change, the counter will display a numeral half-asset, Therefore, in order to exclude wrong readout, windows and a part on the scale plate are distinguished by using different colors.



4.3 Indicating adjustment

Calibration method
1) Put actual measuring liquid into tank and calibrate to the measuring value
2) When tank is empty, calibrate through calculation
3) Put water into tank and calibrate to the measuring value

After removing the cover from the indicator of the gauge head, loosen the cap nut. The longer pointer (white) can be turned freely, whereas the shorter one (yellowish green) can be freed by pulling it toward you.
1) First, set the shorter pointer at the division on the inner scan corresponding to the two lower digits of the liquid level.
2) Then, set the longer pointer at the division corresponding to the upper digit(s) plus the two lower digits (estimate by the eye).

4.3.1 Calibration using actual measuring liquid

By using a measuring tape which has been officially tested for accuracy of ±0.3 mm/m (±1.2mm/10 m), measure liquid level two or three times to obtain a reliable value. Then set the indicator at the reading thus determined.

4.3.2 Calibration through calculation for empty tank

Calculate liquid level L*f* at which the float starts floating up by using the following equation.
For relationship between L*f* and p, refer to Graph 1,2 (Easy installation), Graph 3,4 (Separated Guide Wire installation)

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

Lf : When a float start to float, level height (mm)
W : Float Weight (g)
A : Aross-sectional area of float cylindrical part (cm^2)
Hf : Half of float height (cm)
w : Measuring tape hoising force in conster (g)
ρ: Gravity of actual liquid (g/cm^3)
Q : Half of float volume (cm^3)

4.3.3 Calibration utilizing water filling test

Measure water level and set the indicator at the level. Then, make the necessary correction by adding Lß calculated by the following equation:
For relationship between Lß and p, refer to Graph 1,2 .

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

L_B: When filling water, Indicator corrective value (mm)
W : Float Weight (g)
A : Aross-sectional area of float cylindrical part (cm2)
Hf : Half of float height (cm)
w : Measuring tape hoising force in conster (g)
ρ: Gravity of actual liquid (g/cm^3)
Q : Half of float volume (cm3)

Ø400 float

Calculating formula

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 : Gravity of actual liquit (g/cm^3)
Q : Half of float volume (cm^3)
LB : When filling water, indicator corrective value (mm)

① when tank is empty

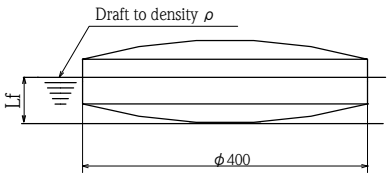
$$Lf = \{ Hf + \frac{(W-w) - Q \times \rho}{A \times \rho} \} \times 10$$

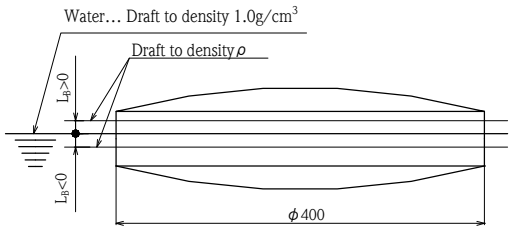
$$= \{ 5.45 + \frac{(W-1200) - 5260\rho}{1256.64\ \rho} \} \times 10$$

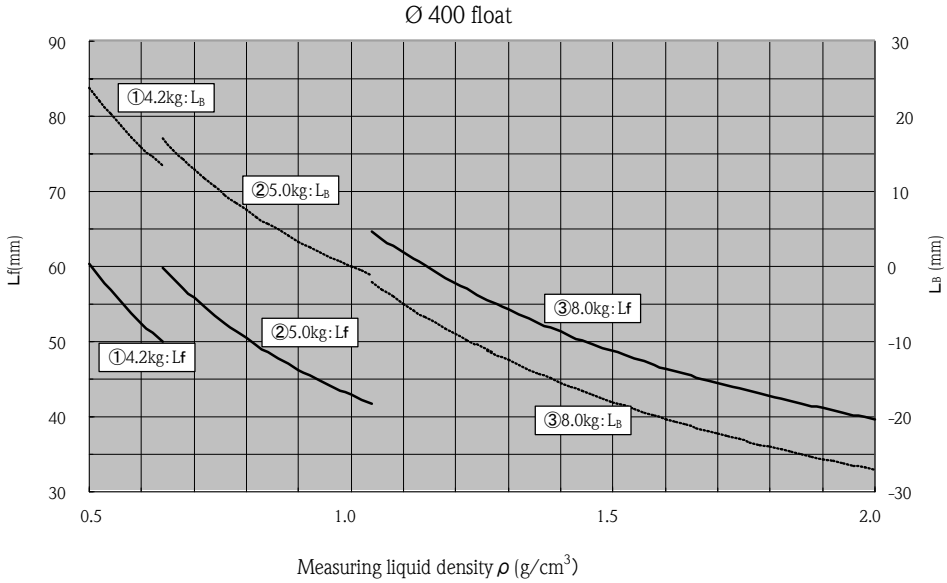
② When putting water in tank

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

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







Graph 1

Ø140 float

Calculating formula

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 : Gravity of actual liquit (g/cm^3)
Q : Half of float volume (cm^3)
LB : When filling water, indicator corrective value (mm)

① when tank is empty

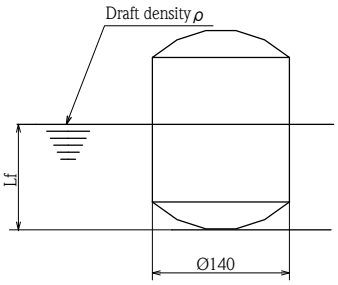
$$Lf = \{ Hf + \frac{(W-w) - Q \times \rho}{A \times \rho} \} \times 10$$

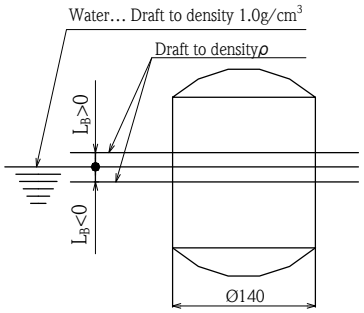
$$= \{ 10 + \frac{(W-1200) - 1330.6\rho}{153.94\ \rho} \} \times 10$$

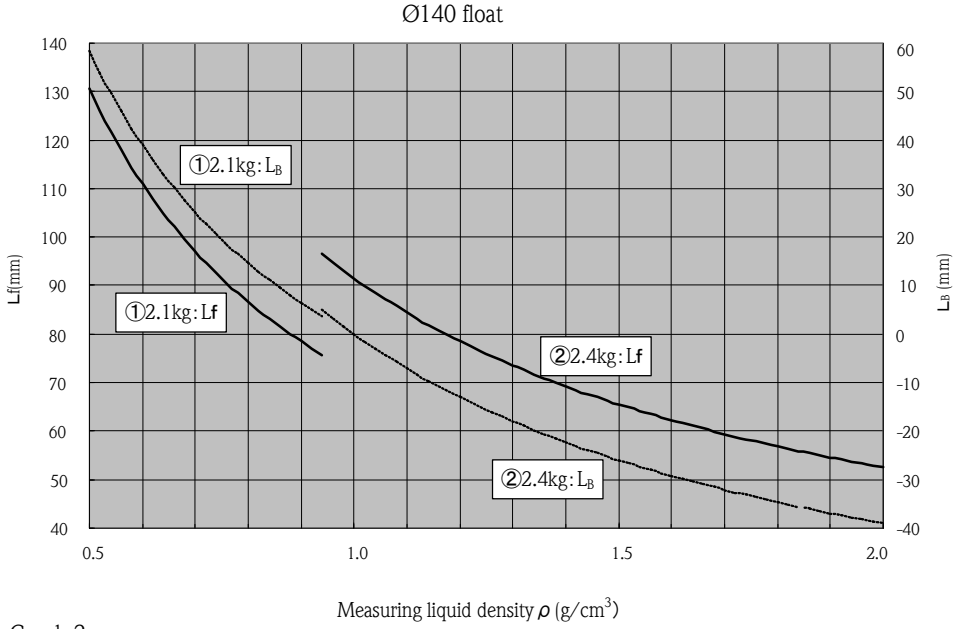
② When putting water in tank

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

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







Graph 2

Cone-roof tank (with seal pot PVC) and Floating roof tank

Calculating formula

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 : Gravity of actual liquit (g/cm^3)
Q : Half of float volume (cm^3)
LB : When filling water, indicator corrective value (mm)

Ø400 float

Cone-roof tank (with seal pot PVC)	Floating roof tank
① when tank is empty $Lf = \{ Hf + \frac{(W-w) - Q\times\rho}{A\times\rho} \} \times 10$ $= \{ 5.45 + \frac{(W-1200) - 5260\rho}{1256.64\rho} \} \times 10$	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 $L_B = \frac{W-w}{A} (\frac{1}{\rho} - 1)\times 10$ $= \frac{W-1200}{1256.56} (\frac{1}{\rho} - 1)\times 10$	② When putting water in tank $L_B = \frac{W-w}{A} (\frac{1}{\rho} - 1)\times 10$ $= \frac{W-1200}{1256.56} (\frac{1}{\rho} - 1)\times 10$

Ø140 float

① when tank is empty $Lf = \{ Hf + \frac{(W-w) - Q\times\rho}{A\times\rho} \} \times 10$ $= \{ 10 + \frac{(W-1200) - 1330.6\rho}{153.94\rho} \} \times 10$	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 $L_B = \frac{W-w}{A} (\frac{1}{\rho} - 1)\times 10$ $= \frac{W-1200}{153.94} (\frac{1}{\rho} - 1)\times 10$	② When putting water in tank $L_B = \frac{W-w}{A} (\frac{1}{\rho} - 1)\times 10$ $= \frac{W-1200}{153.94} (\frac{1}{\rho} - 1)\times 10$

5 Operation

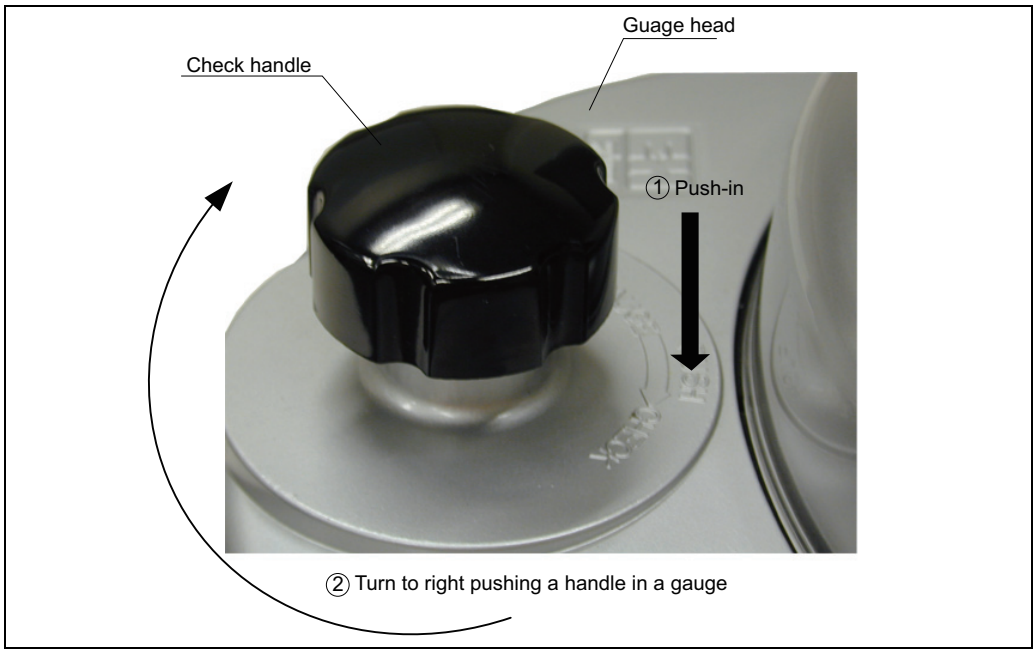
5.1 Check handle

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

Note!
- When checking the gauge performance using Check handle, please do the check after putting a liquit into tank.
- Check handle is not a float hoisting handle. Please do not hoist the float forcefully using Check handle.

1) Check the indicator performance on a scale plate of a gauge head.

2) Push Check handle into a gauge head side and turn to right with its condition. Turn to left at the position where indicator is in high position approx. 4 through 5 mm and then let your hand go from Check handle.



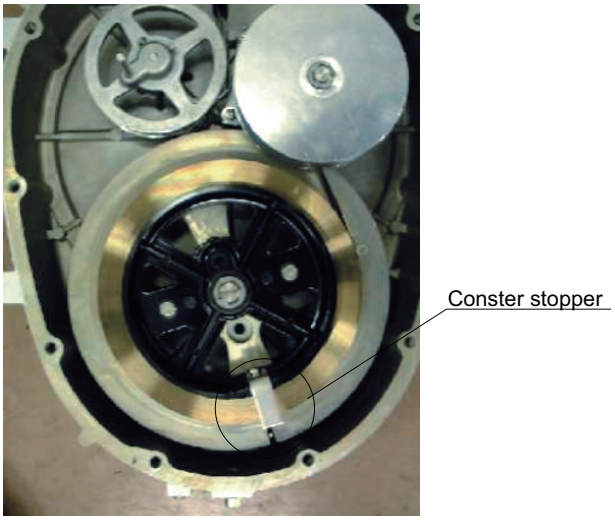
Please refer to “Operating for crank unit” about crank unit operation.

6 Maintenance

6.1 Before you start the maintenance

- Give special attention in handling flammable liquid. Give plenty of waiting time for the liquid to calm down after the loading, then start the maintenance (refer to thetable below).
- Be sure to wear antistatic clothing, gloves, and shoes when working with flammable liquids in tanks.
- Follow the directions of the safety supervisor
- After removing a conster stopper, please start the maintanance.

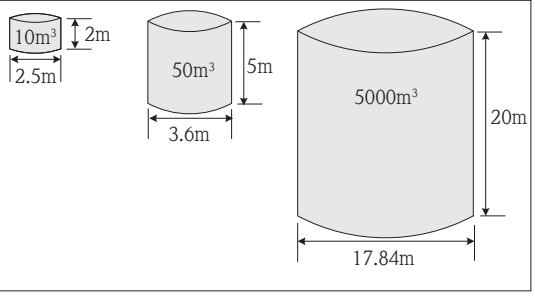
  The conster stopper is necessary parts only when sipping a gauge head. After finishing the maintenance, you need not install it again.



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 or less	1 or less	1 or less	2 or less
10^{-12} to 10^{-8}	Vinyl acetate Toluene Benzene Gasoline	2 or less	3 or less	10 or less	30 or less
10^{-14} to 10^{-12}	Methyl cyclohexane	4 or less	5 or less	60 or less	120 or less
10^{-14} or less	Carbon tetrachloride	10 or less	10 or less	120 or less	240 or less



6.2 Daily checking

The level gauge does not require any operation after it has been properly mounted on a tank.

6.3 Periodical checking

Follow the Table below to do the periodical inspection.

Periodical inspection Procedures

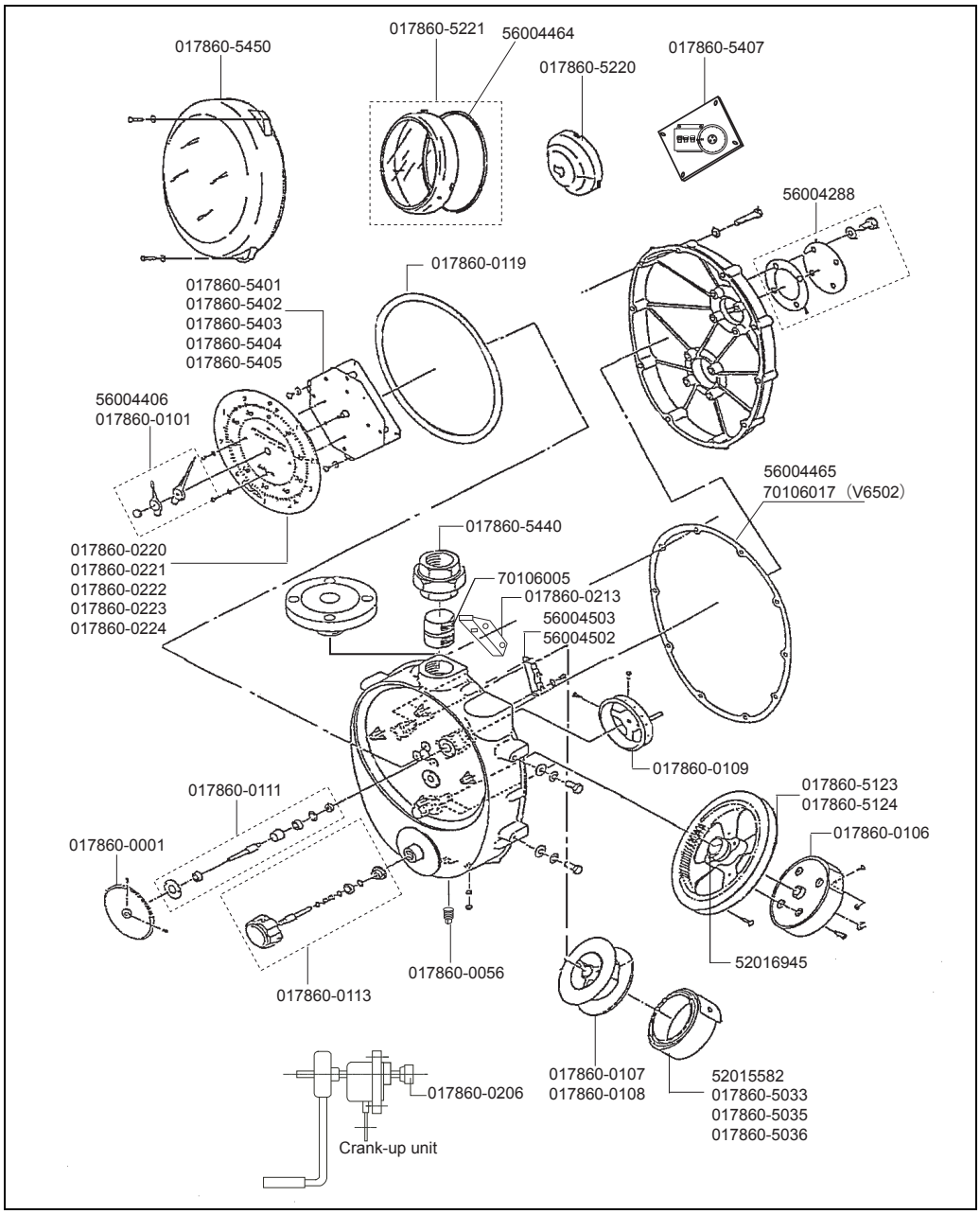
	Check Item	Check Procedure
Gauge head	Corrosion check and cleaning of tape protective pipe	After opening the rear cover of the gauge head, check accumulation of rust. If necessary, remove rust by tapping the protective pipe with a wooden hammer.
	Check of reduction gear engagement and bearing	After removing the indicator cover, rotate the reduction gear to check engagement and confirm that backlash is within 1 mm of indication. Check the bearing for wearing in the similar procedure
	Friction on tape drum and sprocket	After opening the rear cover of the gauge head, check bearings of drums for wearing, corrosion and dust contamination. Clean if required.
	Characteristic change of conster spring	Operate the drive checker for checking operation of the level gauge. If constant indications can not be obtained, clean the conster spring. If constant indications cannot be obtained after cleaning, replace the conster spring with a new one.
	Water drops and dimming on indicator window	Check the indicator cover for tightened condition. Also check to see if foreign matter is caught in the gasket.
	Check of drive checker	Inside the gauge head, check the checker spring for its deformation and operating condition.
guide elbow	Guide elbow friction	In Guide elbow, remove measuring tape from roller and check to rotate smoothly. Remove bearing and check friction condition. Remove extraneous matter from roller.

7 Troubleshooting

Symptom	Possible cause	Corrective Measure
Indication does not change at all	1) Measuring tape broken	After opening the tank, replace assuring tape.
	2) Guide wire caught	After opening the tank, re-stretch guide wire.
	3) Conster spring broken	Replace
	4) Drive checker caught	After opening rear cover of gauge head, repair or replace
	5) transmission gear for indication system worn out	Replace gear set of indication system
	6) Improper setting of sprocket or measuring tape disengaged	Check after opening rear cover of gauge head
	7) Float sinks	Replace after opening the tank
Frequent indication error	1) Conster spring deteriorate	Check gauge operation by operating drive checker. Replace conster spring if deteriorated
	2) Cause mentioned in 2), 4), 5), or 6) mentioned above	Check internal components of gauge head
	3) Indicator pointer loosened	After opening indicator cover, check lock nut for indicator pointer
	4) Improper setting of tape guide	Check gap between sprocket and tape guide
	5) Kink and twist of measuring tape	After opening guide elbow cover, pull measuring tape out and check. It is possible to repair as needed
Some error may be observed compare with measuring value and indication one	1) Some error are observed in gauge	Carry out previous check and countermeasure
	2) Some error are not observed in gauge	Trouble by measuring Influence by measuring technic Influence by sludge deposition Influence by big wind Error by measuring scale
Check handle can not rotate and return	1) Checker shaft has rusted	Clean up the shaft and replace check handle
	2) Check driver spring broken	Replace checker unit

8 Spare parts and drawing

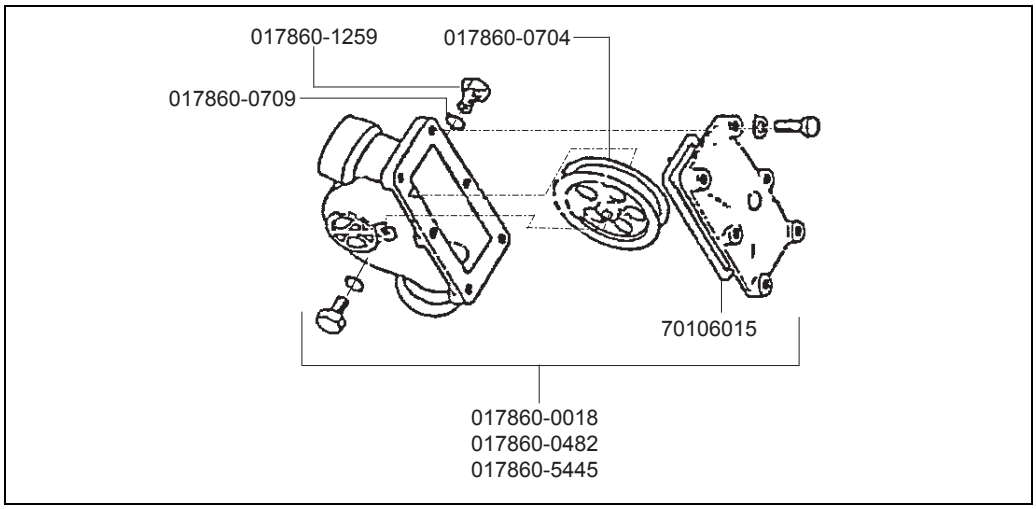
Gauge head



No.	Specification	No.	Specification
017860-0220	Dial plate - 2.5m	017860-0221	Dial plate - 5m
017860-0222	Dial plate - 10m	017860-0223	Dial plate - 16m
017860-0224	Dial plate - 20m	017860-0101	M & MM pointer assembly (with nut)
56004406	M & MM pointer assembly for dial plate, Alumni	017860-5401	Indication gear assembly - 2.5m
017860-5402	Indication gear assembly - 5m	017860-5403	Indication gear assembly - 10m
017860-5404	Indication gear assembly - 16m	017860-5405	Indication gear assembly - 20m
017860-5407	Counter assembly	52015582	Conster spring, 5m
017860-5033	Conster spring, 10m	017860-5035	Conster spring, 20m (f.16m+20m range)

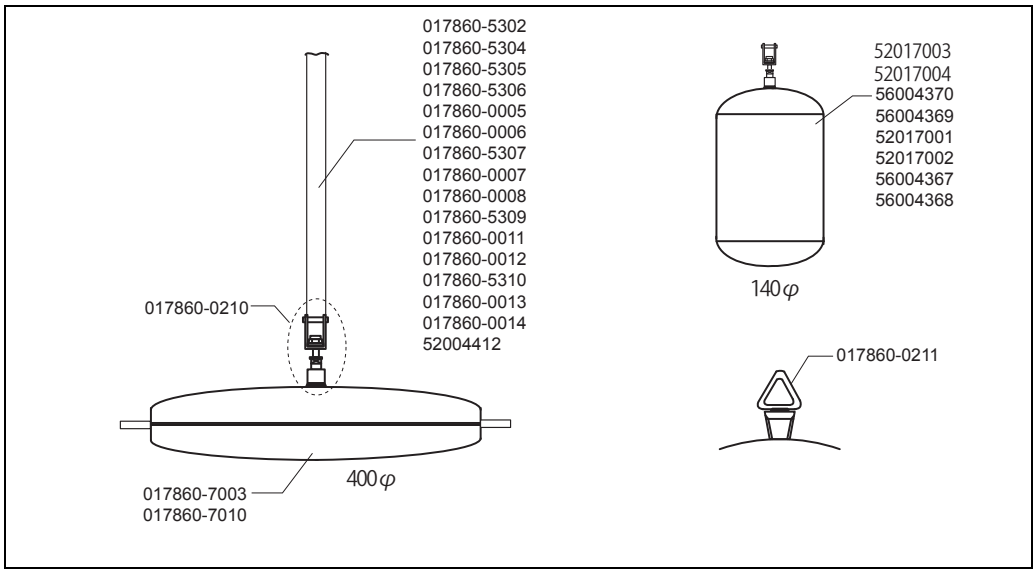
No.	Specification	No.	Specification
017860-5036	Conster spring, 30m	52016945	Bearing for tape drum
017860-5123	Tape drum - standard	56004503	Tape holder (package)
56004502	Tape holder (KAO Spec/package)	017860-0106	Conster drum - large
017860-0107	Conster drum - 20m	017860-0108	Conster drum - 30m
017860-5221	Steel from cover assembly	017860-0001	Gear (diameter 97mm)
017860-0111	Sprocket shaft assembly	017860-0113	Check unit assembly
017860-0206	Crank-up unit assembly	017860-0109	Sprocket wheel
56004465	Packing for rear cover	017860-5220	Counter cover
017860-5440	Union joint steel	017860-5450	Plastic front cover
017860-0119	Packing	56004288	Blind cover SUS assembly
017860-5124	Tape drum, crank up model	017860-0056	Drain plug 1/4" - SUS304
70106005	Gauge head nipple (St. St.)	70106017	Packing, rear cover V6502
56004464	Packing for indicator cover		

Guide elbow



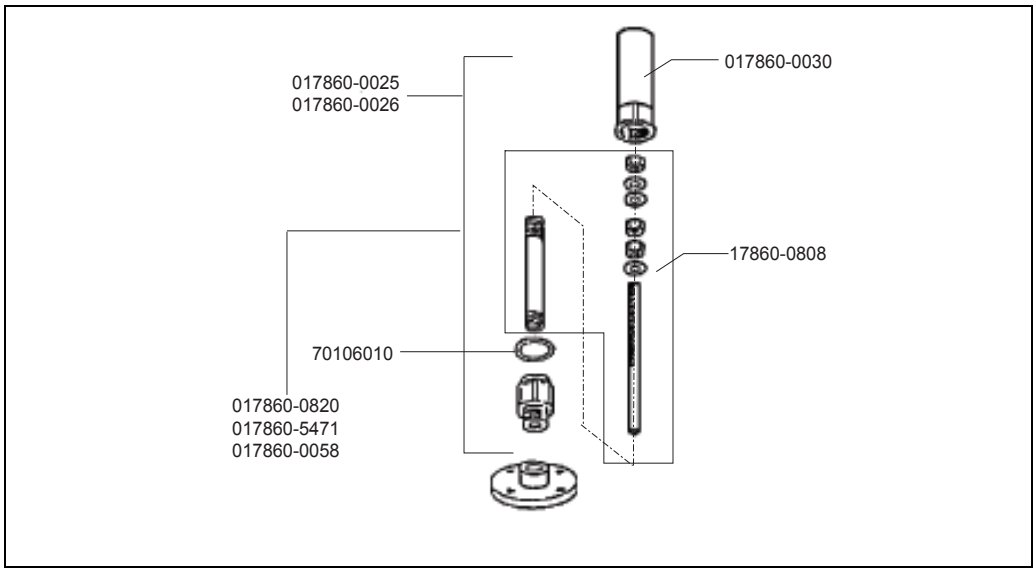
No.	Specification	No.	Specification
017860-0709	O-ring for bearing P8 *	017860-0704	SS316L roller
017860-1259	SS304 bearing	70106015	Packing, elbow low press. V6502
017860-0482	Sheave elbow/SS316 /SS316 roll/1-1/2"	017860-0018	Sh. elbow alu/AISI316 roll 150#
017860-5445	Sheave elbow/alu /SUS316 roll/1-1/2"		

Float and Measuring tape



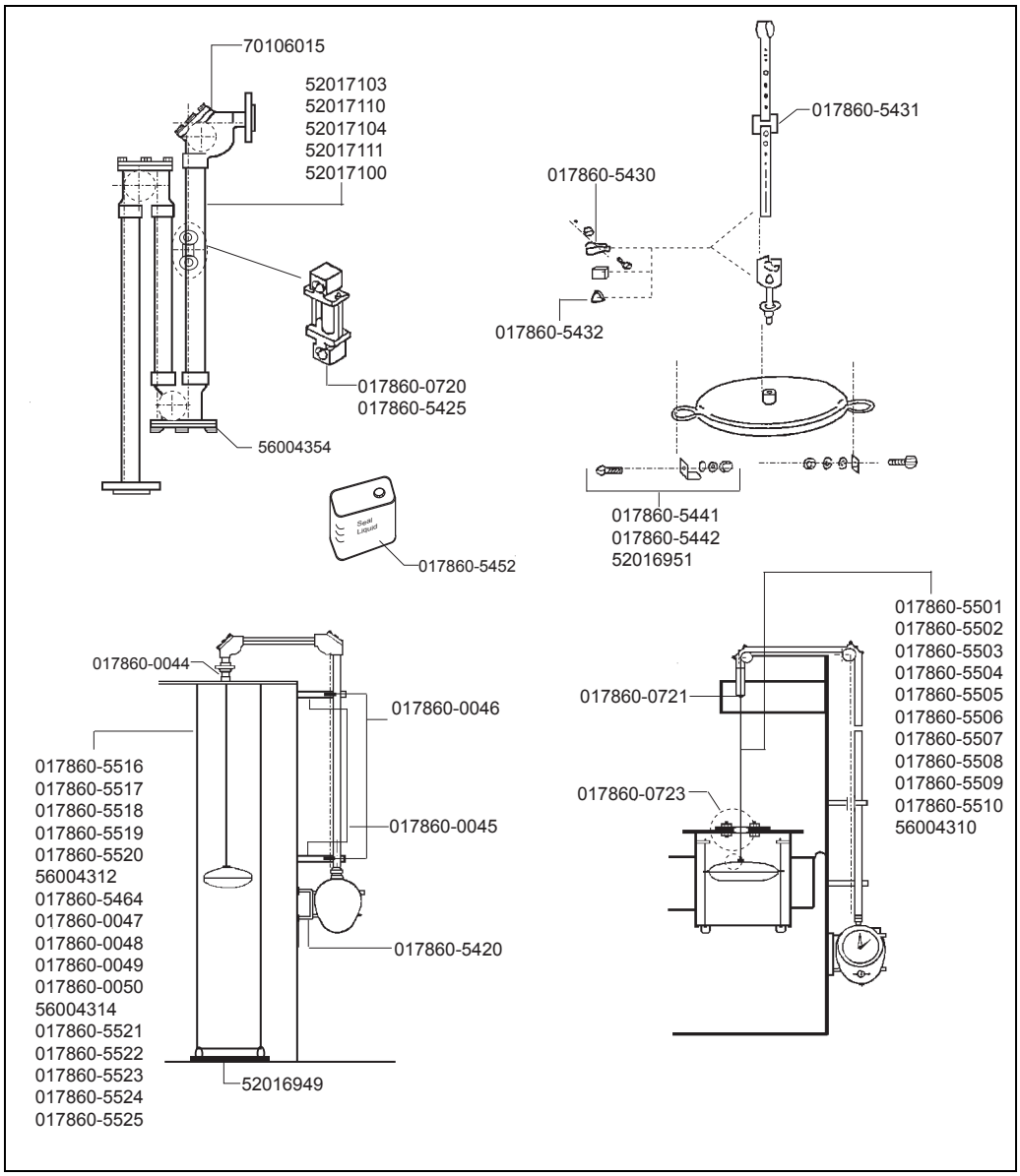
No.	Specification	No.	Specification
56004412	Measuring tape CRT- 5M	017860-5302	Measuring tape CRT-10M BT-5M,overall: 24M
017860-5304	Measuring tape, CRT-20M BT-16M,overall: 45M	017860-5305	Measuring tape?CRT-30M BT-20M,overall:65M
17860-5306	Measuring tape, FRT-5M, Measuring tape only	017860-0005	Measuring tape, FRT-5M+1.6, with Measuring wire
017860-0006	Measuring tape, FRT-5M+1.6, Measuring wire: SS316 PTFE coating	017860-5307	Measuring tape FRT-10M, Measuring tape only
017860-0007	Measuring tape, FRT-10M+1.6, with Measuring wire	017860-0008	Measuring tape, FRT-10M+1.6, Measuring wire: SS316 PTFE coating
017860-5309	Measuring tape, FRT-20M, Measuring tape only	017860-0011	Measuring tape, FRT-20M+1.6, with Measuring wire
017860-0012	Measuring tape, FRT-20M+1.6, Measuring wire: SS316 PTFE coating	017860-5310	Measuring tape, FRT-30M, Measuring tape only
017860-0013	Measuring tape, FRT-30M+1.6, with measuring wire	017860-0014	Measuring tape, FRT-30M+1.6, Measuring wire: SS316 PTFE coating
017860-0210	Universal jouint	01760-0211	Triangle joint
017860-7003	LF-400, SUS316, 5kg? standard	017860-7010	LF-400, SUS316, 8kg
56004370	LF-140 (without ring, SUS316:2.4kg)	56004369	LF-140 (without ring, SUS316:2.1kg)

Top anchor



No.	Specification	No.	Specification
017860-0058	Top anchor SUS316 socketed, PT1", LT1100	017860-0820	Top anchor SUS316 threaded, PT1"
017860-5471	Top anchor Alu+SUS316 shaft/ spring PT1"	017860-0025	Top anchor Alu + SUS316 shaft 150#, 1.5" LT1200
017860-0026	Top anchor SUS316 threaded 150#, 1.5" LT1200	017860-0030	Housing Alu, 1" threaded, LT1100
70106010	Packing, Top anchor, thread, V6502, low pressure	017860-0808	SS304 shaft (for LT-1100/1200)?

Seal pot, measuring wire and guide wire



No.	Specification	No.	Specification
017860-5501	Measuring wire, 316, 5M	017860-5502	Measuring wire, 316, 10M
017860-5503	Measuring wire, 316, 16M	017860-5504	Measuring wire, 316, 20M
017860-5505	Measuring wire, 316, 30M	017860-5506	Measuring wire, teflon coated, 5M
017860-5507	Measuring wire, teflon coated, 10M	017860-5508	Measuring wire, teflon coated, 16M
017860-5509	Measuring wire, teflon coated, 20M	017860-5510	Measuring wire, teflon coated, 30M
56004310	Wire 1.6?, teflon coated, 60M	017860-5516	Guide wire, stranded, 316, 5M
017860-5517	Guide wire, stranded, 316, 10M	017860-5518	Guide wire, stranded, 316, 16M
017860-5519	Guide wire, stranded 316, 20M	017860-5520	Guide wire, stranded, 316, 20M
56004312	D3, stranded SUS316, 60M	017860-5464	Teflon coated 5M
017860-0047	Teflon coated 10M	017860-0048	Teflon coated 16M
017860-0049	Teflon coated 20M	017860-0050	Teflon coated 30M
56004314	D3, Teflon coated 60M	017860-5521	Guide wire, solid, SUS316, 5M
017860-5522	Guide wire, solid, SUS316, 10M	017860-5523	Guide wire, solid, SUS316, 16M

No.	Specification	No.	Specification
017860-5524	Guide wire, solid, SUS316, 20M	017860-5525	Guide wire, solid, 316, 30M
52017103	Seal pot (SGP/AC4A?PS1-1/2")	52017110	Seal pot SS316/SS316,PS1-1/2"
52017104	Seal pot SGP/AC4A,JIS10K 40A	52017111	Seal pot SS316/SS316,JIS10K 40A
52017100	Seal pot PVC/PVC,JIS10K 40A	56004354	Cover elbow, Alu Packing, Plug
017860-0720	Oil gauge (KL60?standard	017860-5452	Seal liquid (paraffin: 2liter)
017860-5441	Wire hook (bottom anchor), Steel, (2 pcs.?	017860-5442	Wire hook (bottom anchor), SUS316, (2 pcs.?
52016951	Wire hook (bottom anchor),SUS316 with PVC & bolt, nut	017860-0045	Pipe support, steel
017860-0046	U-bolts (for pipe support)	017860-0044	Socket 1-1/2", AISI316 1-1/2"
017860-5430	Tape clamp	017860-5432	Wire connector, triangle
017860-5420	Gauge bracket, steel	017860-0723	Wire guide socket, FRT installation (SUS+teflon)
017860-0721	Wire guide socket, FRT installation	52016949	bottom anchors, CS+PVC, bolt, nut
017860-5431	Tape connector, square	70106051	Packing, elbow low pressure?V6502

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