

Installation Manual

DOPPLER SONAR

Model DS-60

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SAFETY INSTRUCTIONS



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



Warning, Caution



Prohibitive Action



Mandatory Action



WARNING



Have a qualified serviceman do the installation.

Only qualified personnel should work inside the equipment.



Turn off the power at the switchboard before installing the equipment.

Fire or electrical shock can result if the power on.



Do not install the unit in a place subject to rain or water splash.

Fire or electrical shock can result.



Use the specified power cable.

Fire can result if an incorrect cable is used.



CAUTION



Attach protective earth securely to the ship's body.

The protective earth (grounding) is required for the AC power supply to prevent electrical shock.



Do not weld the tank with transducer to the ship's hull.



CAUTION



Confirm that the power supply voltage is compatible with the voltage rating of the equipment.

Connection to the wrong power supply can cause fire or damage to the equipment.



The mounting location for the display, distributor and transceiver unit must satisfy the following conditions:

- Away from rain and water splash
- Out of direct sunlight
- Away from air conditioner vents
- Moderate and stable in temperature and humidity



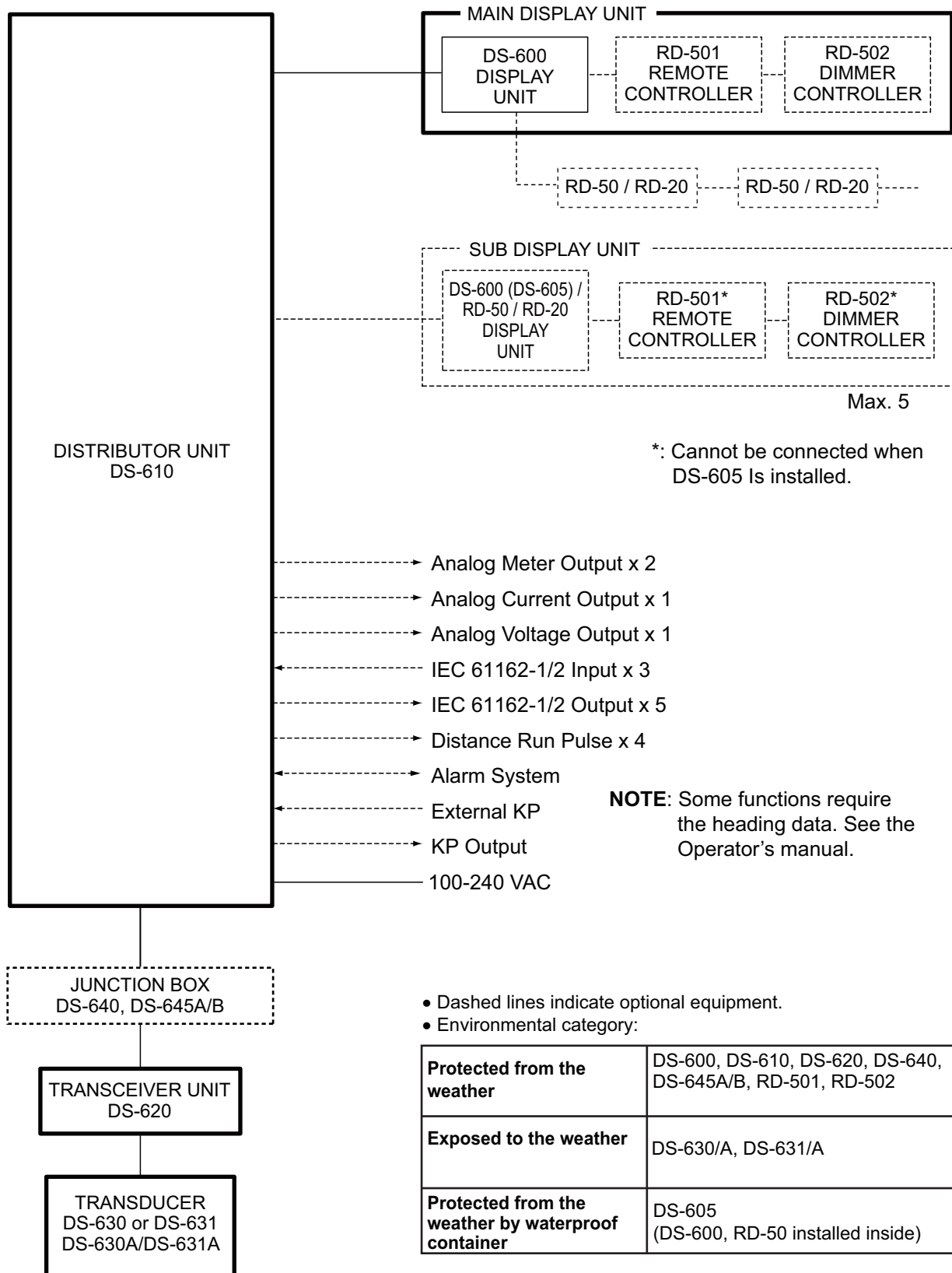
Use Chugoku Toso brand SEATENDER 20 Brown adhesive or the equivalent for the transducer.

Coat thinly and evenly. A thick coat can reduce output power.

Observe the compass safe distances to prevent interference to a magnetic compass.

	Standard	Steering
DS-600	0.60 m	0.40 m
DS-605	0.95 m	0.60 m
DS-610	3.15 m	2.00 m
DS-620	3.20 m	2.05 m
DS-640	1.15 m	0.70 m
DS-645A	1.90 m	1.25 m
DS-645B	2.00 m	1.30 m

SYSTEM CONFIGURATION



EQUIPMENT LISTS

Standard supply

Name	Type	Code No.	Qty	Remarks
Display Unit	DS-600	-	1	8.4" color LCD
Distributor Unit	DS-610	-	1	
Transceiver Unit	DS-620	-	1	
Transducer	DS-630	-	1	No watertight connector. No fixing flange.
	DS-630A	-		No watertight connector. Fixing flange. (Type: 66-027-7003.)
	DS-631	-		With watertight connector. No fixing flange.
	DS-631A	-		With watertight connector and flange. Fixing flange. (Type: 66-027-7003.)
Transducer Tank	DS-660-A	-	1	For DS-630/631. Tank with flange. (Type: 66-027-7002.)
	DS-660-N	-		For DS-630/631. Tank without flange.
	DS-660-S	-		For DS-630/631. Tank with sleeve. (Type: 66-027-7301.)
	DS-660A-A	-		For DS-630A/631A. Tank with flange. (Type: 66-027-7002.)
	DS-660A-N	-		For DS-630A/631A. Tank without flange.
	DS-660A-S	-		For DS-630A/631A. Tank with sleeve. (Type: 66-027-7301.)
Gate Valve	DS-661	-	1	For DS-630 only
Ball Valve	DS-662	-		
Installation Materials	CP26-01501	001-081-900	1 set	For DS-600
	CP66-01701	001-407-270	1 set	For DS-610
	CP66-01702	001-082-290	1 set	For DS-620
	CP66-01703	001-082-630	1 set	For DS-630
	CP66-01740	000-016-374	1 set	For DS-631 (CP66-01704, 30m cable)
	CP66-01750	000-016-375	1 set	For DS-631 (CP66-01704, 40m cable)
	CP66-01760	000-016-376	1 set	For DS-631 (CP66-01760, 50m cable)
	CP66-01770	000-016-377	1 set	For DS-631 (CP66-01760, 60m cable)
	CP66-01710	001-082-830	1 set	For DS-661 (when shipped assembled.)
	CP66-01711	001-082-800	1 set	For DS-661 (when shipped separate.)

EQUIPMENT LISTS

Name	Type	Code No.	Qty	Remarks
Installation Material	CP66-01712	001-082-820	1 set	For DS-661, gasket (when shipped separate.)
	CP66-02301	001-625-270	1 set	For DS-662-N
	CP66-02302	001-625-280	1 set	For DS-662-A
	CP65-01601	001-590-340	1 set	For DS-662
Spare Parts	SP26-00101	001-076-450	1 set	For DS-600 (other than Deep Sea)
		001-077-030	1 set	For DS-600 (Deep Sea)
	SP66-00901	001-407-280	1 set	For DS-610 (other than Deep Sea)
		001-082-210	1 set	For DS-610 (Deep Sea)
	SP66-00902	001-082-520	1 set	For DS-620 (other than Deep Sea)
		001-082-530	1 set	For DS 620 (Deep Sea)
Accessories	FP66-00701	001-082-140	1 set	For DS-600

Optional Supply

Name	Type	Code No.	Qty	Remarks
Display Unit	DS-600	-	1	8.4" color LCD
Hanger	OP26-8	000-016-313	1	For DS-600
Junction Box	DS-640	-	1	w/installation materials (CP66-01721)
	DS-645A/B	-	1	
Waterproof Box	DS-605-R	000-016-398	1	w/Installation materials (CP66-01731), right-hand open door
	DS-605-L	000-016-727	1	w/installation materials (CP66-01731), left-hand open door
Flange	OP66-6	000-016-400	1	For DS-660
Tightening Handle	OP66-7	001-082-950	1	
Remote Controller	RD-501	000-016-197	1	
Dimmer Controller	RD-502	000-016-198	1	
Analog Indicator	FL-200S-1	000-015-997-10	1	-10 to 30kn, flush mount
	FL-200S-2	000-015-998-10	1	-10 to 40kn, flush mount
	SL-200-1	000-016-000-10	1	-10 to 30kn, bulkhead mount
	SL-200-2	000-016-164-10	1	-10 to 40kn, bulkhead mount
	FL-200S-1W	000-174-599-10	1	-10 to 30kn, flush mount
	FL-200S-3	000-174-600-10	1	-10 to 40kn, flush mount
	FE-90	006-931-140	1	-10 to 30 kn, panel flush mount
	FL-90	006-931-150	1	-10 to 30 kn, panel flush mount
Operator's Manual	OME-72640-*	000-172-334-1*	1	Hard copy manual, English
	OMJ-72640-*	000-172-333-1*	1	Hard copy manual, Japanese

1. INSTALLATION

NOTICE

Do not apply paint, anti-corrosive sealant or contact spray to coating or plastic parts of the equipment.

Those items contain organic solvents that can damage coating and plastic parts, especially plastic connectors.

1.1 Display Unit DS-600

Mounting Consideration

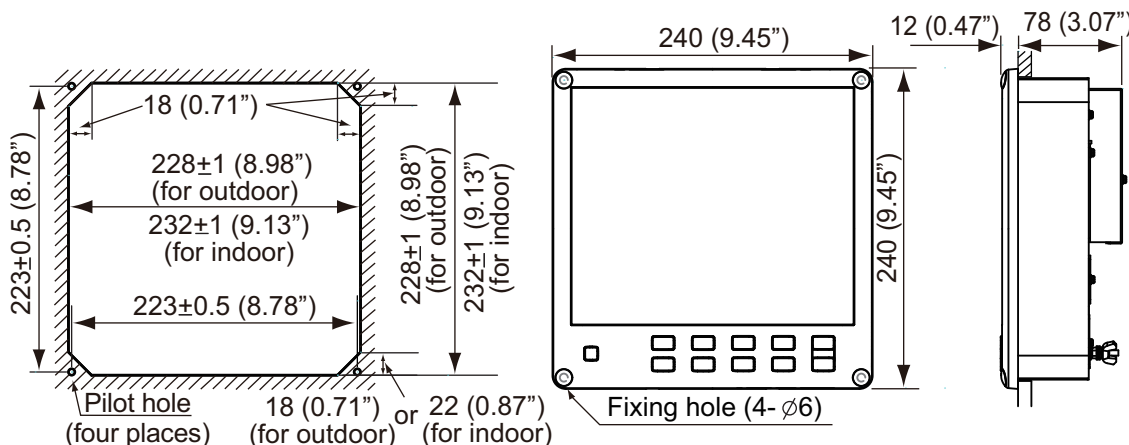
The display unit can be installed on a desktop, on the underside of a table, or flush mounted in a panel. When you select a mounting location, keep in mind the following points:

- Locate the display unit away from exhaust pipes and vents.
- Select an installation location that is well ventilated.
- Locate the display unit where shock and vibration are minimal.
- Allow enough maintenance space at the sides and rear of the display unit and leave enough slack in cables to facilitate maintenance and servicing.
- Observe the compass safe distances (see page i) to prevent the interference to a magnetic compass.
- The nominal viewing distance for the display unit is 1 m. Select a suitable mounting location considering that distance.

Flush Mount

See the outline drawing in the back of this manual. Before you fasten the display unit to the cutout, first connect the cables referring to chapter 2.

1. Make a cutout in the mounting location as shown in the illustration below.



Note: Dimensions for the cutout are different depending on the mounting location, indoor or out-door. For the outdoor mounting, ask dockyard to construct a water-proof case for the display unit.

1. INSTALLATION

2. Make four pilot holes for self-tapping screws (diameter: 5 mm) in the location indicated in the illustration on "Flush Mount" on page 1-1.
3. Insert the sponge to the display unit from the rear side.
4. Set the display unit to the cutout and fasten the display unit with four self-tapping screws (5x20).
5. Set a cosmetic cap to each fixing hole on the front panel. See page 1-3.

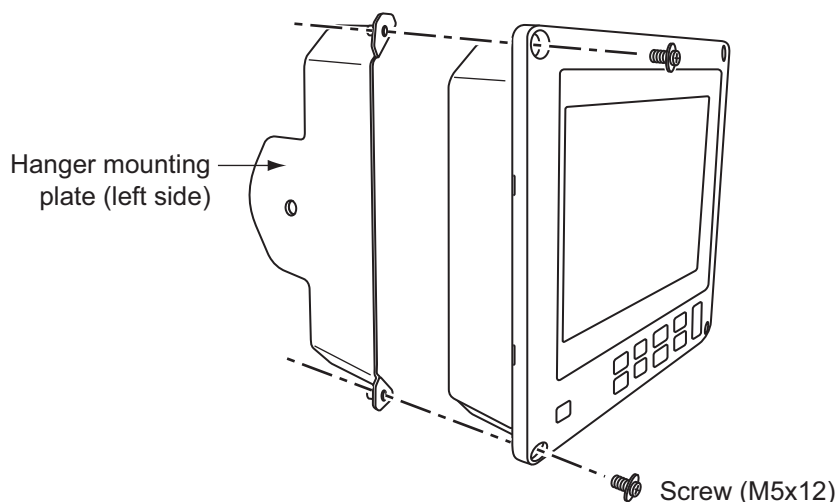
Desktop or table underside mount

The display unit can be mounted on a desktop or on the underside of a table using the optional hanger. See the outline drawing for details.

Hanger assembly (Type: OP26-8, Code No.: 000-016-313-00)

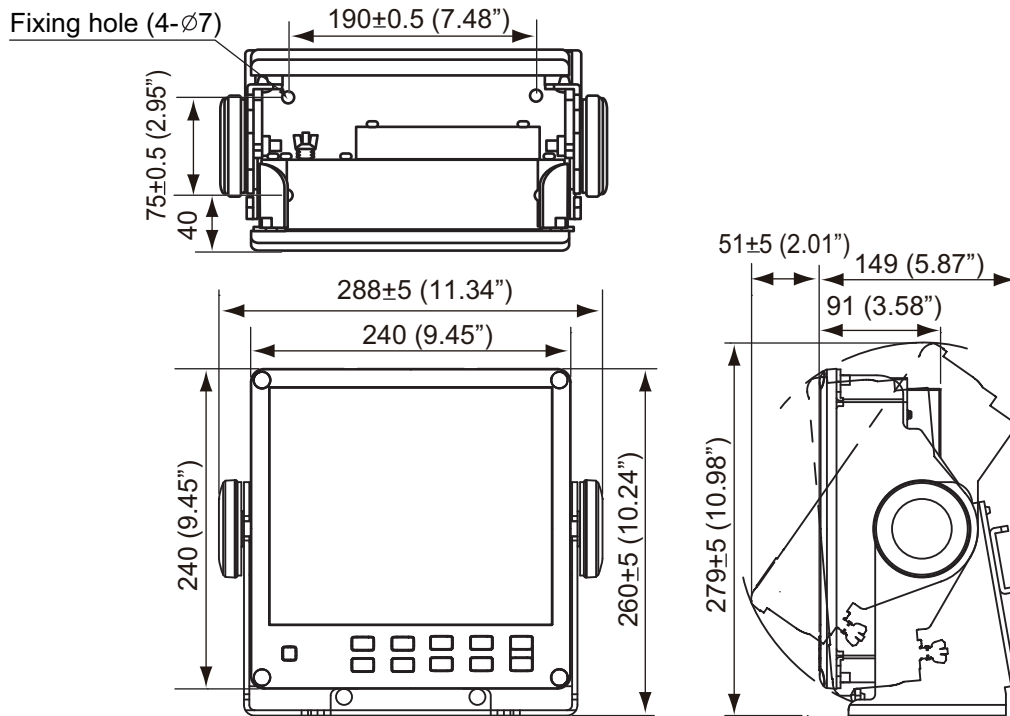
Name	Type	Code No.	Qty
Self-tapping screw	5x20	000-171-997-10	4
Binding head screw	M5x12	000-171-999-10	4
Hanger Assembly	OP26-8-1	001-081-920-00	1

1. Remove the hanger mounting plate from the hanger assembly.
2. Fasten the hanger mounting plate to the display unit from the left side and right side with four binding head screws (M5x12).



3. Make a four pilot holes for self-tapping screws (5x20) in the mounting location.
4. Fix the hanger to the mounting location with four self-tapping screws (5x20).
5. Screw knobs into the display unit loosely.
6. Set the display unit to the hanger.
7. Tighten the knobs to fasten the hanger to the display unit.

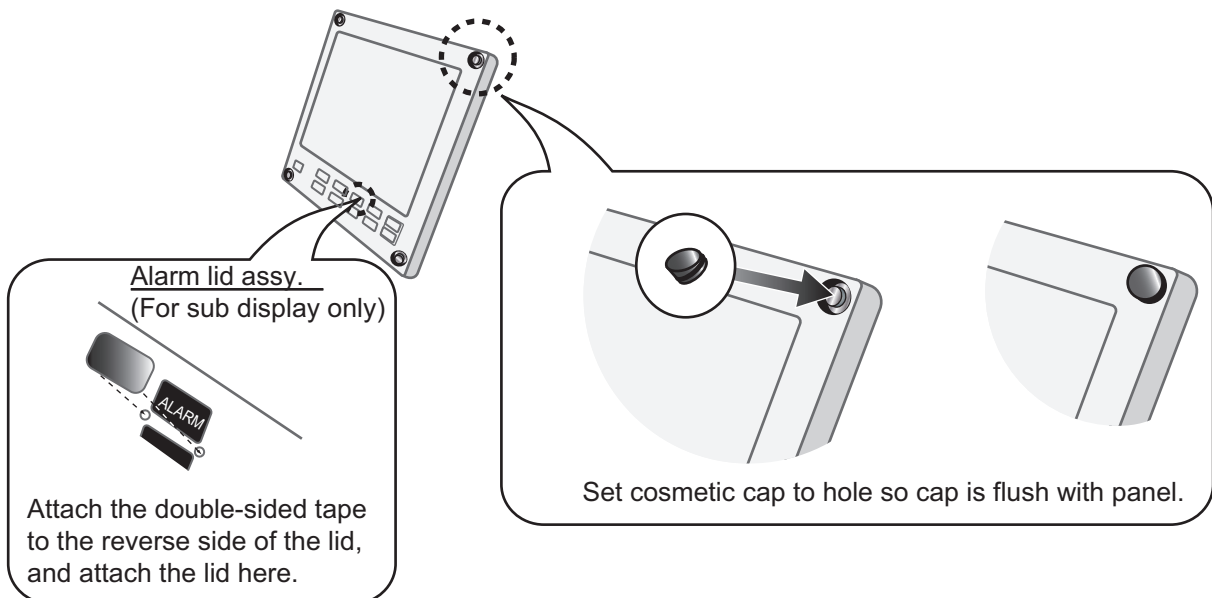
8. Set a cosmetic cap to each fixing hole on the front panel.



How to set the cosmetic cap and alarm lid assembly

Set a cosmetic cap to each fixing hole on the front panel as shown in the illustration below.

For the display unit to be used as a sub display, attach the alarm lid (supplied as accessories) to the **ALARM ACK** key to prevent accidental operation of the key.



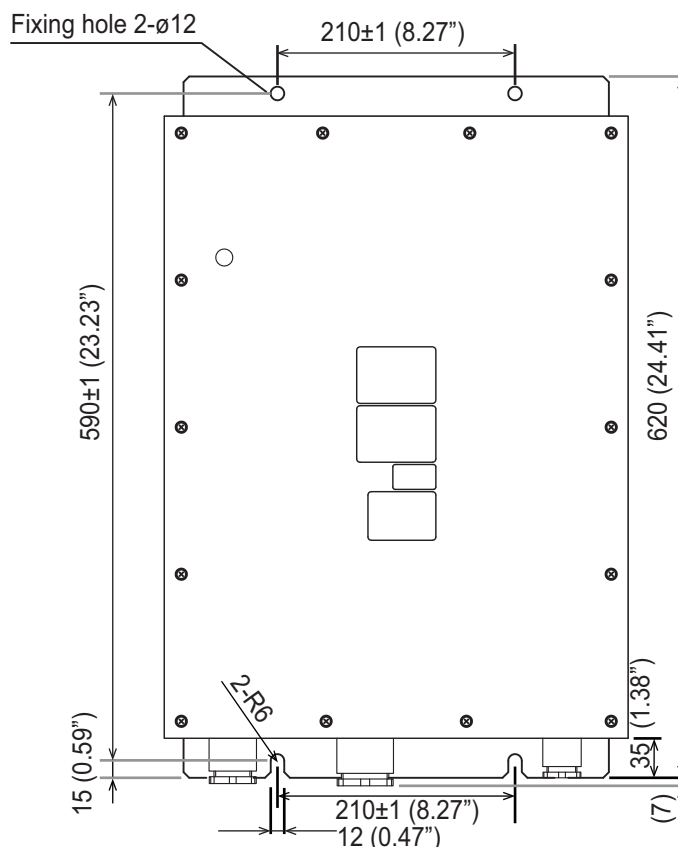
1.2 Transceiver Unit DS-620

Installation considerations

- Since the transceiver unit generates heat, install it in a dry, well-ventilated place. The cooling fans at the top of the unit must not be obstructed, to allow heat to escape.
- This unit is designed for bulkhead mounting to permit dissipation of heat. If bulkhead mounting is absolutely impossible, mount the unit on the floor leaving at least 350 mm clearance between it and the floor to permit dissipation of heat.
- Reinforce the mounting area, if necessary.
- Select a location where the vibration is minimal. When installing the transceiver unit in a location with a lot of vibration such as a bow thruster room, use a vibration isolator (shipyard supply).
- Leave space around the unit for maintenance and checking. Refer to the drawing at the back of this manual for minimum recommended maintenance space.
- A magnetic compass will be affected if the transceiver unit is placed too close to it. Observe the compass safe distances to prevent disturbance to the magnetic compass (page i).

Use four hex. bolts (M10x20) to fix the transceiver unit to the mounting area. See the outline drawing at the back of this manual.

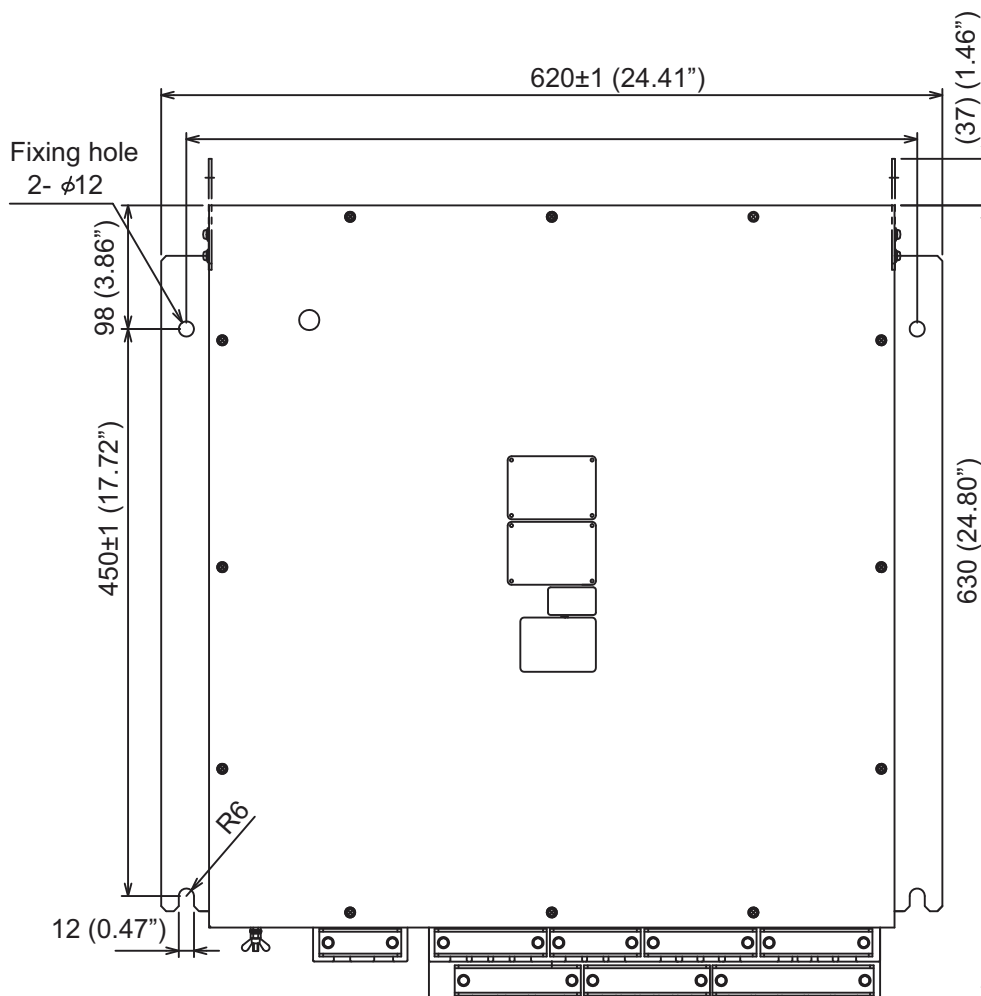
1. Screw in lower hex. bolts so there is 5 mm clearance between bottom of screw head and bulkhead.
2. Hang the unit on the bolts, then tighten the bolts.
3. Fasten the unit with upper hex. bolts.



1.3 Distributor Unit DS-610

The distributor unit can be mounted on the deck or on a bulkhead. Consider the following points when selecting a mounting location.

- Select a location which is both well ventilated and low in humidity to keep the unit cool.
 - For bulkhead mounting, be sure the mounting location is strong enough to support the weight under the continued vibration normally encountered on the vessel.
 - A magnetic compass will be affected if the distribution box is too close. Observe the compass safe distances to prevent disturbance to the magnetic compass.
1. Screw in lower hex. bolts so there is 5 mm clearance between bottom of screw head and bulkhead.
 2. Hang the unit on the bolts, then tighten the bolts.
 3. Fasten the unit with upper hex. bolts.



1.4 Transducer

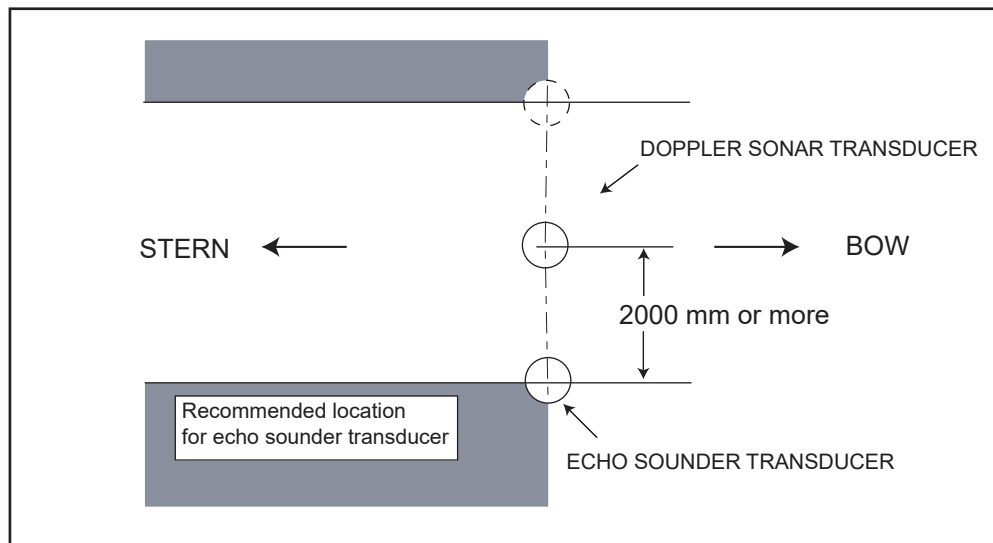
The performance of this equipment is directly dependent on the installation of the transducer.

The installation of the transducer and the tank must be accomplished by a dockyard referring to the installation drawings at the later part of this manual.

1.4.1 Installation location

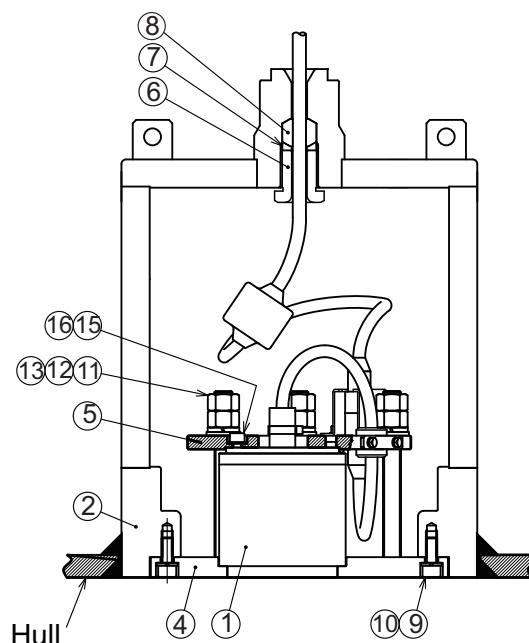
To decide the location of the transducer, the following points must be taken into account.

- Locate the transducer of DS-60 at least 2 m from the transducer of an echo sounder.



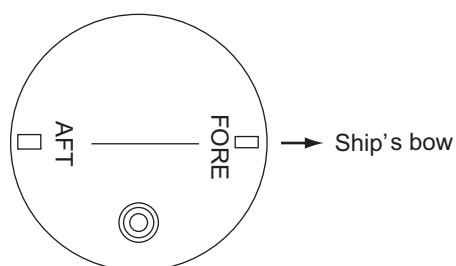
- Separate as far as possible from air bubble sources; e.g., side thruster and water disposal pipes.
- Install in close proximity to the keel, for uniform water flow.
- Generally, best performance is obtained by mounting on the bow; the stern side is influenced easily by air bubbles and propeller cavitation.
- Do not apply any paint to the transducer face.
- Visually confirm that the "FORE" mark on the transducer is oriented to the ship's bow direction after the installation.

1.4.2 Installation using the transducer tank DS-660



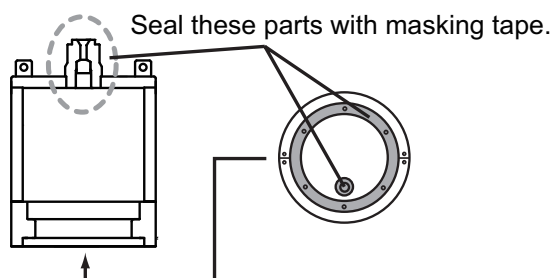
Transducer tank DS-660, sectional view

1. Remove flange (4), fixing plate (5), fixing gland (6), washer (7) and gasket (8) from the tank.
2. Set the tank to the place which was selected at paragraph 1.4.1.
The "FORE-AFT" line on the tank must be parallel with the line between ship's fore and aft (error: within 3°).
For horizontal direction, the bottom of the tank (2) must be parallel to the draft.



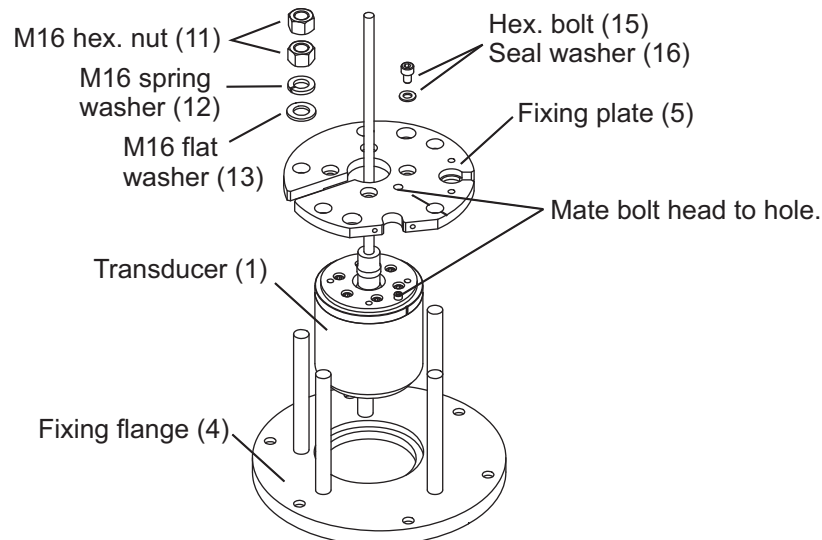
DS-660 Tank, top view

3. Weld the tank (2) to the ship's hull. The doubling and welding methods are left up to the shipyard.
4. Paint the tank (2), flange (4) and fixing plate (5) the same color as the ship's body.
 - The tank (2) is pre-painted with epoxy zinc rich primer.
 - The flange (4) and fixing plate (5) are pre-painted with zinc rich primer and anti-corrosion coat (BANNOH 500). If necessary, remove it with the sandblast, then paint the flange (4) and fixing plate (5) the same color as the ship's body.
5. Apply adhesive (supplied) to the top of the transducer evenly.



1. INSTALLATION

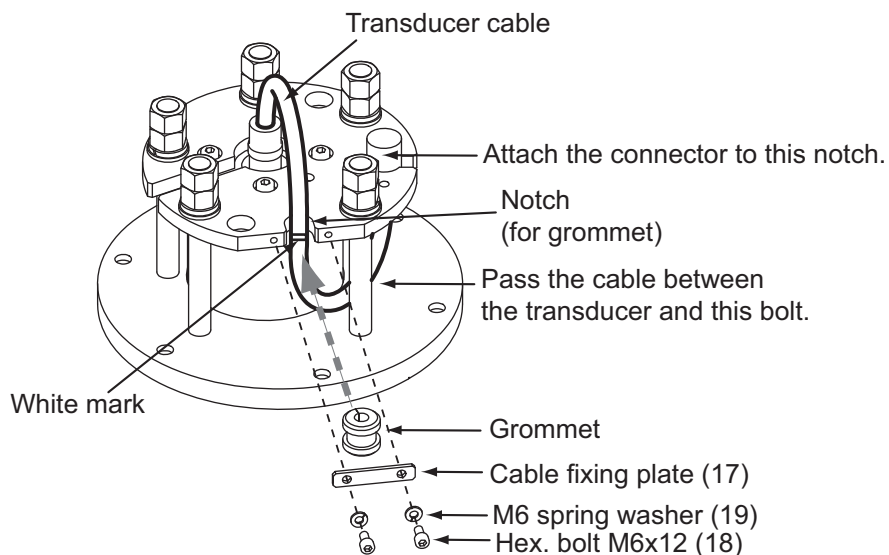
6. Mount the fixing plate (5) on the transducer (1).
7. Attach seal washer (16) to hex. bolt M8x12 (15).
8. Use hex. bolt (15)(16) assembled at step 7 to fasten the transducer (1) and fixing plate (5).
Mate bolt head at the top of the transducer with the hole on the fixing plate as shown in the figure below.
9. Use M16 nut (11), spring washer (12) and flat washer (13) to fix the transducer (1) w/fixing plate to the fixing flange (4).



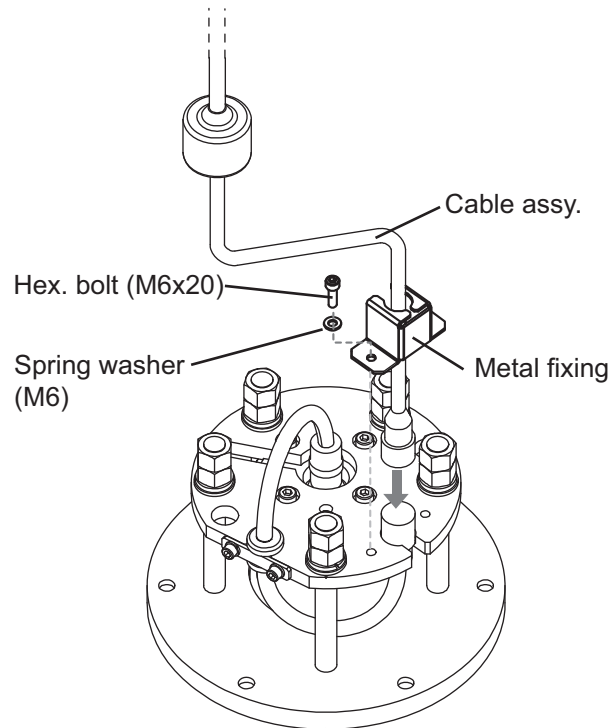
10. For the transducer DS-631, do the following steps:

Note: The underwater connector of DS-631 is coated with silicone grease. It is not necessary to apply silicone grease to the connector for installation. The silicone grease supplied should be used when reconnecting the connector. Do not use other types grease to coat the connector.

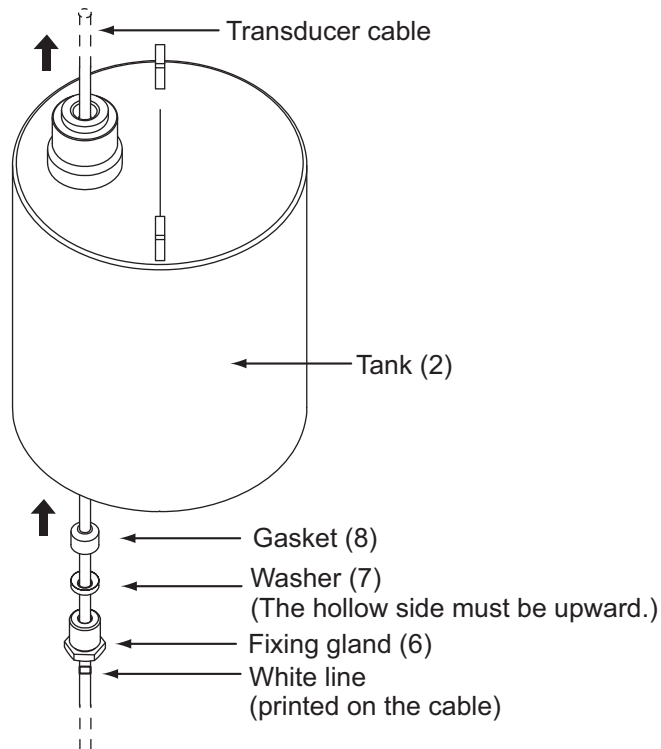
- 1) Attach the grommet (supplied) to the location marked with a white line on the transducer cable.
- 2) Fix the grommet attached at step 1) to the notch shown below, by using the cable fixing plate (17), hex. bolt M6x12 (18), spring washer M6 (19).
- 3) Pass the connector at the end of the transducer cable between the transducer and M16 bolt, and attach the notch as shown below.



- 4) Connect the cable assy. (supplied) to the connector attached at step 3).
Clean the connector faces and pins before the connection.
- 5) Attach the metal fixing (supplied) to the connector, and use two bolts M6x20 and spring washers M6 to fix them.

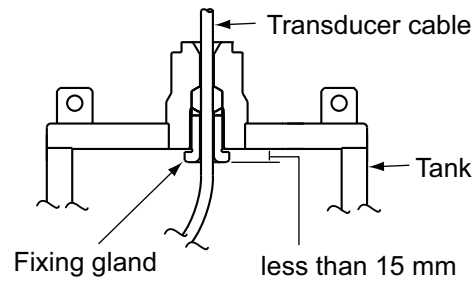


11. Pass the fixing gland (6), washer (7) and gasket (8) through the transducer cable (DS-631: cable assy), and slide them to the white line on the cable.
12. Pass the cable through the hole at the top of the tank (2).



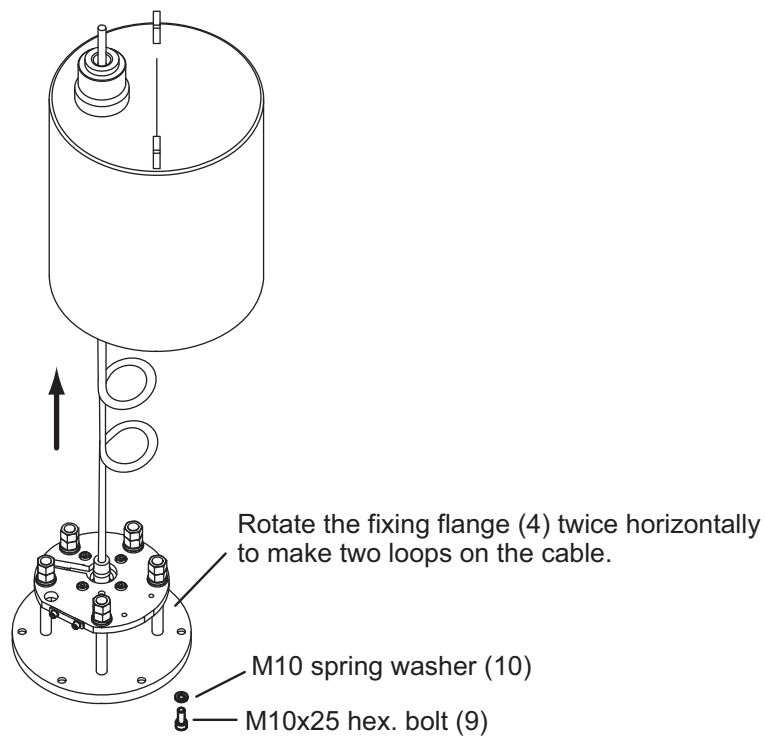
1. INSTALLATION

13. Use the tightening handle (option) to fasten the fixing gland (6) from the inside of the tank (2). The distance between the bottom of the fixing gland (6) and tank must be less than 15 mm.

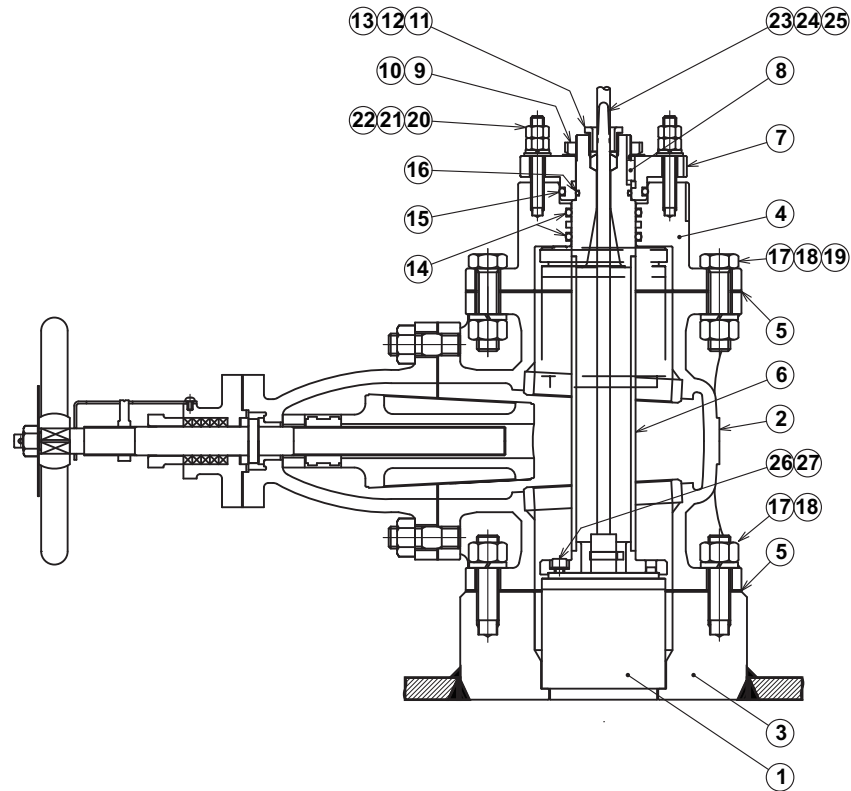


Transducer tank, sectional view

14. Rotate the fixing flange (4) twice horizontally to make two loops. These loops make it easy to put the cable in the tank.
15. Use the bolt M10x25 (9) and spring washer M10 (10) to fasten the fixing flange (4) to the tank (2).



1.4.3 Installation with gate valve DS-661

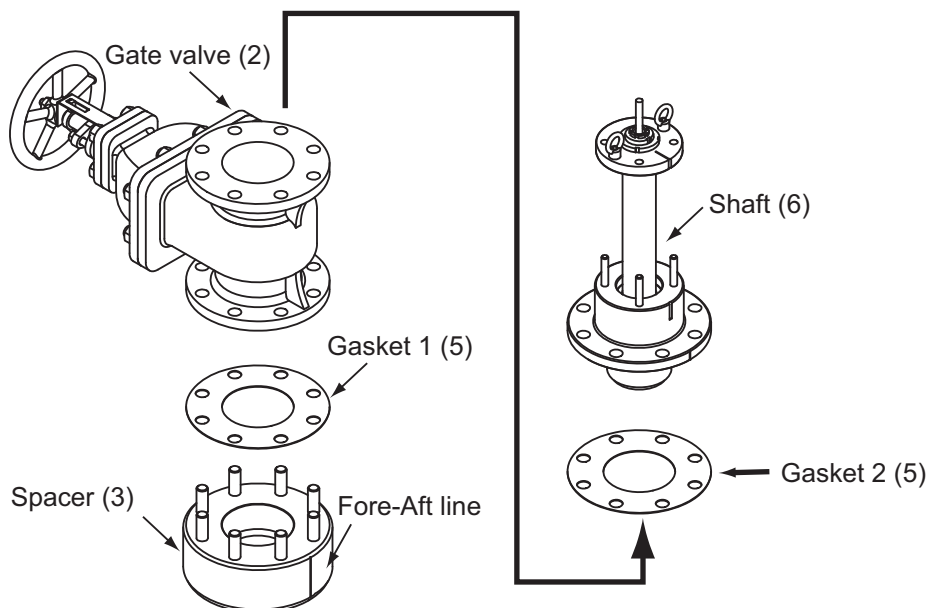


DS-661 gate valve, sectional view

Note: To install the gate valve, service space of 1000 mm height is necessary. For details, see the installation drawing at the back of this manual.

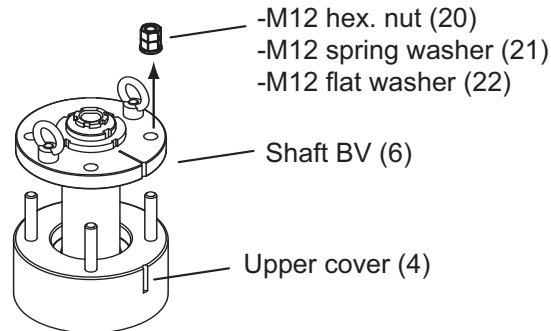
1. When your unit is shipped assembled, remove the five items shown below:

- Gate valve (2)
- Spacer (3)
- Gasket (5), 2 pcs.
- Shaft (6)

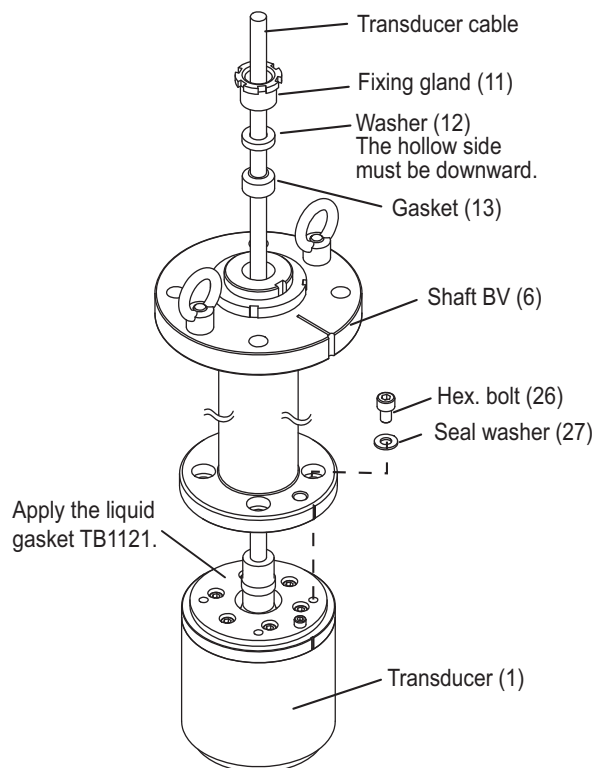


1. INSTALLATION

2. Set the spacer (3) to the place selected at paragraph 1.4.1.
The "FORE-AFT" line on the spacer must be parallel with the ship's fore and aft line (within 3°). For horizontal direction, the bottom of the spacer must be parallel with the ship's draft.
3. Weld the spacer (3) to the ship's hull. The welding and doubling methods are left up to the shipyard.
4. Unfasten M12 hex. nut (20), spring washer (21) and flat washer (22) to remove the shaft (6) from the seachest cap (4).

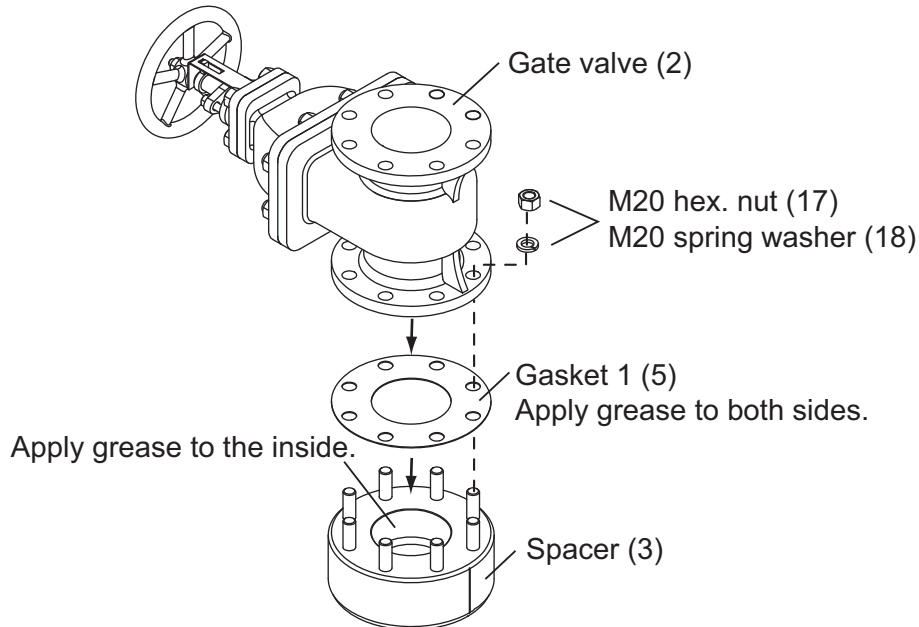


5. Pass the cable from the transducer (1) through the shaft (6) from the bottom.
6. Apply adhesive (supplied) on the top of the transducer (1).
7. Use hex. bolt (26) and seal washer (27) to fasten the transducer (1) to the shaft (6).
8. Pass the gasket (8), flat washer (7) and fixing gland (11) through the transducer cable.

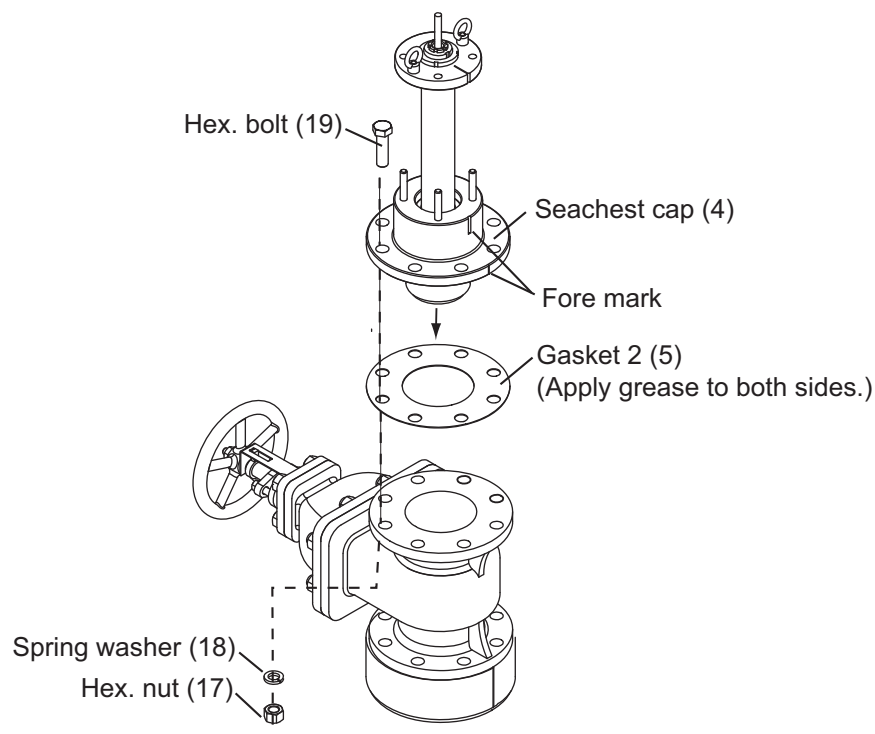


9. Fasten the fixing gland (11) to the top of the shaft (6).
The height between the top of the fixing gland (11) and the top of the shaft (6) must be less than 7 mm.
10. Apply grease (supplied) to both sides of the gasket 1 (5), and set it on the spacer (3).

11. Apply grease (supplied) to the inside of the spacer (3).
12. Clean the top and bottom of the gate valve (2), and mount it on the gasket 1 (5) mounted on the spacer (3) at step 10.
13. Fasten M20 hex. nut (17) and spring washer (18) loosely to the stud bolt of the spacer (3).



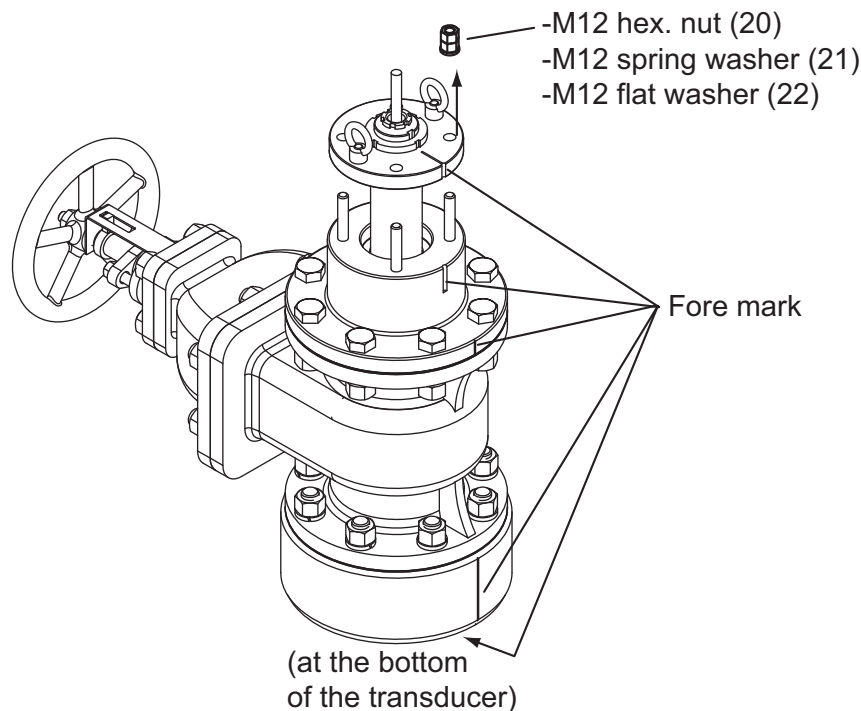
14. Apply grease (supplied) to both sides of the gasket 2 (5), and set it on the gate valve (2).
15. Use hex. nut (17), spring washer (18) and hex. bolt (19) to mount the seachest cap (4) of the shaft (6) on the gate valve (2).



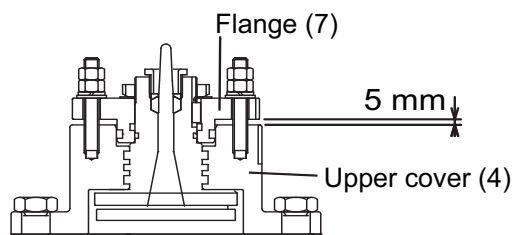
16. Move the shaft (6) upward and downward by hands to check if it moves smoothly.
17. Check that fore marks are aligned, and fasten hex. nut (17), spring washer (18) and hex. bolt (19) tightly.

1. INSTALLATION

18. Fasten hex. nut (20), spring washer (21) and flat washers (22) removed at step 4 to stud bolt on the seachest cap.



The distance between the seachest cap (4) and flange (7) must be 5 mm.



19. Paint the gate valve (2), spacer (3) and seachest cap (4) the same color as ship's body. Paint only gray-colored areas; for other part, seal with a masking tape.

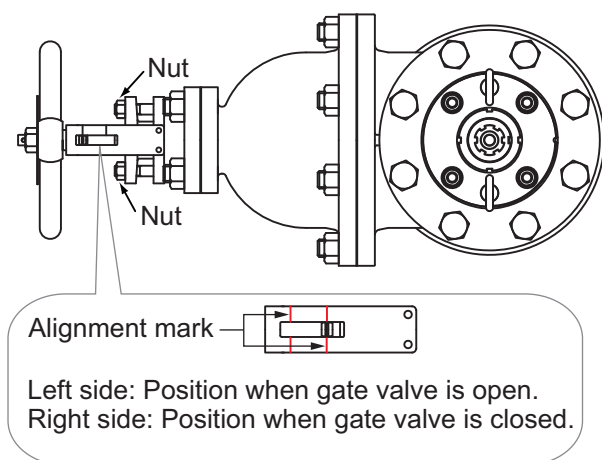
How to open, close the gate valve

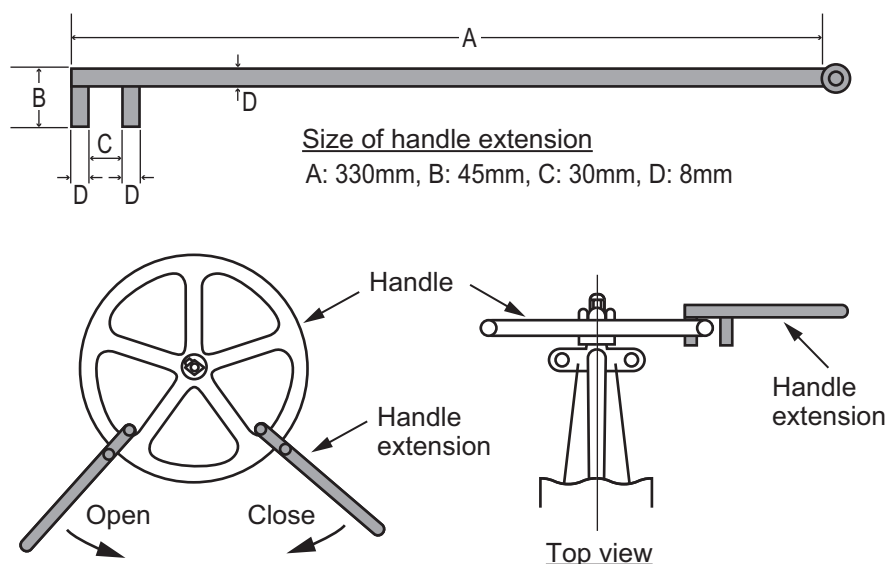
1. Loosen the two nuts fixing the gland gasket until the handle can be turned.
2. Operate the handle to open or close the gate valve.

When closing the gate valve

If additional tightening is necessary after turning the handle by hand, prepare separate handle extensions. Tighten again using the handle extensions until the main handle can no longer be turned. For the size and usage of the handle extension, refer to the figure on the next page.

3. After opening or closing the gate valve, tighten the loosened nuts until the handle cannot be turned.

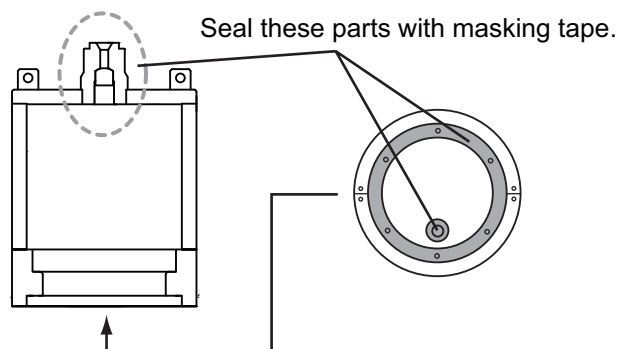
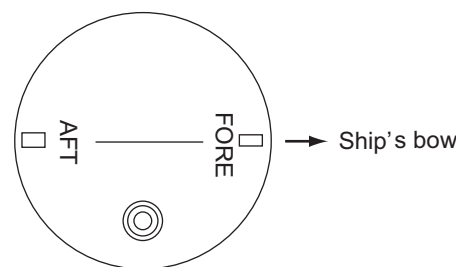




1.4.4 Installation using the transducer tank DS-660A

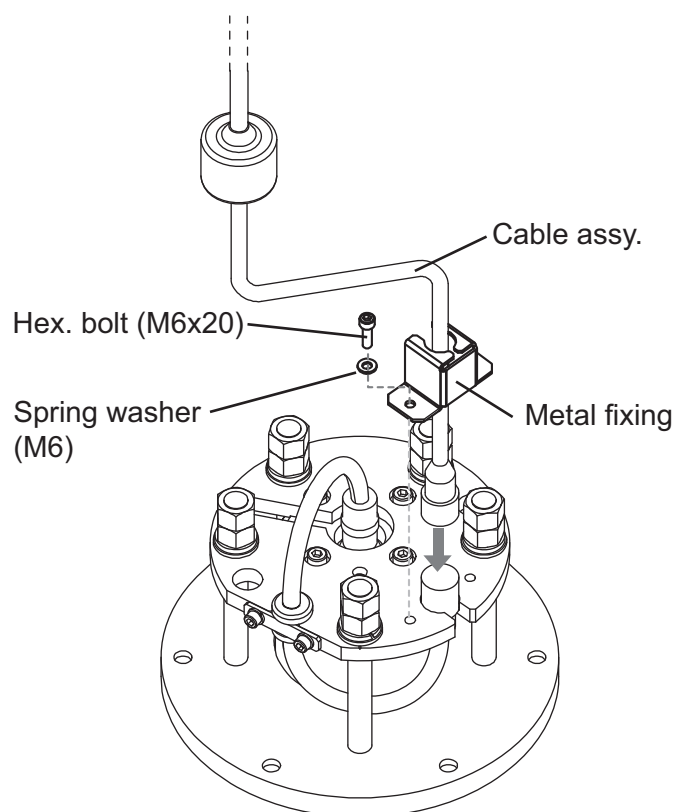
For the sectional view, see page 1-7.

1. Remove fixing gland (6), washer (7) and gasket (8) from the tank.
2. Set the tank to the place which was selected at paragraph 1.4.1.
The "FORE-AFT" line on the tank must be parallel with the line between ship's fore and aft (error: within 3°).
For horizontal direction, the bottom of the tank (2) must be parallel to the draft.
3. Weld the tank (2) to the ship's hull. The doubling and welding methods are left up to the shipyard.
4. Paint the tank (2), flange (4) and fixing plate (5) the same color as the ship's body.
 - The tank (2) is pre-painted with zinc rich primer.
 - The flange (4) and fixing plate (5) are pre-painted with epoxy zinc rich primer and anti-corrosion coat (BANNOH 500). If necessary, remove it with the sand-blast, then paint the flange (4) and fixing plate (5) the same color as the ship's body.
5. For the transducer DS-631A, do the following steps:
 - 1) Unfasten two bolts M6x20 and spring washers M6 to remove the metal fixing.
 - 2) Connect the cable assy. (supplied) to the connector from the transducer.
Clean the connector faces and pins before the connection.

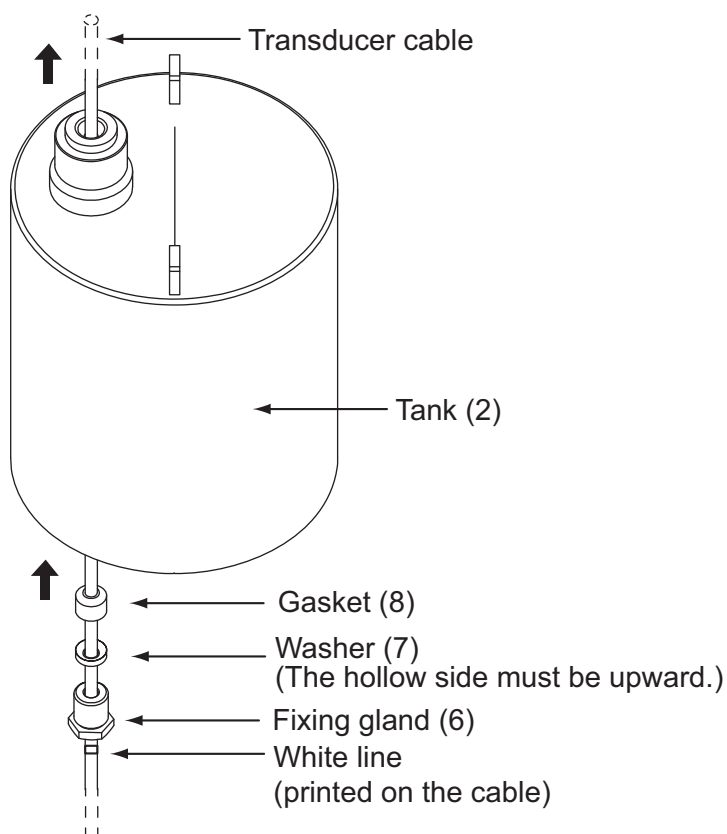


1. INSTALLATION

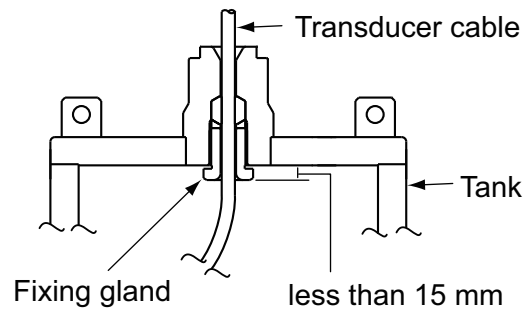
- 3) Attach the metal fixing (supplied) to the connector, and use two bolts M6x20 and spring washers M6 unfastened at step 1) to fix them.



6. Pass the fixing gland (6), washer (7) and gasket (8) through the transducer cable (DS-631A: cable assy), and slide them to the white line on the cable.
7. Pass the cable through the hole at the top of the tank (2).

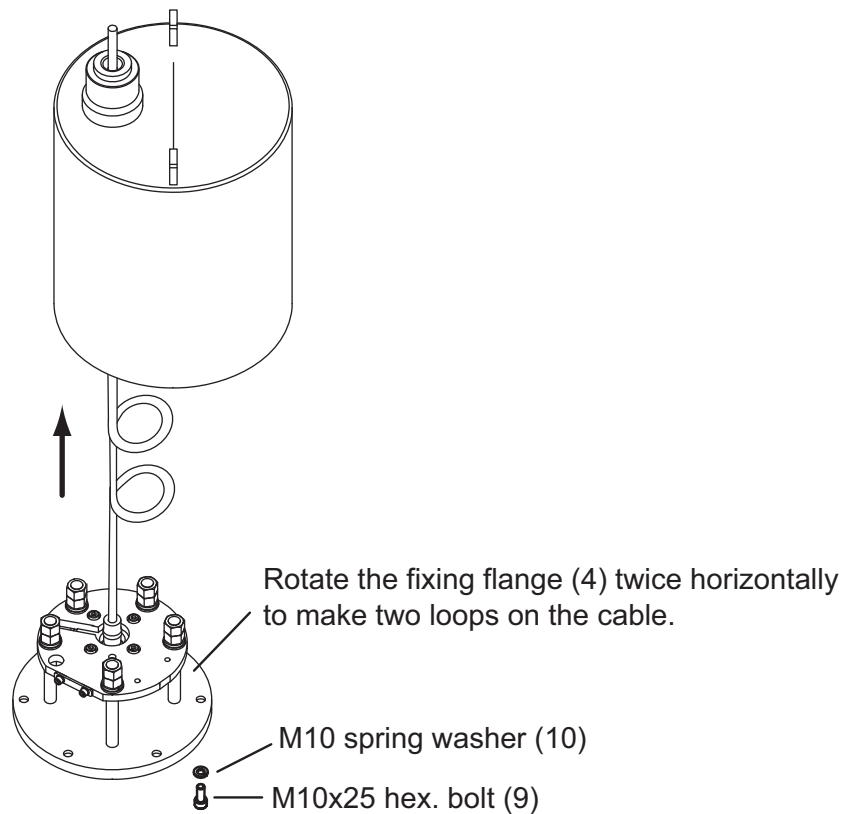


8. Use the tightening handle (option) to fasten the fixing gland (6) from the inside of the tank (2).
The distance between the bottom of the fixing gland (6) and tank must be less than 15 mm.

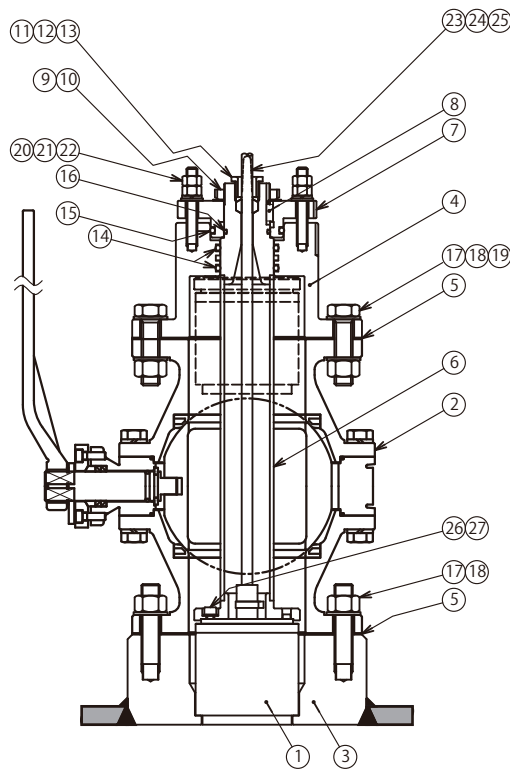


Transducer tank, sectional view

9. Rotate the fixing flange (4) twice horizontally to make two loops. These loops make it easy to put the cable in the tank.
10. Use the bolt M10x25 (9) and spring washer M10 (10) to fasten the fixing flange (4) to the tank (2).



1.4.5 Installation with ball valve DS-662



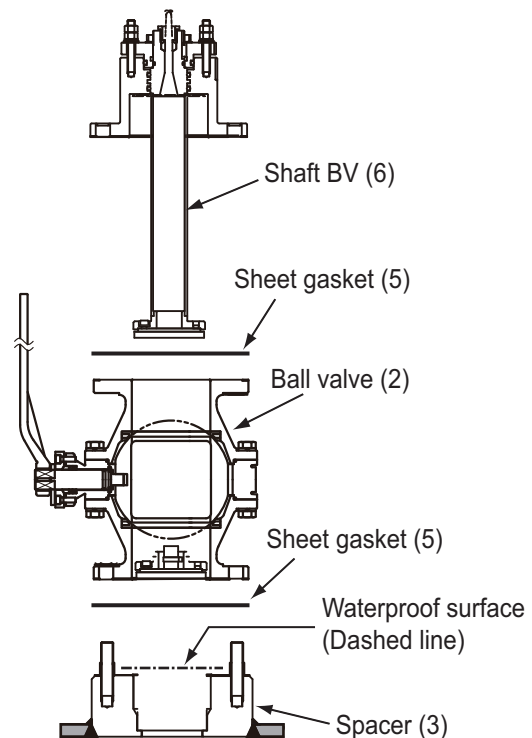
DS-662 ball valve, sectional view

Note 1: The liquid gasket for installation may not be supplied due to export regulations. If the liquid gasket TB1121 is not included in the installation materials, prepare the liquid gasket specified in your country.

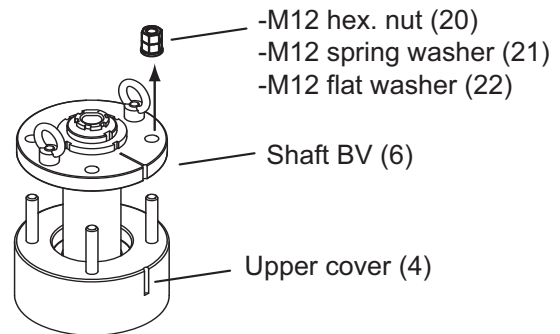
Note: To install the ball valve, service space of 1000 mm height is necessary. For details, see the installation drawing at the back of this manual.

1. When your unit is shipped assembled, remove the five items shown below:

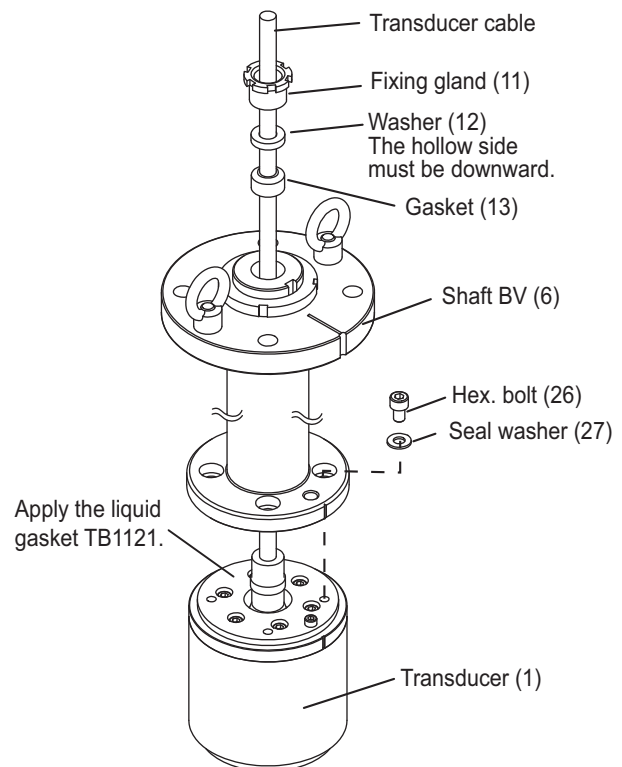
- Ball valve (2)
- Spacer (3)
- Sheet gasket (5), 2 pcs.
- Shaft BV (6)



2. Set the spacer (3) to the place selected at paragraph 1.4.1.
The "FORE-AFT" line on the spacer must be parallel with the ship's fore and aft line (within 3°). For horizontal direction, the bottom of the spacer must be parallel with the ship's draft.
Note: The upper surface of the spacer (3) is a waterproof surface, so handle it with care so as not to damage it.
3. Weld the spacer (3) to the ship's hull. The welding and doubling methods are left up to the shipyard.
4. Unfasten M12 hex. nuts (20), spring washers (21) and flat washers (22) to remove the shaft BV (6) from the upper cover (4).



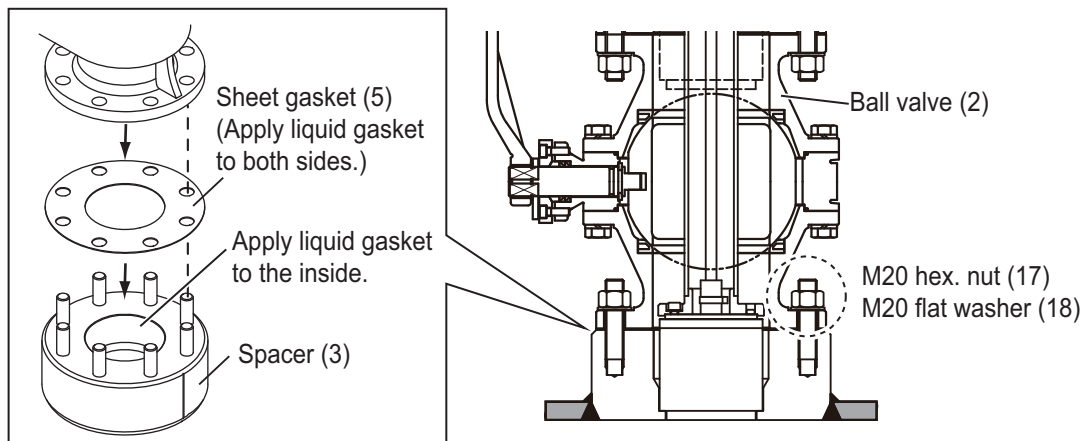
5. Pass the cable from the transducer (1) through the shaft BV (6) from the bottom.
6. Apply the liquid gasket TB1121 on the top of the transducer (1).
7. Use hex. bolt (26) and seal washer (27) to fasten the transducer (1) to the shaft BV (6).
8. Pass the gasket (13), washer (12) and fixing gland (11) through the transducer cable.



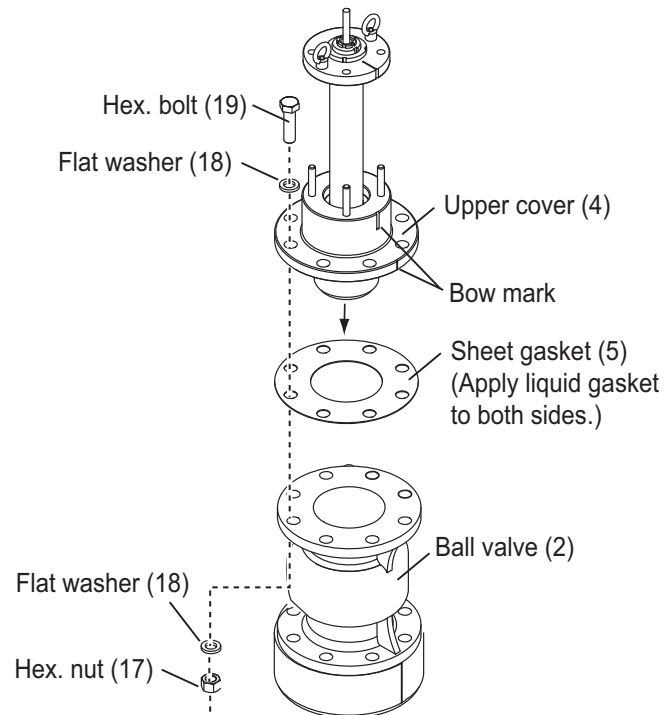
9. Fasten the fixing gland (11) to the top of the shaft BV (6).
The height between the top of the fixing gland (11) and the top of the shaft BV (6) must be less than 7 mm.
10. Apply the liquid gasket TB1121 to both sides of the sheet gasket (5), and set it on the spacer (3).
11. Apply the liquid gasket TB1121 to the inside of the spacer (3).
12. Clean the top and bottom of the ball valve (2), and mount it on the sheet gasket (5) mounted on the spacer (3) at step 10.

1. INSTALLATION

13. Fasten M20 hex. nut (17) and spring washer (18) loosely to the stud bolt of the spacer (3).

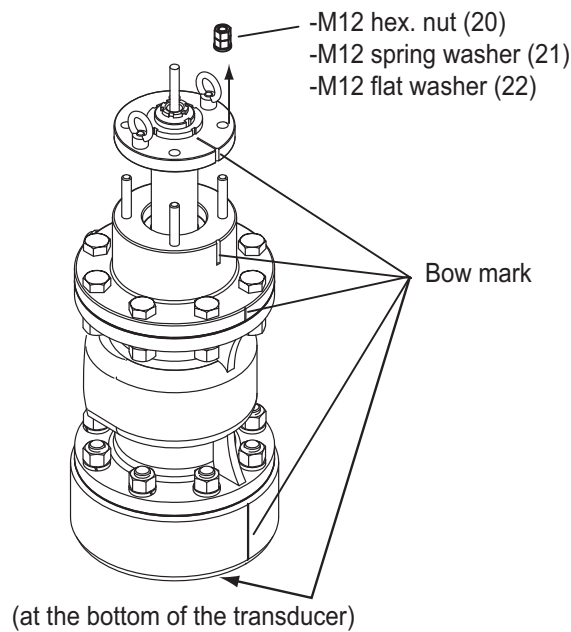


14. Apply the liquid gasket TB1121 to both sides of the sheet gasket (5), and set it on the ball valve (2).
15. Use hex. nut (17), flat washer (18) and hex. bolt (19) to mount the upper cover (4) of the shaft BV (6) on the ball valve (2).

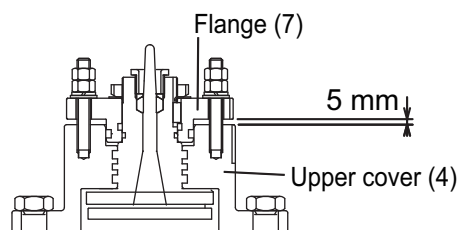


16. Move the shaft BV (6) upward and downward by hands to check if it moves smoothly.
17. Check that bow marks are aligned, and fasten hex. nuts (17), flat washers (18) and hex. bolts (19) tightly.

18. Fasten hex. nuts (20), spring washers (21) and flat washers (22) removed at step 4 to stud bolt on the upper cover (4).



The distance between the upper cover (4) and flange (7) must be 5 mm.



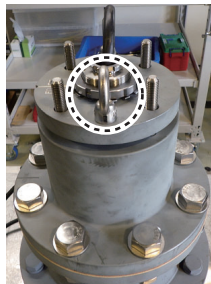
19. Paint the ball valve (2), spacer (3), upper cover (4) and the flange (7) with the same color as ship's body. The upper cover (4) and the flange (7) are attached to the shaft BV (6). Paint only gray-colored areas; cover other parts with masking tape.

How to open/close the ball valve

To open/close the ball valve, attach the supplied handle to the square projection then change the stopper position.

1. Remove the nuts, spring washers and flat washers as shown in the figure below then lift up the shaft BV.

1) Remove the nuts, spring washers and flat washers (four places).

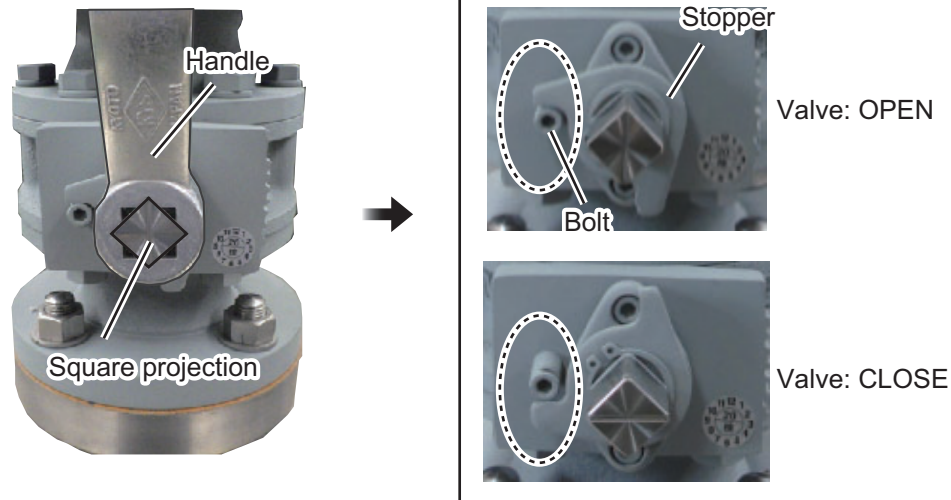


2) Lift up the shaft BV (6).

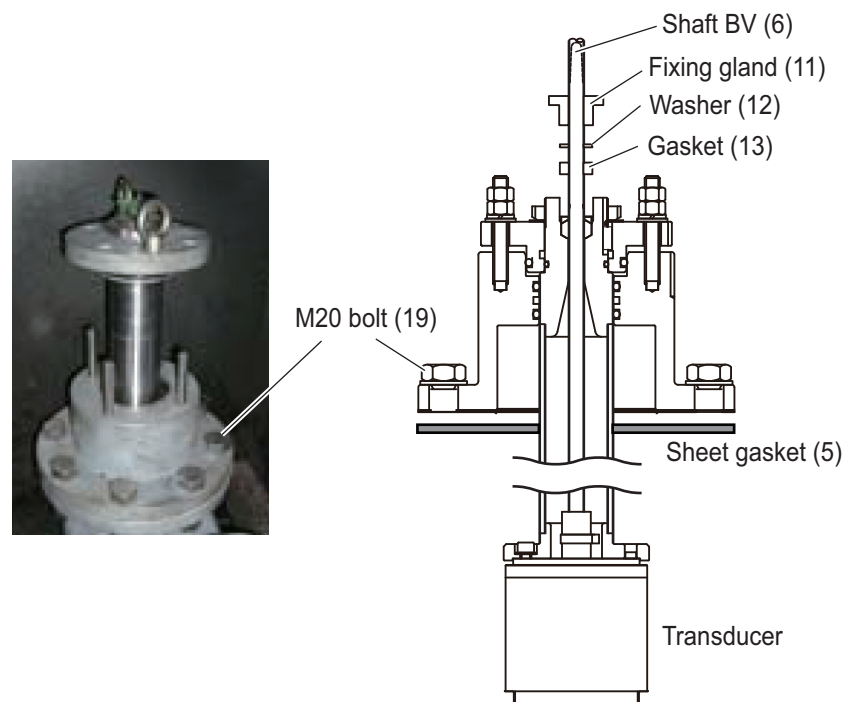


1. INSTALLATION

2. Attach the supplied handle to the square projection and then turn the handle 90° to change the stopper position.



3. After opening or closing the ball valve, remove eight M20 bolts (19) to remove the shaft and the transducer assembly. After removing the assemblies, replace the gaskets (5)(13) as shown in the figure below.



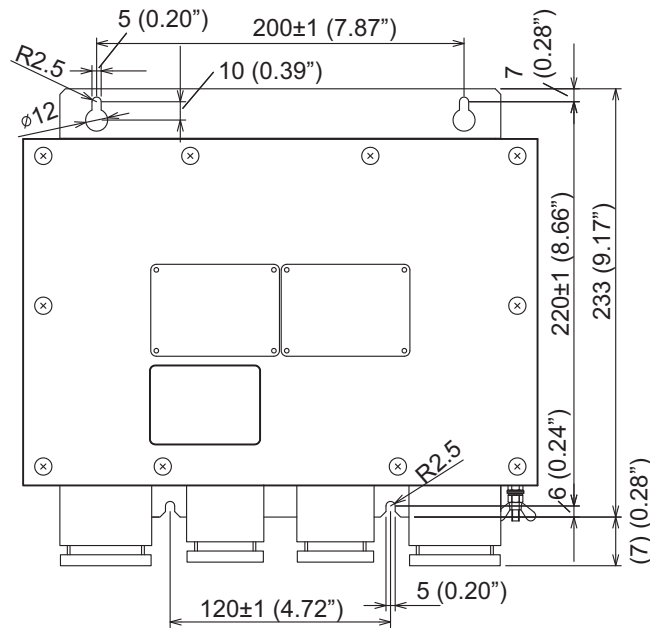
1.5 Junction Box DS-640, DS-645A/B (option)

Installation considerations

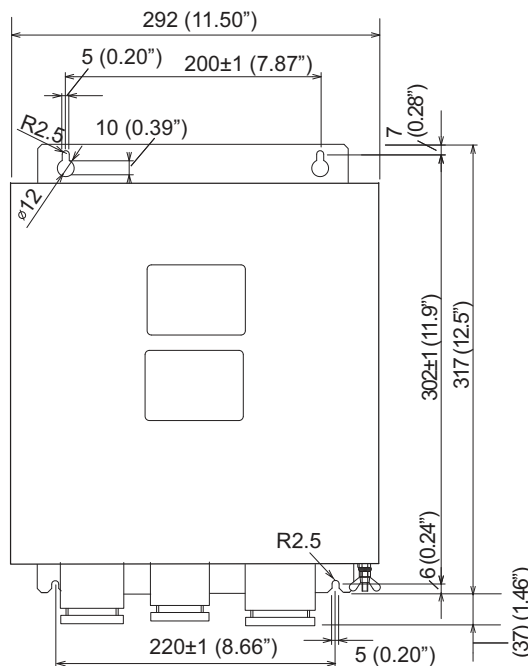
The junction box forms a joint between the distributor and the transceiver unit, and extends the distance between them to max. 500 m. Install it as below:

- Keep the junction box away from noise-emitting electrical machinery, for example, electric generator, radio transmitter and TV.
- Do not install the junction box in place of high temperature and humidity.

See the outline drawing at the back of this manual.



Dimensions for DS-640



Dimensions for DS-645A/B

1.6 Installation of Display Unit with DS-605 (Water-Proof Box, option)

For installation of the display unit on the wings of the bridge, use the optional water proof box DS-605. Fix the DS-605 on the bulkhead and set the display unit therein.

Installation materials for DS-605 (Type: CP66-01731. Code No.: 001-082-660-00)

Name	Type	Code No.	Qty	Comments
Seal Washer	03-001-3002-0 ROHS	300-130-020-10	4	
Gasket (2)	26-003-1605	100-355-310-10	1	
Washer (2)	26-003-1607	100-355-320-10	2	
Cable Gland Washer	JIS F8801 25C	000-172-238-10	2	
Cable Grand Inner gasket	JIS F8801 25C	000-171-892-10	1	
Adhesive	TB5211 50G	000-192-662-10	1	
Binding Head Screw	M5x12 SUS304	000-171-999-10	4	Not included if the flush mount sponge is not attached on the DS-605.

Mounting considerations

The DS-605 has waterproofing protection of IP56. When you select a mounting location for the waterproof box, keep in mind the following points.

- Keep the unit away from electromagnetic field-generating equipment like motors and generators.
- For maintenance and checking purposes, leave enough space at the sides of the unit and leave slack in cables. See the outline drawing at the back of this manual.
- A magnetic compass will be affected if the waterproof box is too close to the magnetic compass. Observe the compass safe distances (see page i) to prevent interference to a magnetic compass.

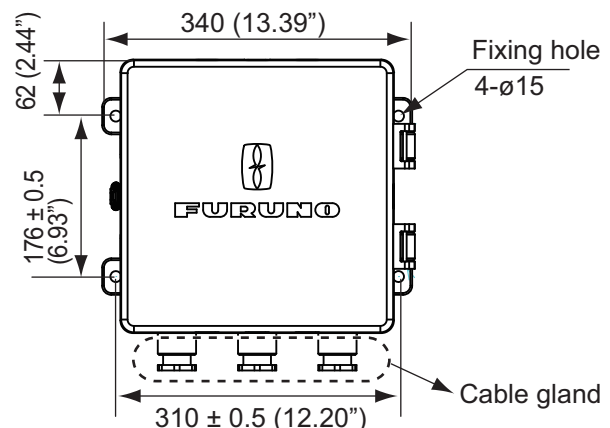
Mounting procedure

Note: Mount the DS-605 on the bulkhead so the cable glands and the drain hole are down.

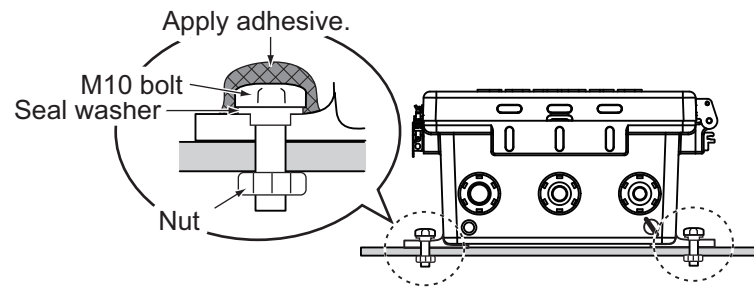
1. Fix the DS-605 on the wings of the bridge.

- 1) Insert the seal washer (03-001-3002-0 ROHS) to four fixing holes.
- 2) Fix the DS-605 with four M10 bolts (dockyard supply).

Note: Mount the unit so the cable glands are down.

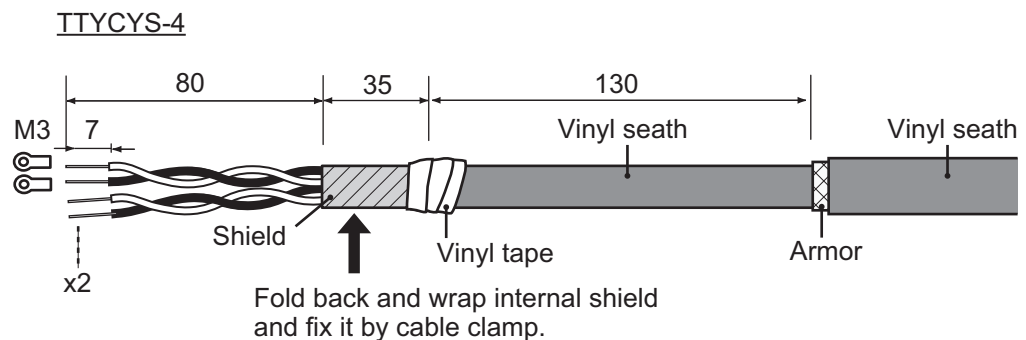


- 3) Apply adhesive to M10 bolts as shown below.

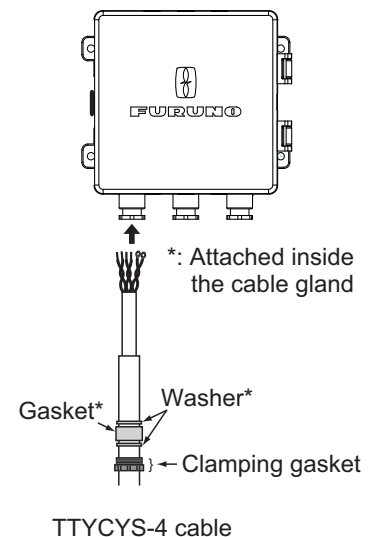


2. Connect the TTYCS-4 cable to the DS-600 through the cable glands for the DS-605.

- 1) Fabricate the cable as shown below.



- 2) Pass the clamping gland, washer (26-003-1607), gasket (26-003-1605) and washer (supplied as installation materials) onto the cable, in that order.
- 3) Pass the cable through the cable gland as shown below.
- 4) Open the front cover of the DS-605 and connect the ground wire attached inside the DS-605 to the ground terminal on the rear of the DS-600.
- 5) Connect the cables to the DS-600. Refer to chapter 2.
3. Remove each binding head screw from four corners of the DS-605 and set the DS-600 to the DS-605. These screws can be discarded.
4. Apply silicon grease to the binding head screws included in CP66-01731 and fix the DS-600 to the DS-605 with four binding head screws.
5. Tighten the clamping glands to fix the cables.
6. Apply the supplied adhesive TB5211 (marine sealant), etc. to the cable glands for waterproofing.
7. Connect the ground terminal for the DS-605 to the ground terminal on the hull with the IV-1.25 sq. wire.



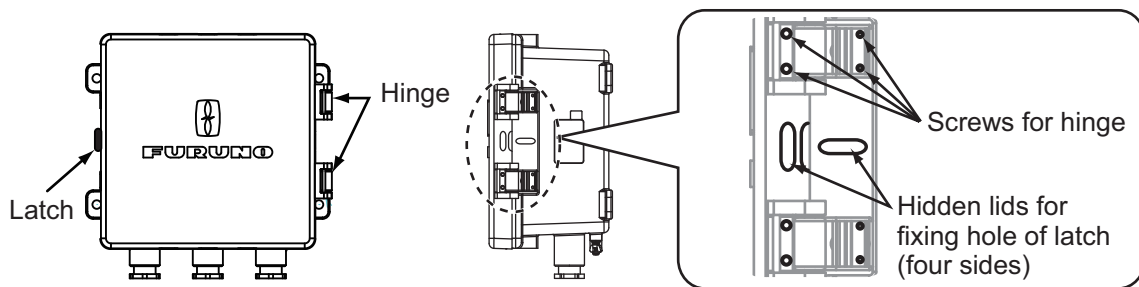
1. INSTALLATION

How to change orientation of the front cover of DS-605

The front cover of the DS-605 can be oriented up, down, right or left. To change the orientation of the front cover, do the following.

Note: Set the front cover so the FURUNO logo on the cover is right side up. The drain hole must be down.

1. Remove eight screws from two hinges.
2. Remove two screws from the latch.
3. Remove the hinges and the hidden lids for fixing hole of latch in consideration of the opening direction. The hidden lids for fixing hole of latch are taped on each side.
4. Orient the front cover as desired and fix the hinges and latch.

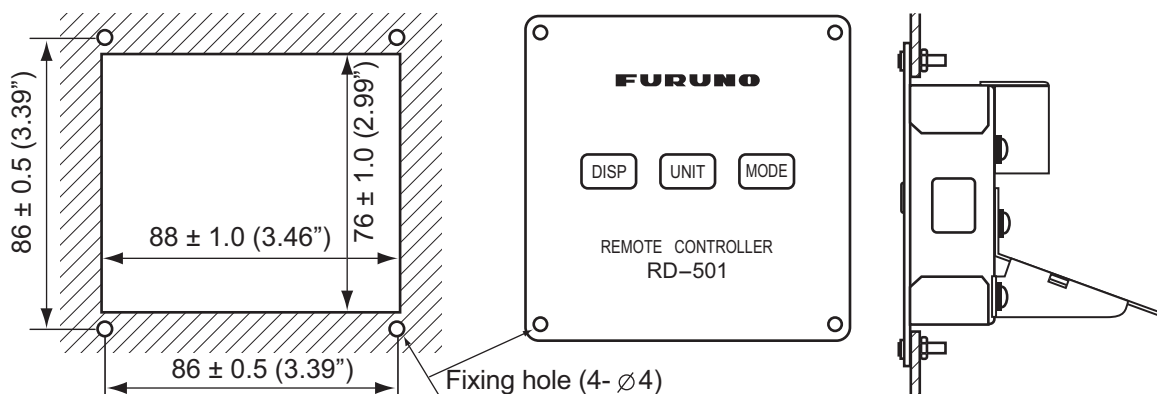


1.7 Remote Controller RD-501/Dimmer Controller RD-502 (option)

The optional remote controller RD-501 and dimmer controller RD-502 can be flush mounted in a panel. The size and the mounting procedure are shared by RD-501 and RD-502. For the mounting location, refer to the mounting considerations for the display unit in section 1.2.

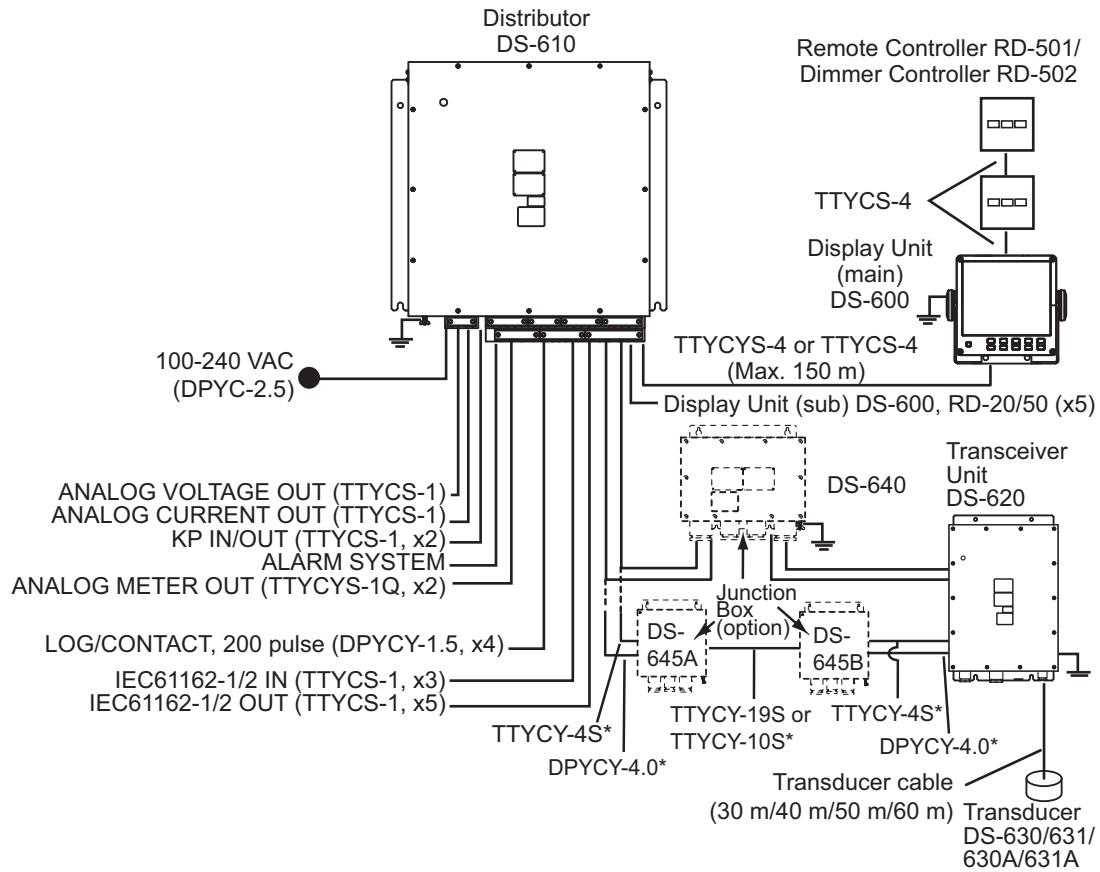
Note: Before you fasten the display unit to the cutout, first connect the cables referring to chapter 2.

1. Make a cutout in the mounting location (88 mm (width) x 76 mm (height)).
2. Make four holes of 4 mm diameter in the locations indicated in the illustration below.
3. Set the remote controller or dimmer controller to the cutout. Insert four binding head screws (M3x12) from the front side then fasten the unit with four sets of flat washers, spring washers and hexagonal nuts from the rear side.



2. WIRING

Refer to the interconnection diagram at the back of this manual to connect cables.



Note: For details of JIS (Japan Industrial Standard) cables, see "JIS CABLE GUIDE" on page AP-4.

Precautions for cable installation

Observe the following guidelines to prevent noise, interference problem.

- The transducer cable carries very weak signals (amplitude less than $0.1 \mu\text{V}$), which are easily interfered by noise. The need for a good ground cannot be overemphasized. Pass the transducer cable through dedicated conduit. Fill the conduit with vibration absorbing material (sand, etc.) to prevent vibration. The part of the cable extending from the conduit should be as short as possible. Separate the transducer cable at least 40 cm from other cables.
- Locate DS-60 cables away from the transmission antenna cable or radio equipment.
- Locate the DS-60 cables away from the power cables mentioned below. Also, separate cables at least 40 cm when the cables are run parallel with power cables.
 - Cable carrying more than a few kilowatts power to fluctuating loads
 - Cable carrying switching waves generated by thyristor, etc.

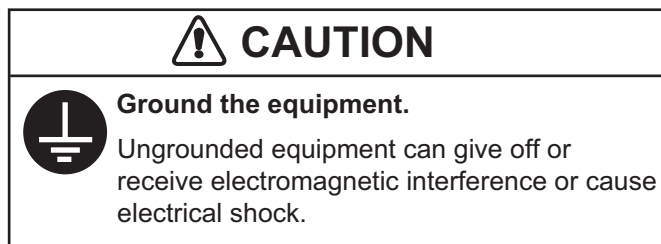
2. WIRING

- If the cables run through conduit or duct behind a non-metallic bulkhead, use a sheathless armored cable and ground the cable to the ship's hull every 50 cm.

Grounding

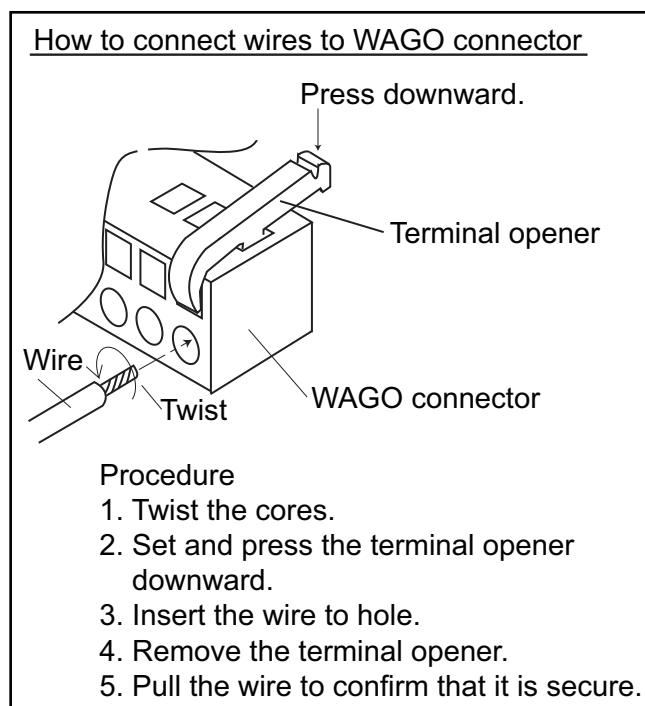
Connect the units and cables to the ground to prevent interference to the system and other equipment, referring to the following points:

- Keep all the units of the DS-60 as far away as possible from other radio equipment.
- Do not put the cables close to the cables of other radio equipment.
- All cables should be as short as possible.
- Ground the units of the DS-60 with suitable grounding wire (local supply).



Connection of WAGO connector

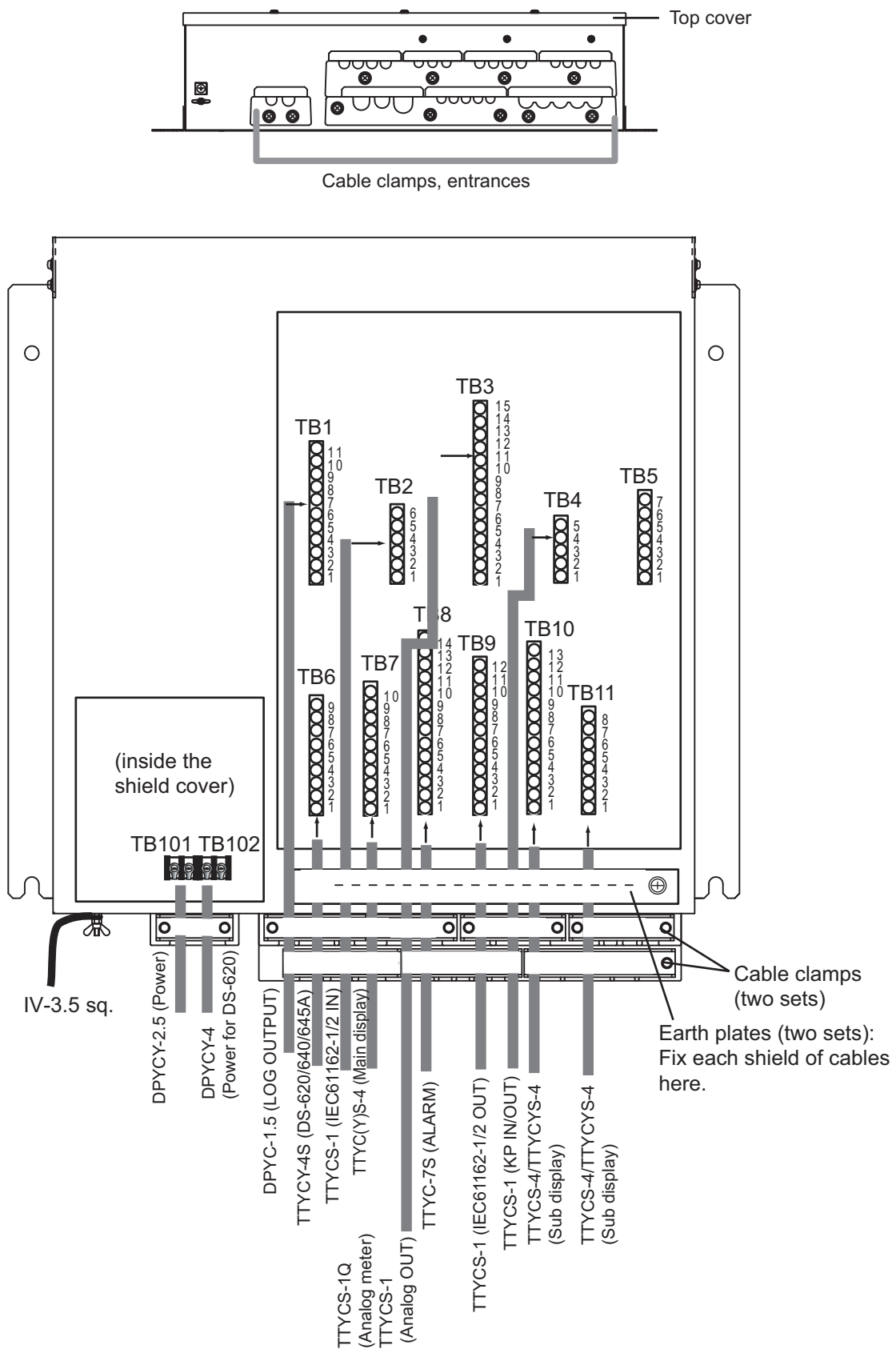
Remove the WAGO connector from each unit and connect each cable core to the WAGO connector. See the interconnection diagram at the back of this manual. The terminal opener is attached inside each unit.



2.1 Distributor Unit DS-610

The Distributor Unit DS-610 has two lines of cable clamps, and there are 13 cable entrances in total. The cables and corresponding cable entrances are shown on the reverse side of the top cover of the DS-610. Fabricate cables referring to page 2-4. Pass

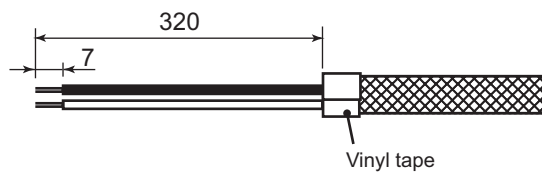
the cables through their respective cable entrances and connect them to WAGO connectors.



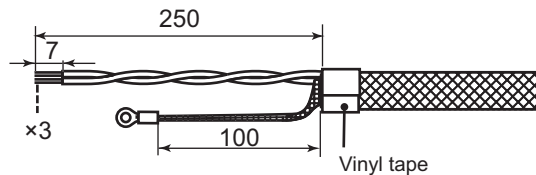
2. WIRING

DS-610 Distributor Unit

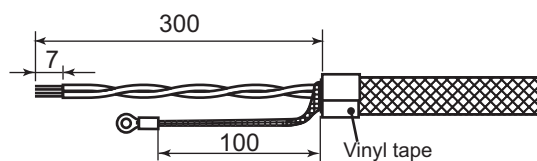
TB1 (LOG OUT), DPYC-1.5



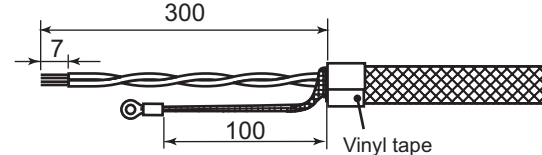
TB2 (IEC61162-1/2 IN), TTYCS-1



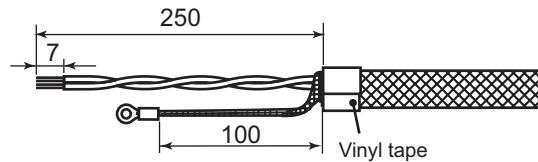
TB3 (Analog meter), TTYCS-1Q



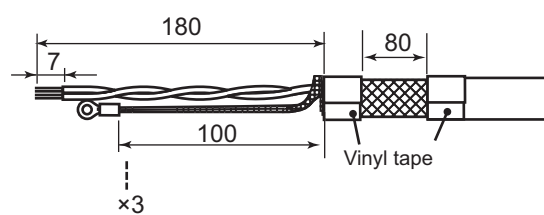
TB3 (Analog current/voltage), TTYCS-1



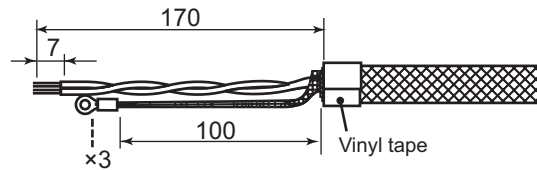
TB4 (KP IN/OUT), TTYCS-1



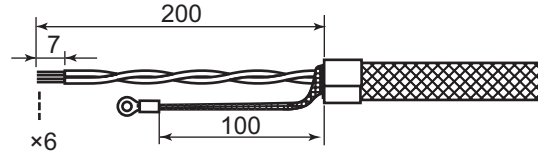
TB6 (DS620/640), TTYCY-4S



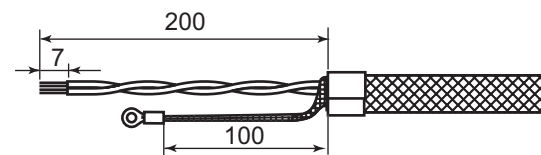
TB7 (DS600), TTYCS-4



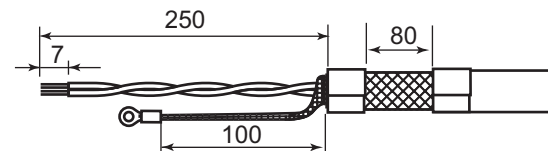
TB8 (ALARM), TTYC-7S



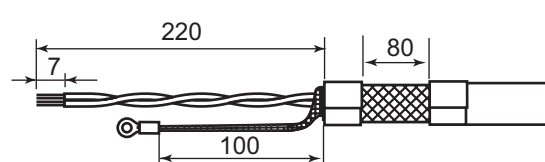
TB9 (IEC61162-1/2 OUT), TTYCS-1



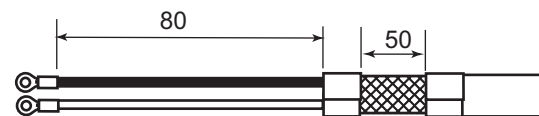
TB10 (Sub display), TTYCS-4/TTYCYS-4 (for DS-605)



TB11 (Sub display), TTYCS-4/TTYCYS-4 (for DS-605)



TB101 Power (main), DPYCY-2.5



TB102 Power (for DS-620), DPYCY-4



2.2 DIPSW S3 Settings

DIPSW S3 is on the MAIN Board (66P3950) inside the Distribution Unit DS-610.

S3-#1.2

When the analog indicator is connected to the DS-610 Distributor Unit (TB3 #1,2 and #5,6), set the output voltage range and the DIPSW according to the speed scale and range. The table below shows the corresponding settings.

DIPSW/ Output voltage range	Analog indicator speed scale range		
	-10 to 20 kn	-10 to 30 kn (Factory default)	-10 to 40 kn
S3-#1	OFF	OFF	ON
S3-#2	ON	OFF	OFF
Output voltage range (mA)	-5.0 to 10 (mA)	-3.3 to 10 (mA)	-2.5 to 10 (mA)

Note: These settings do not affect the analog output ports (TB3 #9 through #12).

S3-#4 to #8

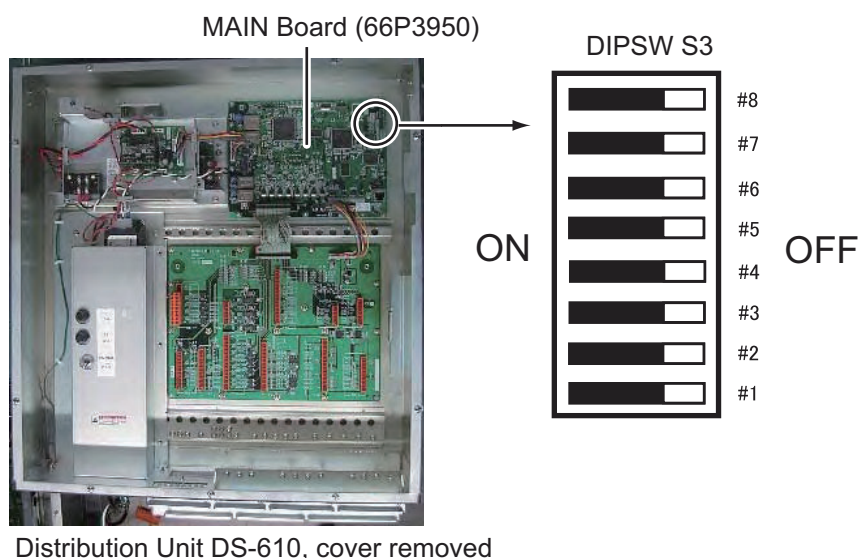
Alarm contact input/output settings by the DIPSW S3 are shown below.

	OFF (Default settings)	ON
S3-#4 REMOTE ACK	Contact input For ACK, close input	Contact input For ACK, open input
S3-#5 LOCAL ACK	Contact output For ACK, close output	Contact output For ACK, open output
S3-#6 ECHO FAIL	Contact output Normal open output	Contact output Normal close output
S3-#7 SPEED LIMIT	Contact output Normal open output	Contact output Normal close output
S3-#8 SYSTEM FAIL	Contact output Normal open output	Contact output Normal close output

Note 1: S3-#3 should remain OFF, the default setting.

Note 2: [POWER FAIL] is normal close output regardless of the settings of DIPSW.

When the power is off, all contact outputs are open output.

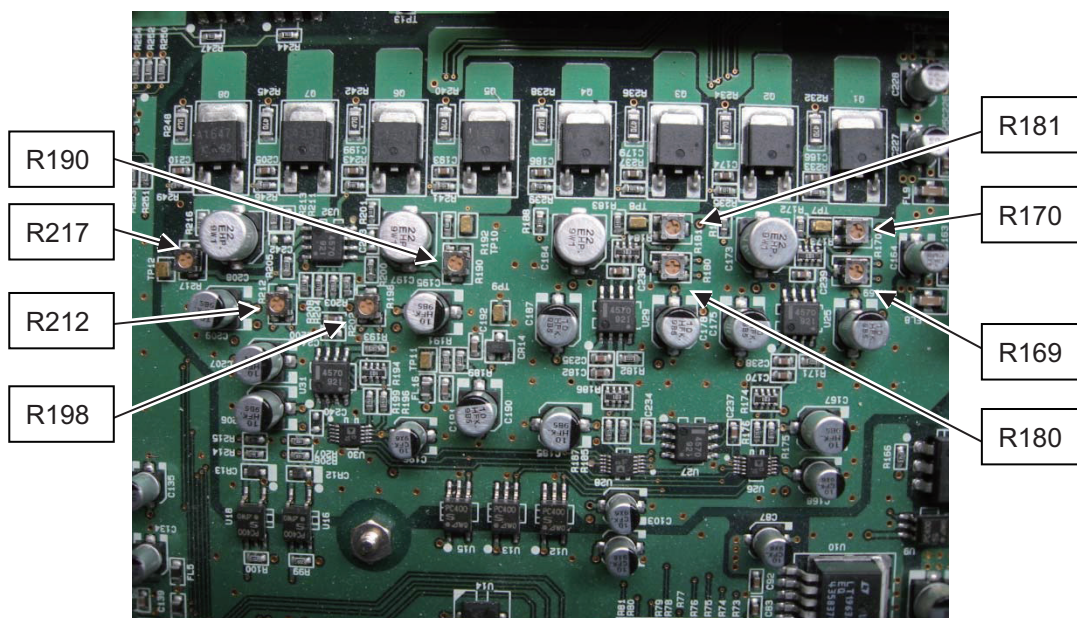


Distribution Unit DS-610, cover removed

2.3 How to Adjust the Analog Indicator

If it is necessary to adjust the offset or gain of the analog indicator or analog output, output dummy speed from the demo mode then adjust the applicable potentiometer on the MAIN board in the DS-610.

- 1) ANA_DISP1 offset adjustment: R180 (Rotate clockwise to offset in the AST direction)
- 2) ANA_DISP1 gain adjustment: R181 (Rotate clockwise to decrease the gain)
- 3) ANA_DISP2 offset adjustment: R169 (Rotate clockwise to offset in the AST direction)
- 4) ANA_DISP2 gain adjustment: R181 (Rotate clockwise to decrease the gain)
- 5) ANA_V offset adjustment: R198 (Rotate clockwise to increase the offset value)
- 6) ANA_V gain adjustment: R190 (Rotate clockwise to increase the gain)
- 7) ANA_C offset adjustment: R212 (Rotate clockwise to increase the offset value)
- 8) ANA_C gain adjustment: R217 (Rotate clockwise to increase the gain)



How to adjust the analog indicator

1. Set 0 kn for test speed in the demo mode, then adjust the offset of the analog indicator.
2. Set 15 kn or 20 kn for test speed in the demo mode, then adjust the gain of the analog indicator.

Note: Do the test for the gain adjustment with the ship's cruising speed.

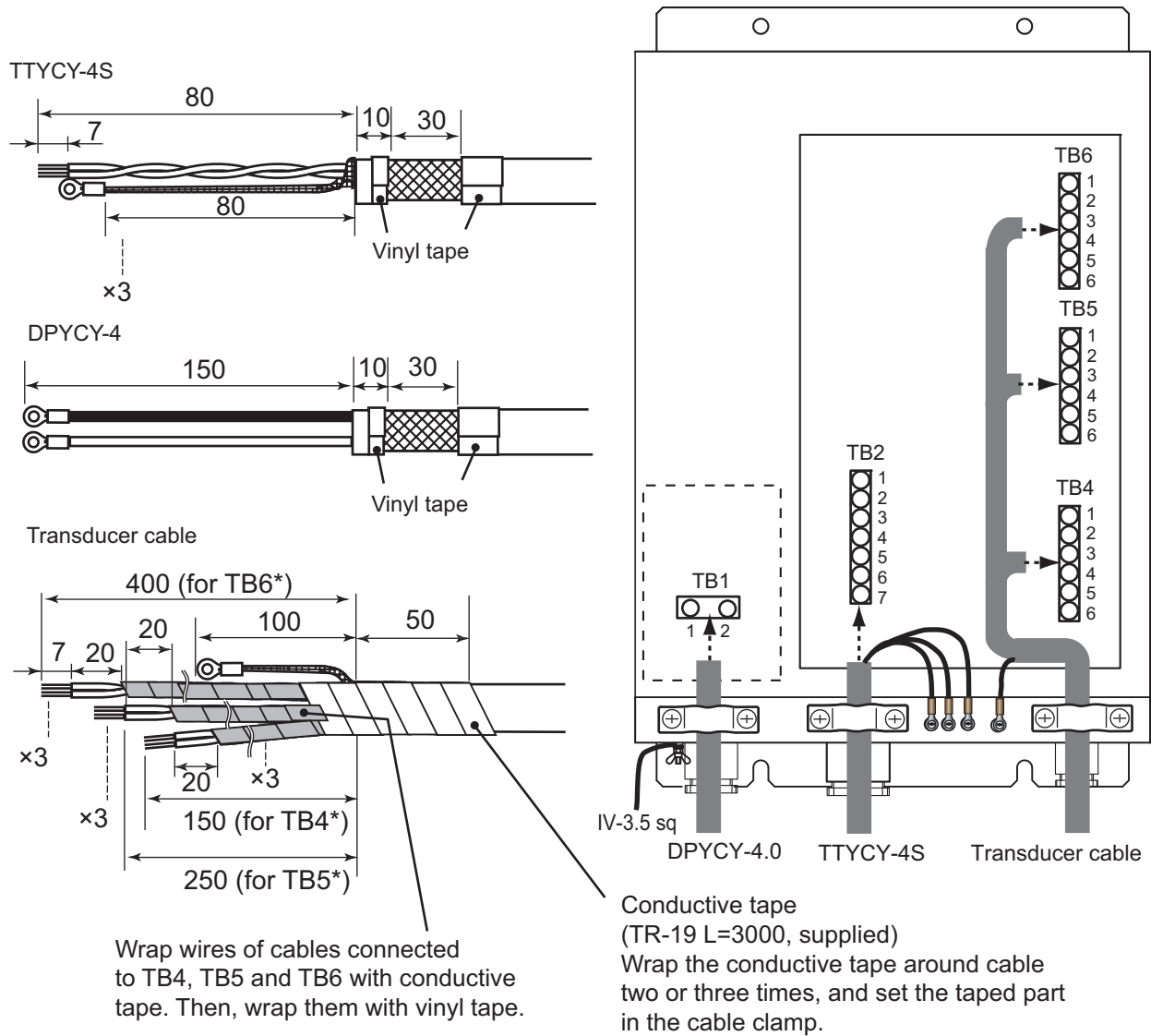
The specifications of voltage and current for analog indicator

Voltage output	-10 to 30 kn: -3.33 to 10.0 V
Current output	-10 to 30 kn: 4.0 to 20.0 mA (0 kn: 8.0 mA)

2.4 Transceiver Unit DS-620

Cables TTYCY-4S, DPYCY-4 and the transducer cable are connected to the DS-620. Fabricate and pass them through their respective the cable clamps at the bottom.

DS-620 Transceiver unit



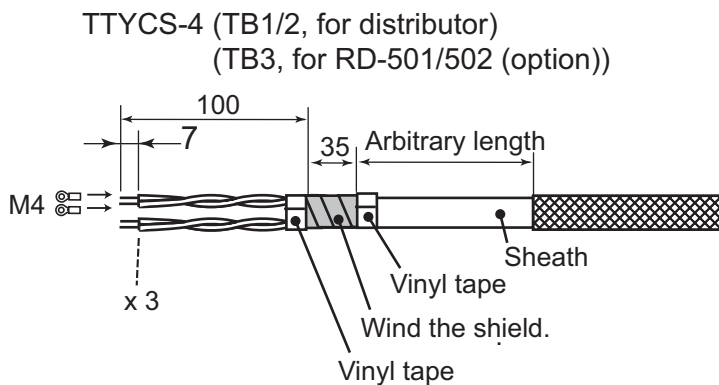
Note: The transducer cable has nine twisted-pairs of signal lines (w/polarity). Be careful to connect them to the correct connectors in the transceiver unit.

2.5 Display Unit DS-600, Remote Controller RD-501/ Dimmer Controller RD-502 (option)

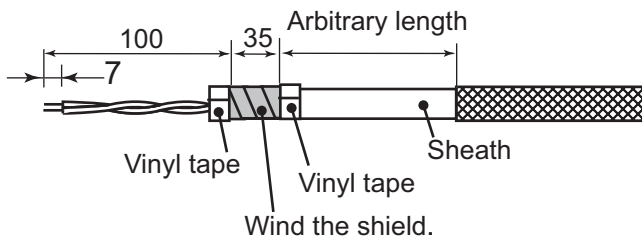
Use the TTYCS-4 cable to connect the display unit DS-600 to the distributor.

Note: The cable length must be less than 150 m.

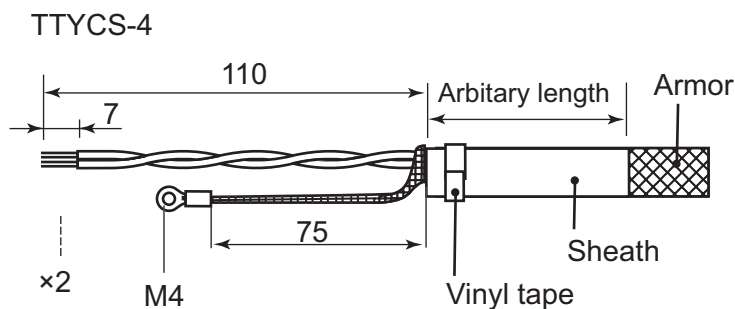
DS-600 Display unit



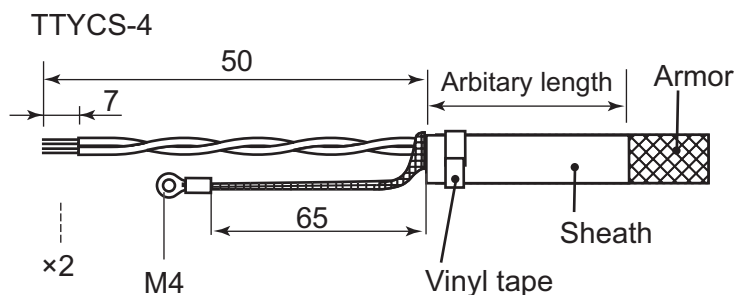
TTYCS-1 (TB4, for RD-20/50 (option))



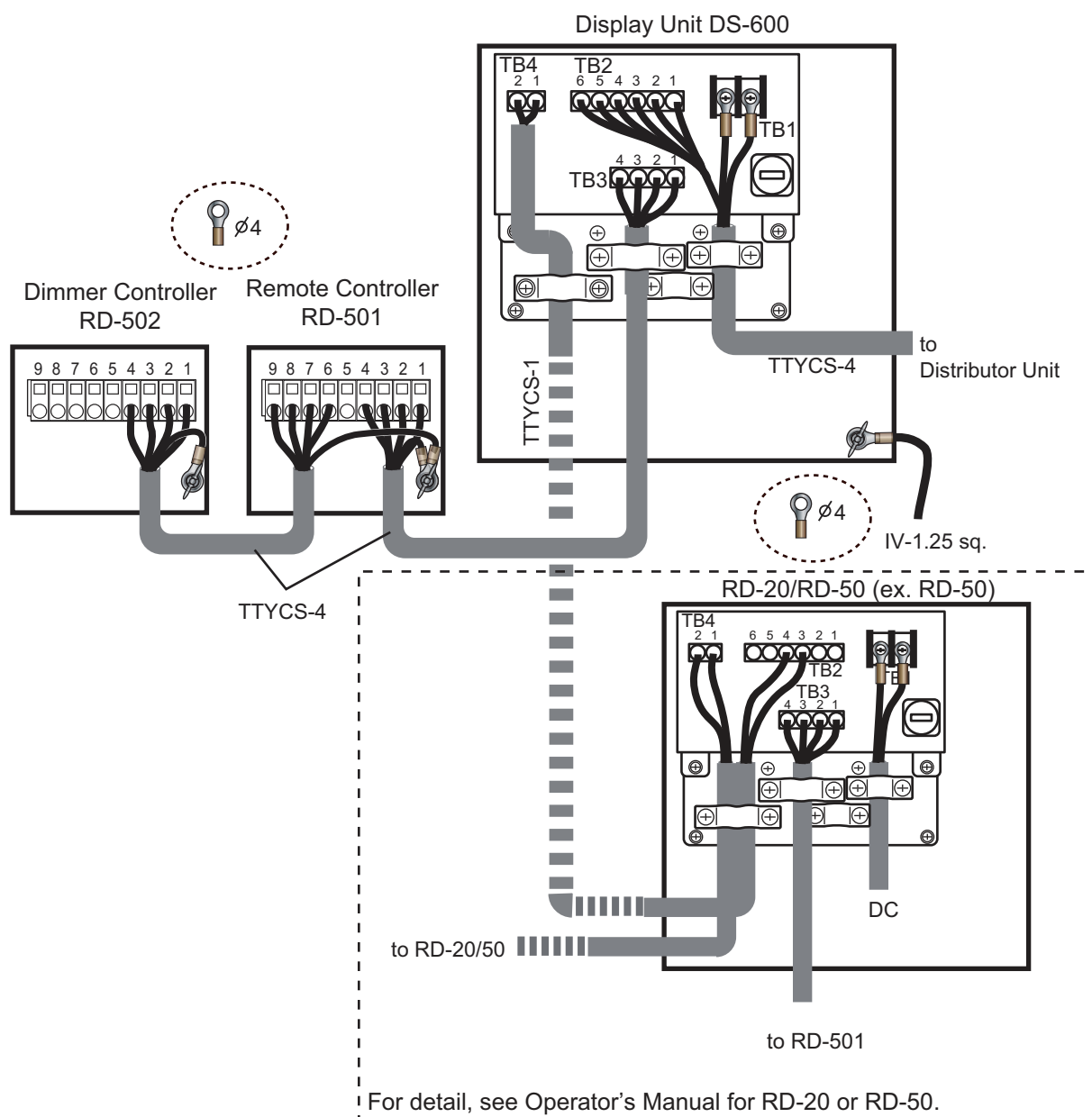
RD-501 (end of RD-501)



RD-502 (end of RD-502)



Connect cables fabricated on the previous page to terminals on the back of the unit, and fix them with clamps.



DS-600, example of connection

When using the optional water proof box DS-605, TTYCYS-4 cable is necessary.

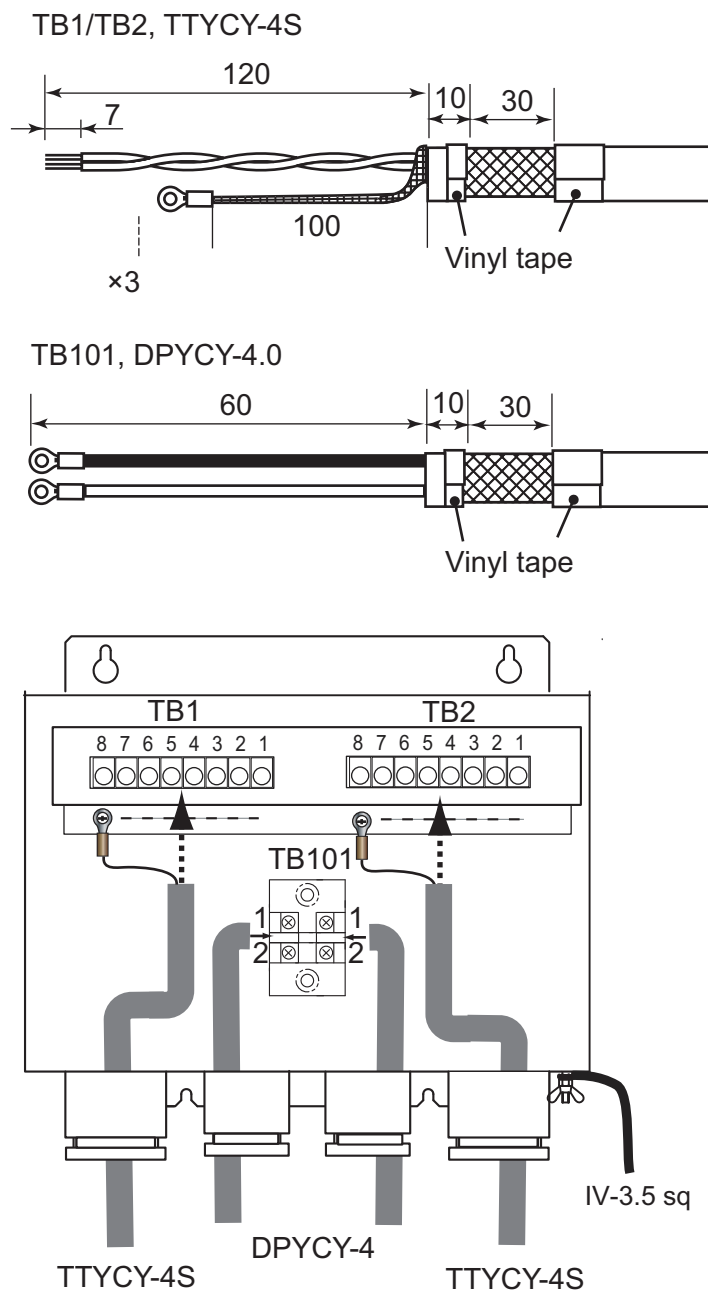
2.6 Junction Box (option)

The optional Junction Box DS-640 permits extension of the cable connected between the Junction Box and the Transceiver Unit up to maximum of 500 m.

2.6.1 DS-640

Fabricate two TTYCY-4S and DPYCY-4 cables as shown below.

DS-640 Junction Box

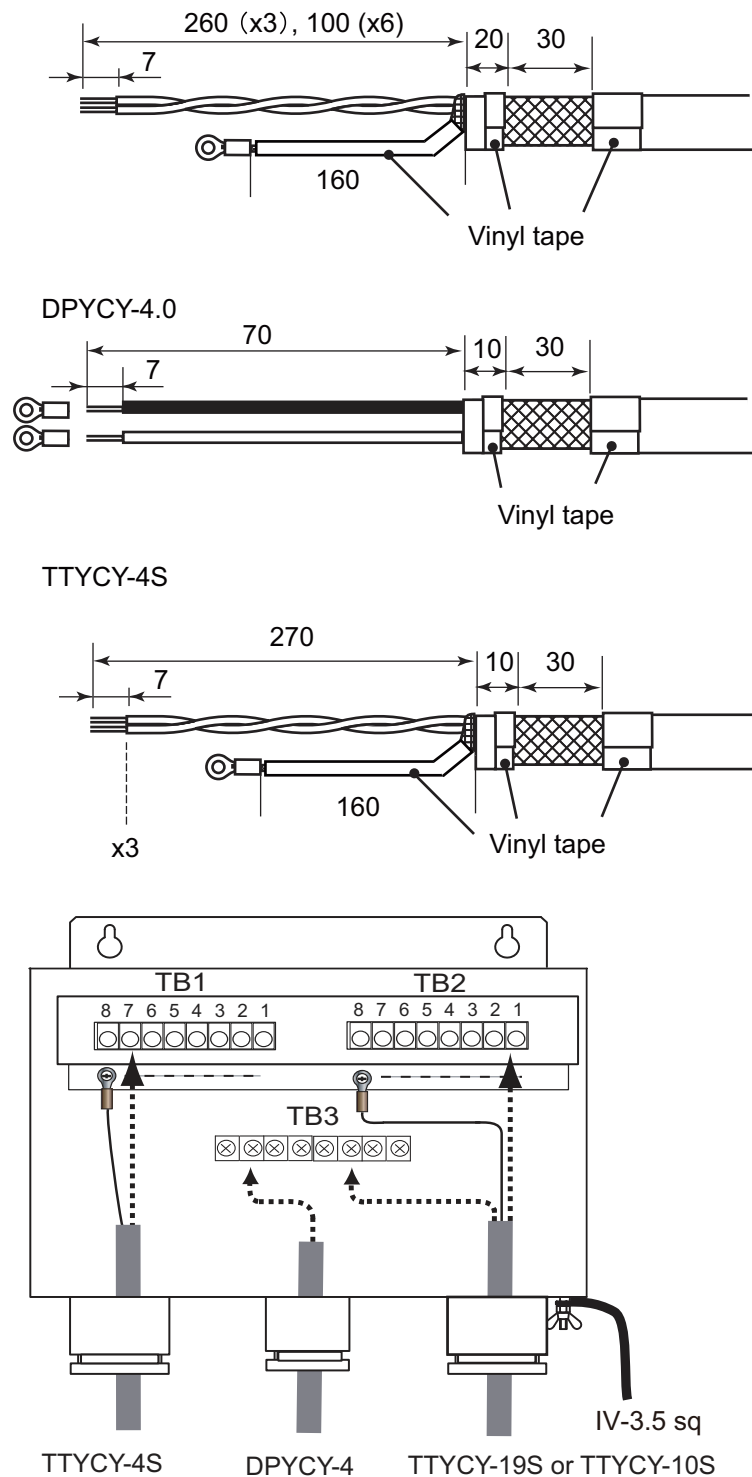


DS-640, internal view

2.6.2 DS-645A/645B

When using the JIS cable TTYCY-19S or TTYCY-10S between the distributor and the transceiver unit, select the optional DS-645A and B. These units are supplied with one pair, and you should take care to install them correctly; DS-645A: connected to the distributor unit, DS-645B: connected to the transceiver unit.

DS-645A/B Junction Box



2. WIRING

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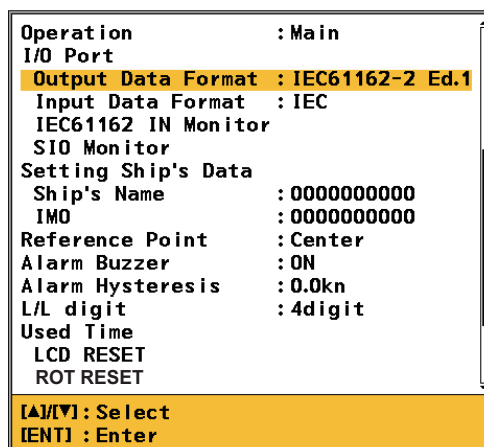
3. MENU SETTINGS

After the installation is completed, set up the system from the [Service] and [System] menus.

3.1 How to Use the [Service] Menu

1. With the power off, press and hold the **DISP** key, then press the **PWR** key to show the [Service] menu.

Note: Do not release the **DISP** key until the system releases a audible beep.

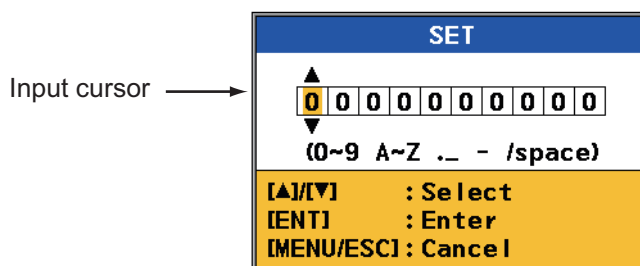


[Service] menu

2. Press **▲** or **▼** to select a menu item, and press the **ENT** key to show the setting window.
3. Press **▲** or **▼** to change the setting, and press the **ENT** key. To return to the menu, press the **MENU/ESC** key.

To enter alphanumeric data; for example, [Ship's Name], do the following:

- 1) A character input box appears, with the input cursor at the far-left position.



- 2) Press **▲** or **▼** to select character.
- 3) Press the **ENT** key to confirm selection.
- 4) Repeat step 2) and step 3) to complete the item.
You can move the input cursor with the **ENT** and **MENU/ESC** keys.
ENT: Move right.
MENU/ESC: Move left.
4. Repeat step 2 and step 3 to complete the setting.
For items to be set at the installation, see the table on next page.
5. Press the **PWR** key to turn the power off.

3. MENU SETTINGS

Menu item	Meaning	Option (default in boldface)
[Operation]	Select [Main], [Sub] or [Satellite] to use. For display units connected to TB7 in the DS-610, select [Main]. For sub display units connected to a GS-100 and DS-60 (dual input), select [Satellite].	[Main], [Sub], [Satellite]
[Alarm Mode]	Select the alarm mode. (Select [Alert I/F1] or [Alert I/F2] when connected to AMS.)	[Legacy], [Alert I/F1], [Alert I/F2]
[Buzzer Stop]	Select the signal to input to TB8 #11 and #12 of DS-610 (main display only). Note: This item is grayed out (inoperative) when [Alarm Mode] is [Alert I/F1] or [Alert I/F2]. [Enable]: Stop the audible alarm at the external equipment. To “ACK” the alarm, press the ALARM ACK key. [Disable]: Stop the audible alarm and “ACK” the alarm at the external equipment.	[Enable], [Disable]
[Output Data Format]	Select the version of IEC61162 data to output from DS-610. Note: If IEC61162-1 Ed.5 format is used, select [IEC61162-1 Ed.4].	[IEC61162-1 Ed.2] [IEC61162-1 Ed.3] [IEC61162-2 Ed.1] [IEC61162-1 Ed.4]

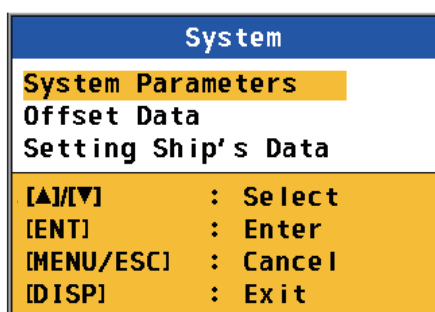
Menu item			Meaning	Option (default in boldface)	
[Input Data Format]	[IEC]	[61162_IN_1]	Select IEC data format input to the channel 1 of the IN port, TB2-#1, 2 in DS-610. (main display only) Note: If IEC61162-1 Ed.5 format is used, select [IEC61162-1 Ed.4].	[IEC61162-1 Ed.2] [IEC61162-1 Ed.3] [IEC61162-2 Ed.1] [IEC61162-1 Ed.4]	
		[61162_IN_2]	Select IEC data format to input to the channel 2 of the IN port, TB2-#3, 4 in DS-610. (main display only) Note: If IEC61162-1 Ed.5 format is used, select [IEC61162-1 Ed.4].		
		[61162_IN_3]	Select IEC data format to input to the channel 3 of the IN port, TB2-#5, 6 in DS-610. (main display only) Note: If IEC61162-1 Ed.5 format is used, select [IEC61162-1 Ed.4].		
	[NMEA]	[61162_IN_1]	Select NMEA data baud rate to input to the channel 1 of the IN port, TB2-#1, 2 in DS-610. (main display only)	[4800] [38400]	
		[61162_IN_2]	Select NMEA data baud rate to input to the channel 2 of the IN port, TB2-#3, 4 in DS-610. (main display only)		
		[61162_IN_3]	Select NMEA data baud rate to input to the channel 3 of the IN port, TB2-#5, 6 in DS-610. (main display only)		
	[IEC61162 IN Monitor]		Monitor the IEC input signal described above. (main display only)		
	[SIO Monitor]		Monitor the serial signal input to the display units. (main and sub)		
	[Reference Point]			Select the reference position to use to calculate ship's speed. (main display only)	[Bow] [Transducer] [Center]
	[Alarm Buzzer]			Select [ON] to get the audio alarm when the speed limit alarm is violated. (main display only)	[ON] , [OFF]
[Alarm Hysteresis]			Set the amount of tolerance to apply to the Speed Limit alarm (main display only). For example, if you set "1 kn" here and "30 kn" for the Speed Limit alarm, that alarm is cancelled when ship's speed drops to 29 kn from 30 kn.	[0 to 5 kn] (Default: 0 kn)	
[L/L digit]			Set the number of digits to show for the minutes indication in latitude and longitude position.	[3 digit], [4 digit]	
[Others]			For the serviceman. These are not used at the installation.		

3.2 How to Set the [System] Menu

Set the items on the [System] menu after completing those on the [System] menu.

3.2.1 How to show the [System] menu

1. Press the **PWR** key to turn the power on.
2. Press the **MENU/ESC** key to show the main menu.
3. Press **▼** to select [System], and press the **ENT** key.

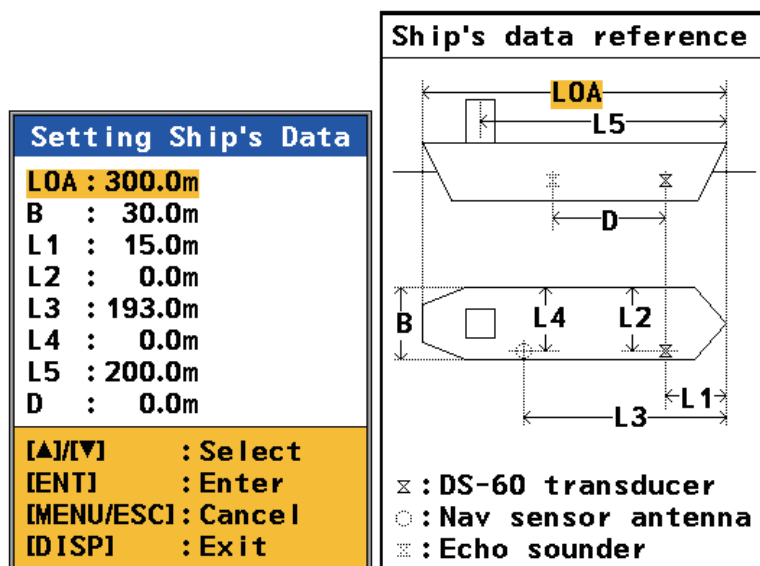


[System] menu

3.2.2 How to set ship's data

Enter the dimensions of your ship's on the [Setting Ships Data] menu.

1. Press **▼** to select [Setting Ship's Data], and press the **ENT** key to show the Setting Ships Data menu.



[Setting Ship's Data] menu

2. Select an item, and press the **ENT** key to show the setting window.
Refer to the table in below to enter the dimensions.

Item	Meaning	Setting range
[LOA]	Ship's length	50.0 to 400.0 m
[B]	Ship's width	5.0 to 100.0 m
[L1]	Horizontal distance from the ship's bow to transducer	0.0 m to the setting value for [LOA]

Item	Meaning	Setting range
[L2]	Horizontal distance from port to transducer	0.0 m to the setting value for [B]
[L3]	Horizontal distance from ship's bow to GPS antenna	0.0 m to the setting value for [LOA]
[L4]	Horizontal distance from port to GPS antenna	0.0 m to setting value for [B]
[L5]	Horizontal distance from ship's bow and CCRP (bridge)	0.0 m to setting value for [LOA]
[D]	Horizontal distance between transducers for DS-60 and echo sounder.	0.0 m to ([LOA]-[L1])

3. Press the **MENU/ESC** key to close the menu.

3.2.3 How to enter offset values

1. Press **▲** to select [Offset Data], and **ENT** key to show the [Offset Data] menu.

Offset Data		
Trim	:	0.0deg
Heel	:	0.0deg
XDCR	:	0.0deg
Compass Calibration	:	0.0deg
SOG Calibration	:	0.0%
STW Calibration	:	0.0%
[▲]/[▼] : Select		
[ENT] : Enter		
[MENU/ESC] : Cancel		
[DISP] : Exit		

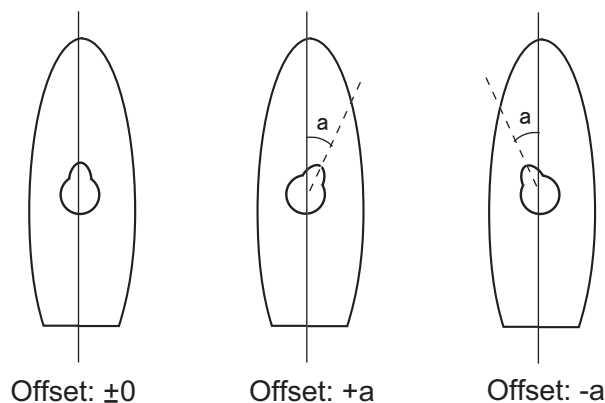
2. Select [Trim], and press the **ENT** key.

SET	
▲	
0.0deg	
▼	
(-12.5~+12.5)	
Step 0.1deg	
[▲]/[▼] : Select	
[ENT] : Enter	
[MENU/ESC] : Cancel	
[DISP] : Exit	

3. Enter the offset value for inclined angle, and press the **ENT** key (setting range: -12.5 to +12.5°, +: rise at bow).
4. Press **▼** to select [Heel], and press the **ENT** key.
5. Enter the offset value for the heel, and press the **ENT** key (setting range: -12.5 to +12.5°, +: rise at port).
6. Press **▼** to select [XDCR], and press the **ENT** key.

3. MENU SETTINGS

7. Enter the offset value if transducer is not installed perfectly with ship's fore-aft line (setting range: -60.0 to $+60.0^\circ$). Measure the difference between ship's fore-aft line and the line on the transducer, and enter it.



3.2.4 How to correct the ship's speed

Correct the speed error using the test sheet at the back of this manual.

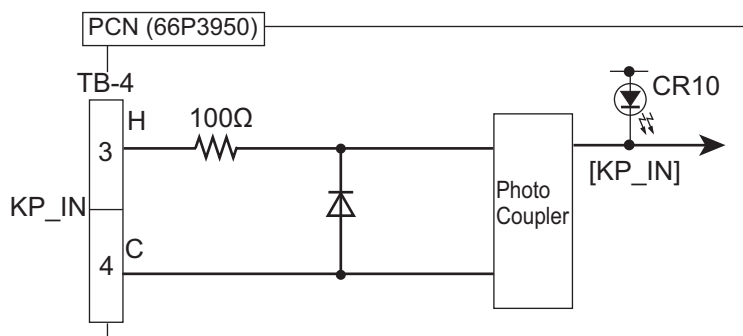
1. Press **▼** to select [SOG Calibration], and press the **ENT** key.
2. Enter the offset value for the speed over ground, and press the **ENT** key (setting range: -12.5 to $+12.5\%$).
3. Press **▼** to select [STW Calibration], and press the **ENT** key.
4. Enter the offset value for the speed through water, and press the **ENT** key (setting range: -12.5 to $+12.5\%$).
5. Press the **MENU/ESC** key several times to close the menu.

3.2.5 Interference rejection

Interference rejection (Input)

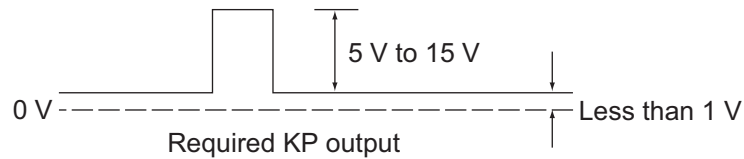
Interference can be detected during a noise test, and the interference may affect the speed log measurements and readings. To reject the interference, you can use the interference rejection circuit inside the transceiver unit.

The circuit uses the keying pulse (KP) from the external equipment to reject interference. External equipment should be connected to the KP_IN terminal.

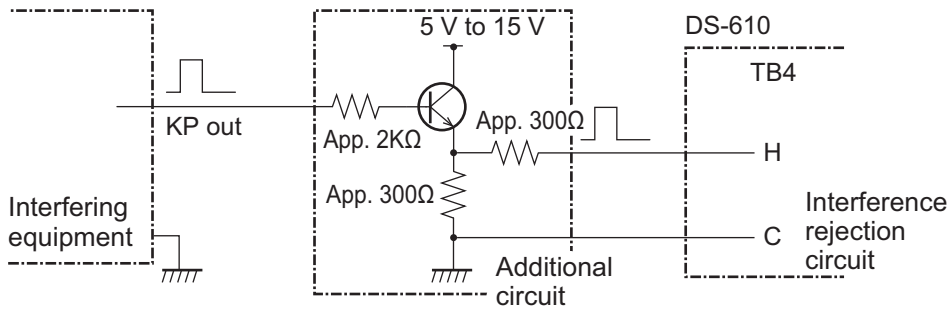


Required KP output

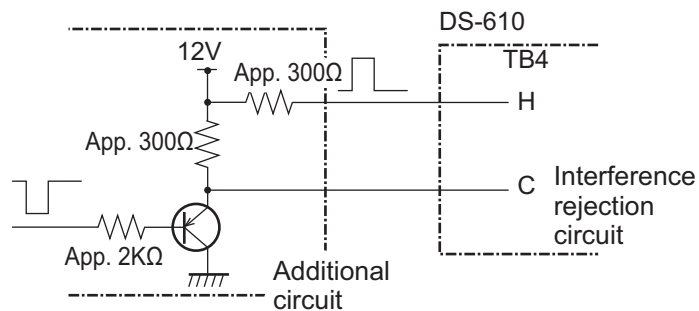
The interference rejection circuit requires the following KP output. If the interfering equipment has KP output outside this range, take the measure shown in “How to buffer the KP” on the following page.



How to buffer the KP



The following method can also be used:



Menu settings

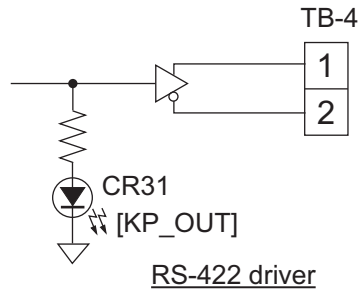
Where external equipment is connected to the KP_IN terminal, the following procedure must also be completed.

1. Press the **MENU/ESC** key to show the main menu.
2. Press **▲** or **▼** to select [System], then press the **ENT** key.
3. Press **▼** to select [System Parameters], then press the **ENT** key.
4. Press **▼** to select [IR], then press the **ENT** key.
5. Press **▲** to select [ON], then press the **ENT** key.

Note: The DS-60 does not have a mode to allow synchronization with external equipment's KP.

Interference rejection (Output)

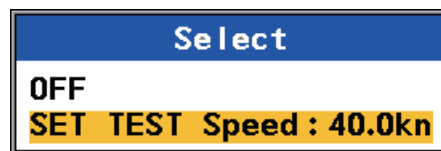
When outputting KP from the DS-60 for the purpose of suppressing interference to other ultrasound equipment, remove the TX trigger pulse from the TB4 (KP_OUT) terminal.



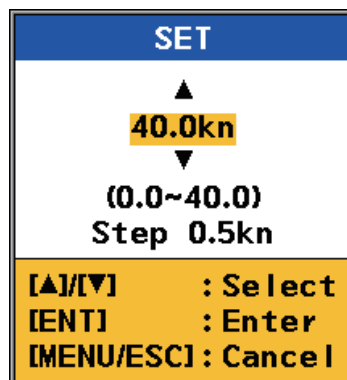
3.3 Demo Mode

The demonstration mode displays and outputs internally generated speed data and requires external input of navigational data. This mode can be used for demonstration and to check output to external equipment. “SIM” appears on the screen when the demonstration mode is active.

1. While pressing the **DISP** key, press the **PWR** key to turn on the power. The [Service] menu appears.
2. Press ▲ or ▼ to select [SIM], and press the **ENT** key.



3. Press to select [SET TEST Speed], and press the **ENT** key. The window for setting of the test speed appears.



4. Press ▲ or ▼ to select the appropriate speed, and press the **ENT** key.
5. Press the **PWR** key to turn off the power.
6. Press the **PWR** key again to turn on the power. The simulation mode starts.
7. To stop the simulation mode, press the **PWR** key to turn off the power. Do step 1 to re-apply the power. Whenever you open the [Service] menu, the [SIM] menu is set to [OFF].
8. Press the **PWR** key to turn off the power.

APPX. 1 CALIBRATION

For an accurate display of speed, a speed trial test to find the difference between your actual speed and the speed calculated by the equipment is necessary. The speed trial should be conducted in area where a stable speed can be measured using SOG (speed over ground). If a stable SOG measurement is not possible, conduct the test using STW (speed thru water) with multiple passes. The offset values are calculated from the speed test by comparing the DGPS measurements.

Note: To obtain accurate offset values, it is recommended to conduct the test using similar conditions and speeds to a regular voyage.

Calibration from the speed trial

Calibration values can be calculated by comparing the doppler speed log with DGPS or other similar speed measuring devices.

1) How to use the GPS milepost.

Speed trial result conducted using a GPS milepost may differ depending on the shipyard's measurement methods, as shown below:

- The ship's speed is calculated based on the time traveled.
- The ship's fore/aft (Y-axis) speed is calculated based on the time traveled.
- Calculation is based on a one-mile course, traveled three times.
- Calculation is based on the time traveled over a predetermined time.

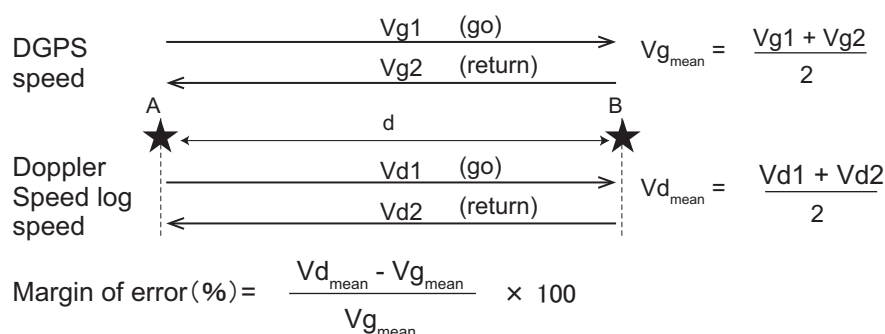
Offset calculation for the above methods is described below.

a) The ship's speed is calculated based on the time traveled.

Vectors are combined to calculate the ship speed. The DS-60 requires vector data in order to calculate the speed. For this reason, use the data sentences VHW or VTG for speed data. Where ground-referenced measurement can be taken, use the VTG sentence; otherwise, use the VHW sentence.

Note 1: The depth of 40 m more is required for STW (VHW) calibrations. Ground (seabed) echoes can interfere with the measurement if the depth is less than 40 m. This can cause an alert to be released.

Note 2: Current influences are taken into account for calculation and comparison. Changes in currents can result in erroneous measurements.



Where; d: distance run (NM), V_{g1} , V_{g2} : GPS measured speed (kn), V_{d1} , V_{d2} : doppler speed log measured speed (kn). SOG: measured from VTG, STW: measured from VHW.

Steer the ship at a steady speed for 10 minutes or longer on the test course (EG: A to B in the figure). The ship's speed data is collected as NMEA output data. Calculate the offset values by averaging the difference between the DS-60's measured speeds and the DGPS speeds. The calibration value should be this calculated average.

- b) The ship's fore/aft (Y-axis) speed is calculated based on the time traveled.
This method uses the fore/aft (Y-axis) speed as the GPS milepost. The calculation is made by comparing the VTG speed (taken immediately after switching to ground-based speed) and the VBW speed (taken immediately after switching to water-based speed).
- c) Calculation is based on a one-mile course, traveled three times.
Calculation is done with the same method as a).
- d) Calculation is based on the time traveled over a predetermined time.
Calculation is done with the same method as a).

- 2) How to use survey poles as a milepost
Calculation is done using b) from method 1).

By conducting the same test using different speed conditions, you can obtain varied sampling data. Use the average values to calculate a calibration value and allow a 2% margin of error.

Note: The procedure for setting the calibration value in the menu is covered at the end of this appendix.

Calibration Setting

The speed error can be corrected at [OFFSET DATA] on the [System] menu as follows:

1. Press the **MENU/ESC** key.
2. Select [System] and press the **ENT** key.
3. Select [OFFSET DATA] and press the **ENT** key.
4. Select [STW CALIBRATION] and press the **ENT** key.
5. Enter offset value (calibration) for STW.
6. Select [SOG CALIBRATION] and press the **ENT** key.
7. Enter offset value (calibration) for SOG.



TEST SHEET FOR DOPPLER SPEED LOG

Type: _____ Serial No.: _____
Date: _____ Place: _____ Ship's length: _____ m Draft: Fore: _____ m
Ship's Name: _____ Hull No.: _____ Shipyard: _____ Aft: _____ m

RUN No.	Engine		DGPS Speed (kn)	Doppler Speed Log			Shipyard Data				Note
	Load (%)	Rev. (rpm)		Speed (kn)	*1 Error (%)	Calibration (%)	Depth (m)	Course (deg)	Wind (m/s)	Sea condition	
-											
-											
Mean											
-											
-											
Mean											
-											
-											
Mean											
-											
-											
Mean											
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Mean											
-											
-											
Mean											
-											
-											
Mean											

*1 Error = $\frac{\text{DS Speed (NM)} - \text{DGPS (NM)}}{\text{DGPS (NM)}} \times 100 (\%)$

Owner's Signature: _____
Company name: _____
Engineer's Signature: _____

APPX. 2 JIS CABLE GUIDE

Cables listed in the manual are usually shown as Japanese Industrial Standard (JIS). Use the following guide to locate an equivalent cable locally.

JIS cable names may have up to 6 alphabetical characters, followed by a dash and a numerical value (example: DPYC-2.5).

For core types D and T, the numerical designation indicates the *cross-sectional Area (mm²)* of the core wire(s) in the cable.

For core types M and TT, the numerical designation indicates the *number of core wires* in the cable.

1. Core Type

D: Double core power line

T: Triple core power line

M: Multi core

TT: Twisted pair communications
(1Q=quad cable)

2. Insulation Type

P: Ethylene Propylene Rubber

3. Sheath Type

Y: PVC (Vinyl)

4. Armor Type

C: Steel

5. Sheath Type

Y: Anticorrosive vinyl sheath

6. Shielding Type

SLA: All cores in one shield, plastic tape w/aluminum tape

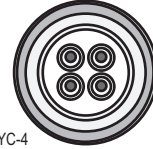
-SLA: Individually shielded cores, plastic tape w/aluminum tape



DPYCY



TPYCY



MPYC-4



TTYCSLA-4

EX: ¹ ³ ⁴ ⁵ ⁶
TTYCYSLA - 4
 Designation type # of twisted pairs

¹ ² ³ ⁴
MPYC - 4
 Designation type # of cores

The following reference table lists gives the measurements of JIS cables commonly used with Furuno products:

Type	Area	Core Diameter	Cable Diameter	Type	Area	Core Diameter	Cable Diameter
DPYC-1.5	1.5mm ²	1.56mm	11.7mm	TTYCSLA-1	0.75mm ²	1.11mm	9.4mm
DPYC-2.5	2.5mm ²	2.01mm	12.8mm	TTYCSLA-1T	0.75mm ²	1.11mm	10.1mm
DPYC-4	4.0mm ²	2.55mm	13.9mm	TTYCSLA-1Q	0.75mm ²	1.11mm	10.8mm
DPYC-6	6.0mm ²	3.12mm	15.2mm	TTYCSLA-4	0.75mm ²	1.11mm	15.7mm
DPYC-10	10.0mm ²	4.05mm	17.1mm	TTYCY-1	0.75mm ²	1.11mm	11.0mm
DPYCY-1.5	1.5mm ²	1.56mm	13.7mm	TTYCY-1T	0.75mm ²	1.11mm	11.7mm
DPYCY-2.5	2.5mm ²	2.01mm	14.8mm	TTYCY-1Q	0.75mm ²	1.11mm	12.6mm
DPYCY-4	4.0mm ²	2.55mm	15.9mm	TTYCY-4	0.75mm ²	1.11mm	17.7mm
MPYC-2	1.0mm ²	1.29mm	10.0mm	TTYCY-4SLA	0.75mm ²	1.11mm	19.5mm
MPYC-4	1.0mm ²	1.29mm	11.2mm	TTYCYSLA-1	0.75mm ²	1.11mm	11.2mm
MPYC-7	1.0mm ²	1.29mm	13.2mm	TTYCYSLA-4	0.75mm ²	1.11mm	17.9mm
MPYC-12	1.0mm ²	1.29mm	16.8mm	TTPYCSLA-1	0.75mm ²	1.11mm	9.2mm
TPYC-1.5	1.5mm ²	1.56mm	12.5mm	TTPYCSLA-1T	0.75mm ²	1.11mm	9.8mm
TPYC-2.5	2.5mm ²	2.01mm	13.5mm	TTPYCSLA-1Q	0.75mm ²	1.11mm	10.5mm
TPYC-4	4.0mm ²	2.55mm	14.7mm	TTPYCSLA-4	0.75mm ²	1.11mm	15.3mm
TPYCY-1.5	1.5mm ²	1.56mm	14.5mm				
TPYCY-2.5	2.5mm ²	2.01mm	15.5mm				
TPYCY-4	4.0mm ²	2.55mm	16.9mm				

APPX. 3 DIGITAL INTERFACE

Input sentences

ACN, DBT, DPT, GGA, GLL, GNS, HDG, HDT, MWV, RMC, ROT, VTG, THS, ZDA

Output sentences

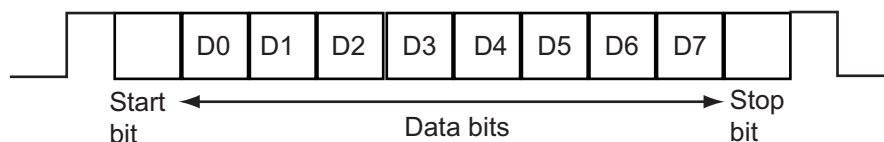
ALC, ALF, ALR, ARC, VBW, VDR, VHW, VLW, VTG

Data reception

Data is received in serial asynchronous form in accordance with the standard referenced in IEC 61162-2.

The following parameters are used:

- Baud rate
Input: 38400 bps IEC 61162-2-1, 4800 bps, IEC 61162-1-2
Output: Same as above. Baud rate fixed at 38400 bps for DS-600.
- Data bits: 8 (D7 = 0), Parity: none, Stop bits: 1



Data sentences: Input

Data format is IEC 61162-1 Edition 5.0 unless noted otherwise.

ACN - Alert command

```
$**ACN,hhmmss.ss,aaa,x.x,x.x,c,a*hh<CR><LF>
```

1 2 3 4 5 6

1. Time (UTC)
2. Manufacturer mnemonic code (3 digits, null)
3. Alert Identifier (0 to 9999999)
4. Alert Instance (1 to 999999, null)
5. Alert command (A,Q,O,S)
A=acknowledge
Q=request/repeat information
O=responsibility transfer
S=silence
6. Sentence status flag(C) (fixed)

DBT - Depth below transducer

```
$ ** DBT,    x.x, f, x.x, M, x.x, F *hh <CR><LF>
```

1 2 3 4 5 6

- 1, 2 Water depth, feet
- 3, 4 Water depth, m
- 5, 6 Water depth, fathom

DPT - Depth

\$ ** DPT, x.x, x.x, x.x*hh <CR><LF>
 1 2 3

1. Water depth relative to transducer, in meters
2. Offset from transducer, in meters
3. Maximum range scale in use

GGA - Global Positioning System Fix Data

\$ ** GGA, hhmmss.ss, llll.ll, a, yyyyy.yy, a, x, xx, x.x, x.x, M, x.x, M, x.x, xxxx *hh <CR><LF>
 1 2 3 4 5 6 7 8 9 10 11 12 13 14

1. UTC of position (no use)
2. Latitude (0.00000 to 9000.00000)
3. N/S
4. Longitude (0.00000 to 18000.00000)
5. E/W
6. GPS quality indicator (1 to 5, 8)
7. Number of satellite in use (no use)
8. Horizontal dilution of precision (no use)
9. Antenna altitude above/below mean sealevel (no use)
10. Unit, m (no use)
11. Geoidal separation (no use)
12. Unit, m (no use)
13. Age of differential GPS data (no use)
14. Differential reference station ID (no use)

GLL - Geographic position

\$ ** GLL, llll.ll, a, yyyyy.yyy, a, hhmmss.ss, A, a *hh <CR><LF>
 1 2 3 4 5 6 7

1. Latitude
2. N/S
3. Longitude
4. E/W
5. UTC of Position
6. Status (A: Data valid, V: Data not valid)
7. Mode indicator (A: Autonomous, D: Differential mode, S: Simulator mode)

GNS - GNSS Fix Data

\$ ** GNS, hhmmss.ss, llll.ll, a, yyyyy.yyy, a, cc, xx, x.x, x.x, x.x x.x, x.x, a *hh <CR><LF>
 1 2 3 4 5 6 7 8 9 10 11 12 13

1. UTC of position (no use)
2. Latitude
3. N/S
4. Longitude
5. E/W
6. Mode indicator (N=No fix, A=Autonomous, D=Differential, P=Precise, R=Real Time Kinetic, F=Float RTK, E=Estimated Mode, M=Manual Input Mode, S=Simulator Mode)
7. Total number of satellite in use (no use)
8. HDOP (no use)
9. Antenna altitude (no use)
10. Geoidal separation (no use)
11. Age of differential data (no use)
12. Differential reference station ID (no use)
13. Navigational status indicator (S=Safe, C=Caution, U=Unsafe, V=Navigational status not valid)

HDG - Heading, Deviation and Variation

\$ ** HDG, x.x, x.x, a, x.x, a *hh <CR><LF>
 1 2 3 4 5

1. Magnetic sensor heading, degrees
2. Magnetic deviation, degrees
3. Magnetic variation, degrees E/W
4. Magnetic deviation, degrees
5. Magnetic variation, degrees E/W

HDT - Heading True

\$ ** HDT, x.x, T *hh <CR><LF>
 1 2

1. Heading, degrees
2. True

MWV - Wind Speed and Angle

\$ ** MWV, x.x, a, x.x, a, A *hh <CR><LF>
 1 2 3 4 5

1. Wind angle (degrees)
2. Reference, R=relative, T=true
3. Wind speed
4. Wind speed units, K/M/N
5. Status, A=data valid, V=data invalid

RMC - Recommended Minimum Specific GNSS Data

\$ ** RMC, hhmmss.ss A, llll.ll, a, yyyyy.yy, a, x.x, x.x, xxxxxx, x.x, a, a, a*hh <CR><LF>
 1 2 3 4 5 6 7 8 9 10 11 12 13

1. UTC of position fix (no use)
2. Status: A=data valid, V=navigation receiver warning
3. Latitude
4. N/S
5. Longitude
6. E/W
7. Speed over ground, knots
8. Course over ground, degrees true
9. Date: dd/mm/yy (no use)
10. Magnetic variation, degrees E/W (no use)
11. E/W
12. Mode indicator
 (A=Autonomous mode, D=Differential mode, F=Float, P=Precise, R= Real time kinematic
 S=Simulator mode)
13. Navigational status indicator (S=Safe, C=Caution, U=Unsafe, V=Navigaitonal status not valid)

ROT - Rate of Turn

\$ ** ROT, x.x, A *hh <CR><LF>
 1 2

1. Rate of turn, deg/min, "-"=bow turns to port
2. Status: A=data valid, V=data invalid

THS - True heading and status

\$**THS,xxx.x,a*hh<CR><LF>
 1 2

1. Heading, degrees True (0.00 to 360.00)
2. Mode indicator.
 (A=Autonomous E=Estimated (dead reckoning) M=Manual input
 S=Simulator mode V=Data not valid (including standby))

VTG - Course over the ground and ground speed

\$ ** VTG, x.x, T, x.x, M, x.x, N, x.x, K, a *hh <CR><LF>
 1 2 3 4 5 6 7 8 9

1. Course over ground, degrees true
2. T
3. Course over ground, degrees magnetic (no use)
4. M (no use)
5. Speed over ground, knots
6. N
7. Speed over ground, km/h
8. K
9. Mode indicator
 (A=Autonomous, D=Differential, P=Precise, S=Simulator)

ZDA - Time and date

\$ ** ZDA, hhmmss.ss, xx, xx, xxxx, xx, xx *hh <CR><LF>
 1 2 3 4 5 6

1. UTC
2. Day, 01 to 31(UTC)
3. Month, 01 to 12(UTC)
4. Year(UTC)
5. Local zone hours, 00 to ± 13
6. Local zone minutes, 00 to +59

Data sentences: Output

ALC - Cyclic alert list

\$**ALC,xx,xx,xx,x.x,aaa,x.x,x.x,x.x,"""*hh<CR><LF>

1 2 3 4 5 6 7 8 9

1. Total number of sentences this message (01 to 99)
2. Sentence number (01 to 99)
3. Sequential message identifier (00 to 99)
4. Number of alert entries (0 to n; n=number of detected alerts)
5. Manufacturer mnemonic code (FEC, null)
6. Alert identifier (1 to 999999, null)
7. Alert instance (null)
8. Revision counter (1 to 99)
9. Additional alert entries (same as 5 to 8)

ALF - Alert sentence

1 2 3 4 5 6 7 8 9 10 11 12 13

1. Total number of ALF sentences this message (1, 2)
2. Sentence number (1, 2)
3. Sequential message identifier (0 to 9)
4. Time of last change (hh=00 to 23, mm=00 to 59, ss.ss=00.00 to 59.99), null
5. Alert category (B=Alert category B), null
6. Alert priority (C=Caution), null when #2 is 2.
7. Alert state (A=Active, N=Normal), null when #2 is 2.
8. Manufacturer mnemonic code (FEC, null)
9. Alert identifier (000 to 999999)
10. Alert instance (1 to 999999, null)
11. Revision counter (1 to 99)
12. Escalation counter (0 to 9)
13. Alert text

ALR - Set alarm state

\$**ALR,hhmmss.ss,xxx,A,A,c—c*hh<CR><LF>

1 2 3 4 5

1. Time of alarm condition change, UTC (hh=00 to 23, mm=00 to 59, ss.ss=00.00 to 59.99), null
2. Unique alarm number (identifier) at alarm source (001 to 011)
3. Alarm condition (A=threshold exceeded, V=not exceeded)
4. Alarm acknowledge state (A=acknowledged, V=unacknowledged)
5. Alarm's description text

ARC - Alert command refused

\$**ARC,hhmmss.ss,aaa,x.x,x.x,c*hh<CR><LF>

1 2 3 4 5

1. Release time of the Alert Command Refused (UTC) (hh=00 to 23, mm=00 to 59, ss.ss=00.00 to 59.99), null
2. Used for proprietary alerts, defined by the manufacturer (FEC,null)
3. The alert identifier (1 to 999999, null)
4. The alert instance(null)
5. Refused Alert Command (A=acknowledge, O=responsibility transfer, Q=request/repeat information S=silence)

VBW - Dual ground/water speed

\$ ** VBW, x.x, x.x, A, x.x, x.x, A, x.x, A, x.x, A *hh <CR><LF>
 1 2 3 4 5 6 7 8 9 10

1. Longitudinal water speed, knots
2. Transverse water speed, knots
3. Status: water speed (A=data valid, V=data invalid)
4. Longitudinal ground speed, knots
5. Transverse ground speed, knots
6. Status: ground speed (A=data valid, V=data invalid)
7. Stern water speed, knots
8. Status: stern water speed (A=data valid, V=data invalid)
9. Stern transverse ground speed, knots
10. Status: stern transverse ground speed (A=data valid, V=data invalid)

VDR - Set and Drift

\$ ** VDR, x.x, T, x.x, M, x.x, N*hh <CR><LF>
 1 2 3 4 5 6

1. Direction, degree True
2. T
3. Direction, degree Magnetic
4. Magnetic
5. Current speed, knots
6. N

VHW - Water Speed and Heading

\$ ** VHW, x.x, T, x.x, M, x.x, N, x.x, K *hh <CR><LF>
 1 2 3 4 5 6 7 8

1. Heading, degrees true
2. T
3. Heading, degrees magnetic (null)
4. M
5. Speed, knots
6. N
- 7 Speed, km/h
8. K

VLW - Dual Ground/Water Distance

\$ ** VLW, x.x, N, x.x, N, x.x, N, x.x, N*hh <CR><LF>
 1 2 3 4 5 6 7 8

1. Total cumulative water distance, nautical miles
2. Nautical miles
3. Water distance since reset
4. Nautical miles
5. Total cumulative ground distance (null)
6. nautical miles
7. Ground distance since reset (null)
8. Nautical miles

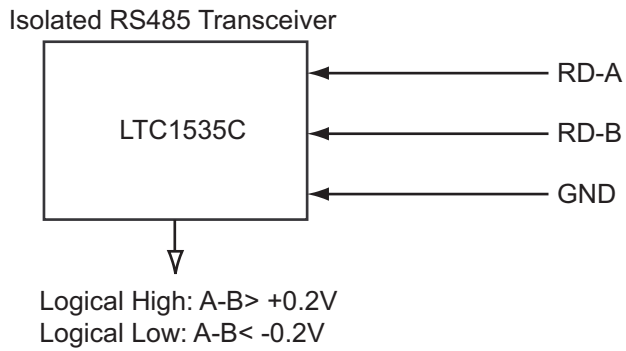
VTG - Course Over the Ground and Ground Speed

See VTG at input sentences section.

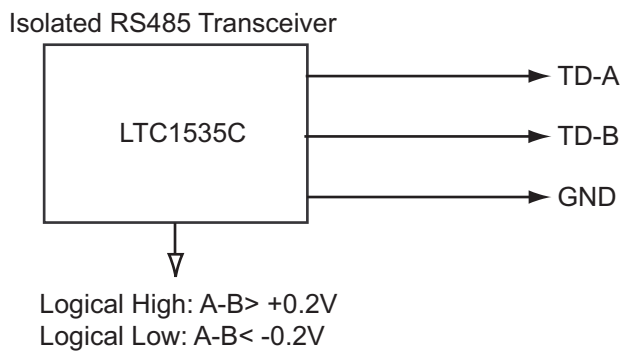
Serial Interface

Baud rate is selectable from 4800 bps and 38400 bps. The serial interface complies with IEC 61162-2.

Input port (RD-A, RD-B)



Output port (TD-A, TD-B)



APPX. 4 ALERT LIST

The table which follows shows the alert messages that can appear on the display, in the [Alert I/F1], [Alert I/F2] and [Legacy] modes.

Note: The following features are **NOT** supported.

- Alert aggregation
- Functional alert grouping
- Responsibility transfer (The alert type of DS-60 is "Caution" only.)
- Alert Escalation (The alert type of DS-60 is "Caution" only.)

Legacy Mode	Alert I/F1 Mode	Alert I/F2 Mode
!! 310 Echo Failure	!! 011 Echo Failure	!! 3056 Echo Failure

Alert title	Alert description text	Priority	Alert category	Alert ID			Meaning	Measures
				Legacy	Alert I/F 1	Alert I/F 2		
Lost MEAS	TCVR PS ERR stopped speed MEAS.	Caution	B	210	001	3009-1	Ship speed measurement stops because transceiver unit's transmission high voltage circuit is abnormal.	Contact your dealer.
Lost MEAS	TCVR BV ERR stopped speed MEAS.	Caution	B	211	002	3009-2	Ship speed measurement stops because transceiver's transmission high voltage is outside specified range.	
Lost MEAS	TCVR 5V ERR stopped speed MEAS.	Caution	B	212	003	3009-3	Ship speed measurement stops because transceiver's 5V voltage is outside specified range.	
Lost MEAS	TCVR 12V ERR stopped speed MEAS.	Caution	B	213	004	3009-4	Ship speed measurement stops because transceiver's 12V voltage is outside specified range.	
Missing ROT	ROT TEMP ERR stops 3-axis speed.	Caution	B	220	005	3119-1	Ship speed measurement of "Bow" and "Center" stops because temperature in ROT GYRO chassis outside specified range.	
Missing ROT	ROT OPT ERR stops 3-axis speed.	Caution	B	221	006	3119-2	Ship speed measurement of "Bow" and "Center" stops because ROT GYRO optical system damaged (Possible light source failure).	
Missing ROT	ROT CTRL ERR stops 3-axis speed.	Caution	B	222	007	3119-3	Ship speed measurement of "Bow" and "Center" stops because ROT GYRO control damaged.	
Lost DISP	DISP COM ERR stops display update.	Caution	B	231	008	3003-1	Display update stops because communication error with display unit.	
Lost TCVR	TCVR COM ERR stops speed MEAS.	Caution	B	232	009	3003-2	Ship speed measurement stops because communication error with transceiver unit.	Check if it depends on draft or ship speed. If this error recurs, contact your dealer.
Echo Failure	RX echo ERR reduces reliability.	Caution	B	310	011	3056	The speed reliability is reduced because the received echo is affected by bubbles and noise.	

FURUNO

CODE NO.	001-407-270-00	66AT-X-9415 -0
TYPE	CP66-01701	1/1

工事材料表					
INSTALLATION MATERIALS					
番号 NO.	名 称 NAME	略 図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	六角ボルト HEX. BOLT		M10X20 SUS304 CODE NO. 000-162-779-10	4	

型式/コード番号が2段の場合、下段より上段に代わる適置部品であり、どちらかが入っています。なお、品質は変わりません。

TWO TYPES AND CODES MAY BE LISTED FOR AN ITEM. THE LOWER PRODUCT MAY BE SHIPPED IN PLACE OF THE UPPER PRODUCT. QUALITY IS THE SAME.
(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO ELECTRIC CO., LTD.

KR

C7264-M15-A

FURUNO

CODE NO.	001-082-290-00	66AT-X-9411 -1
TYPE	CP66-01702	1/1

工事材料表		DS-620			
INSTALLATION MATERIALS					
番号 NO.	名 称 NAME	略 図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	六角ボルト HEX. BOLT		M10X20 SUS304 CODE NO. 000-162-779-10	4	
2	導電布テープ SHIELDING TAPE		TR-19 L=3000 CODE NO. 000-173-067-10	1	テープは絶縁 シート'処理用 FOR WRAPPING CABLES

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO ELECTRIC CO., LTD.

C7264-M11-B

FURUNO

CODE NO.	001-081-900-00	26AC-X-9403 -3
TYPE	CP26-01501	1/1

工事材料表					
INSTALLATION MATERIALS					
番号 NO.	名 称 NAME	略 図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	ケーブルクランプ (2) CABLE CLAMP (2)		26-003-1529-0 CODE NO. 100-352-110-10	1	
2	フラッシュマウンティング FLUSH MOUNTING SPONGE		26-005-1532-2 CODE NO. 100-352-202-10	1	
3	パイロットタッピングビス TAPPING SCREW		5X20 SUS304 CODE NO. 000-171-997-10	4	

型式/コード番号が2段の場合、下段より上段に代わる適置部品であり、どちらかが入っています。なお、品質は変わりません。

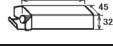
TWO TYPES AND CODES MAY BE LISTED FOR AN ITEM. THE LOWER PRODUCT MAY BE SHIPPED IN PLACE OF THE UPPER PRODUCT. QUALITY IS THE SAME.
(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO ELECTRIC CO., LTD.

C4453-M03-D

FURUNO

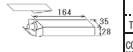
CODE NO.	001-496-120-00	66AT-X-9407 -4
TYPE	CP66-01704	1/1

工事材料表		DS-631			
INSTALLATION MATERIALS					
番号 NO.	名 称 NAME	略 図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	コネクタ固定金具 METAL FIXING FOR CONNECTOR		66-027-6019-0 CODE NO. 100-354-660-10	1	
2	グロメット GROMET		66-027-6021-0 CODE NO. 100-354-705-10	1	
3	ケーブル押え板 CABLE FIXING PLATE		66-027-6022-0 CODE NO. 100-354-710-10	1	
4	バネワッシャー SPRING WASHER		M6 SUS316L CODE NO. 000-167-409-10	4	
5	六角穴付ボルト HEXAGONAL HEAD BOLT		M6X12 SUS316L CODE NO. 000-172-253-10	2	
6	六角穴付ボルト HEXAGONAL HEAD BOLT		M6X20 SUS316L CODE NO. 000-162-745-10	2	
7	六角穴付ボルト HEXAGONAL HEAD BOLT		M6X12 SUS316L CODE NO. 000-172-255-10	4	
8	シールワッシャー SEAL WASHER		SUS 16 CODE NO. 000-164-584-10	4	
9	接着剤袋 ADHESIVE		TB5211 50G CODE NO. 001-477-870-00	1	
10	グリス GREASE		G-30M-100 CODE NO. 000-169-306-10	1	

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO ELECTRIC CO., LTD.

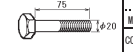
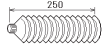
C7264-M07-E

FURUNO		CODE NO. 001-496-110-00		66AT-X-9406 -3	
		TYPE CP66-01703		1/1	
工事材料表					
INSTALLATION MATERIALS					
番 号 NO.	名 称 NAME	略 図 OUTLINE	型 名／規格 DESCRIPTIONS	数 量 Q'TY	用 途／備 考 REMARKS
1	六角穴付*ボルト HEXAGONAL HEAD BOLT		M06X12 SUS316L CODE NO. 000-172-285-10	4	
2	シーリングワッシャー SEAL WASHER		SUS 316 CODE NO. 000-167-584-10	4	
3	接着剤塗布 ADHESIVE		TBS211 50G CODE NO. 001-477-870-00	1	

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO ELECTRIC CO., LTD.

C7264-M06-D

FURUNO		CODE NO. 001-082-800-00		66AT-X-9409 -1	
		TYPE		CP66-01711	
1/1					
工事材料表					
INSTALLATION MATERIALS		DS-661			
番号 NO.	名 称 NAME	略 図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	防水座金 WATERPROOF WASHER		66-027-7206-1 CODE NO. 100-354-571-10	1	
2	防水パッキン WATERPROOF GASKET		66-027-7207-1 CODE NO. 100-354-581-10	1	
3	ケーブル用締付 CABLE GLAND NIPPLE		JIS F8801 203φ CODE NO. 000-171-874-10	1	
4	六角ナット 19mm HEXAGONAL NUT		M12 SUS316L CODE NO. 000-167-494-10	8	
5	平座金 FLAT WASHER		M12 SUS316L CODE NO. 000-167-471-10	4	
6	バネ座金 SPRING WASHER		M12 SUS316L CODE NO. 000-167-596-10	4	
7	六角ナット 19mm HEXAGONAL NUT		M20 SUS316L CODE NO. 000-167-495-10	16	
8	バネ座金 SPRING WASHER		M20 SUS316L CODE NO. 000-167-492-10	16	
9	六角穴付ボルト HEXAGONAL HEAD BOLT		M20X75 SUS316L CODE NO. 000-172-024-10	8	
10	グリス 3kg GREASE		No. 1 400G ジェット CODE NO. 000-166-774-10	1	

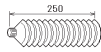
型式/コード番号が2段の場合、下段より上段に代わる適量製品であり、どちらが入っています。なお、品質は変わりません。

TWO TYPES AND CODES MAY BE LISTED FOR AN ITEM. THE LOWER PRODUCT MAY BE SHIPPED IN PLACE OF THE UPPER PRODUCT. QUALITY IS THE SAME.

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO ELECTRIC CO., LTD.

C7264-M09-B

FURUNO		CODE NO.	001-082-830-00	66AT-X-9408 -0	
		TYPE	CP66-01710	1/1	
工事材料表					
INSTALLATION MATERIALS					
DS-661					
番 号 NO.	名 称 NAME	略 図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q T Y	用途／備考 REMARKS
1	グリス 3kg GREASE		No. 1 400G ジェットグリス CODE NO. 000-166-774-10	1	

型式/コード番号が2段の場合、下段より上段に代わる適量製品であり、どちらが入っています。なお、品質は変わりません。

TWO TYPES AND CODES MAY BE LISTED FOR AN ITEM. THE LOWER PRODUCT MAY BE SHIPPED IN PLACE OF THE UPPER PRODUCT. QUALITY IS THE SAME.

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO ELECTRIC CO., LTD.

C7264-M08-A

FURUNO		CODE NO.	001-082-820-00	66AT-X-9410 -0	
		TYPE	CP66-01712	1/1	
工事材料表					
INSTALLATION MATERIALS					
DS-661					
番 号 NO.	名 称 NAME	略 図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q T Y	用途／備考 REMARKS
1	ガスケット GASKET		66-027-7203-0 CODE NO. 100-354-040-10	2	

型式/コード番号が2段の場合、下段より上段に代わる適量製品であり、どちらが入っています。なお、品質は変わりません。

TWO TYPES AND CODES MAY BE LISTED FOR AN ITEM. THE LOWER PRODUCT MAY BE SHIPPED IN PLACE OF THE UPPER PRODUCT. QUALITY IS THE SAME.

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO ELECTRIC CO., LTD.

C7264-M10-A

FURUNO

CODE NO.	001-407-280-00	66AT-X-9303-1 1/1
TYPE	SP66-00901	BOX NO. P

[illegible]

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO

CODE NO.	001-082-140-00	66AT-X-9501 -1 1/1
TYPE	FP66-00701	

付属品表		DS-600-S/HK, DS-600-S/HK-V	
ACCESSORIES			
番号 NO.	名称 NAME	略図 OUTLINE	数量 Q'TY
1	フタ拭キクリーナー LCD CLEANING CLOTH		1
2	おシ キャップ CAP		02-155-1082-2 CODE NO. 100-332-652-10
			26-003-1508-1 CODE NO. 100-356-091-10
3	ALARMフタ組品 ALARM LID ASSY.		1

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

型式/コード番号が2段の場合、下段より上段に付わる通称製品であり、どちらもが入っています。なお、品質は変わりません。

TWO TYPES AND CODES MAY BE LISTED FOR AN ITEM. THE LOWER PRODUCT MAY BE SHIPPED IN PLACE OF THE UPPER PRODUCT. QUALITY IS THE SAME.

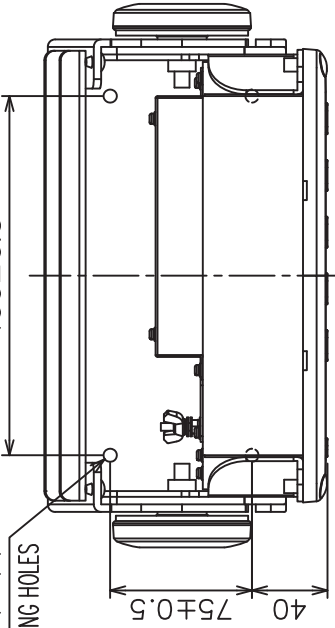
FURUNO ELECTRIC CO., LTD.

C7264-F01-B

取付穴
4-φ7

FIXING HOLES

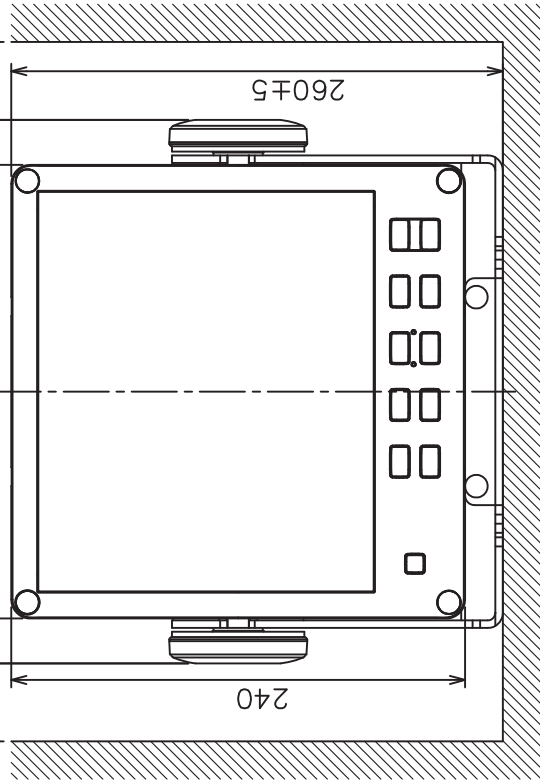
190±0.5



#80

288±5

240



#150

149

91

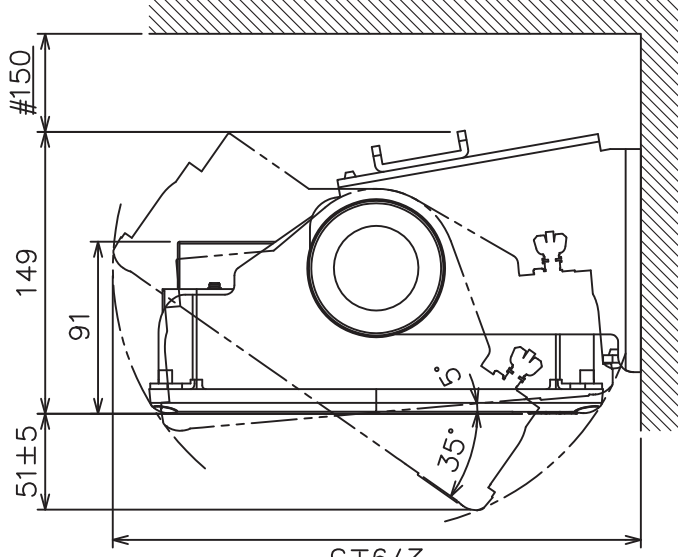
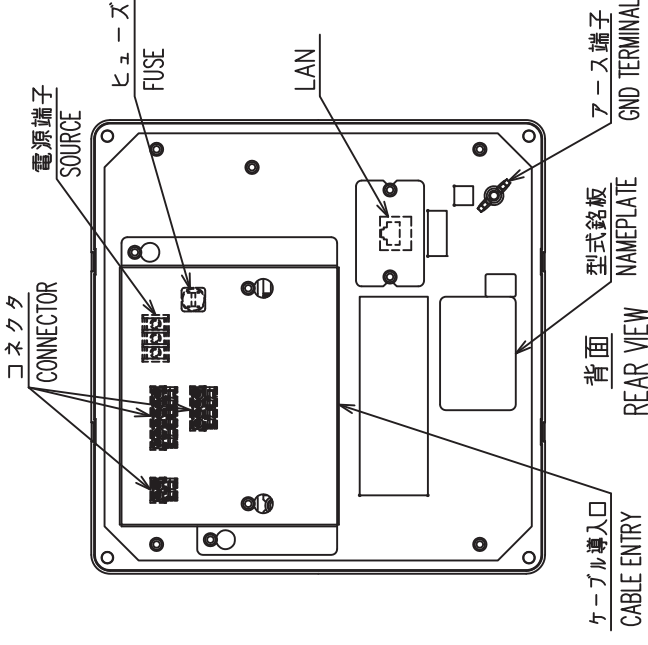


表1 TABLE 1

寸法区分 (mm) DIMENSION	公差 (mm) TOLERANCE
L ≤ 50	±1.5
50 < L ≤ 100	±2.5
100 < L ≤ 500	±3

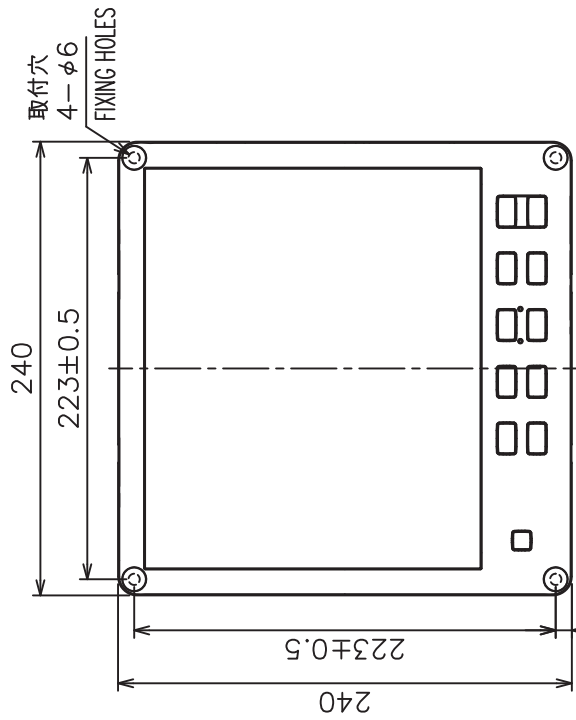
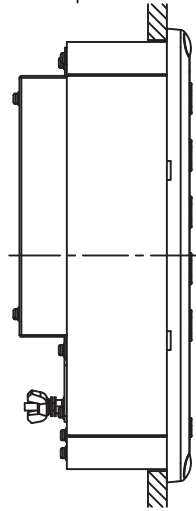


- 注記 1) 指定外の寸法公差は表 1 による。
 2) #印寸法は最小サービスクリアランスとする。
 3) 取付用ネジはバイネジ呼び径 5 × 20 を使用のこと。
- NOTE 1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
 2. #: MINIMUM SERVICE CLEARANCE.
 3. USE BIND TAPPING SCREWS Ø5×20 FOR FIXING THE UNIT.

DRAWN	5/Mar/2010	T.YAMASAKI	TITLE	DS-600
CHECKED	5/Mar/2010	T.TAKAHASHI	名称	指示器 (卓上装備)
APPROVED	8/Mar/2010	Y.NISHIYAMA	外寸図	
SCALE	1/4	WASS 3.3 kg	NAME	DISPLAY UNIT (TABLETOP MOUNT)
DWG.No.	C7264-G01-C	REF.No.	66-027-101G-5	OUTLINE DRAWING

表1 TABLE 1

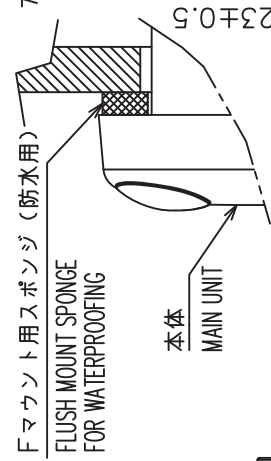
寸法区分 (mm) DIMENSION	公差 (mm) TOLERANCE
L ≤ 50	±1.5
50 < L ≤ 100	±2.5
100 < L ≤ 500	±3



85

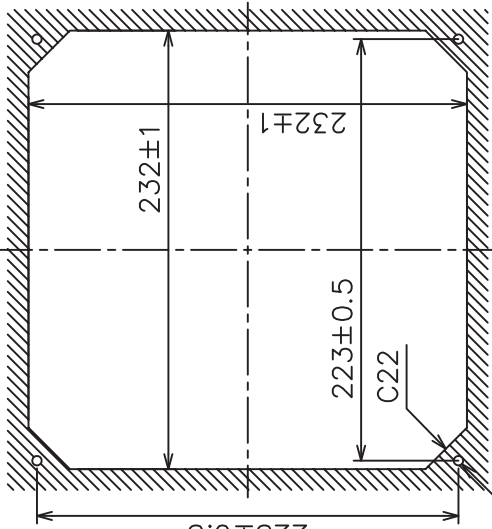
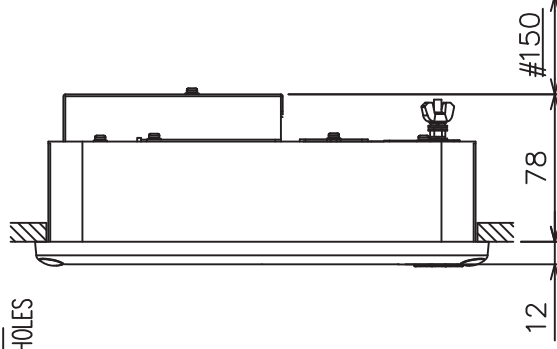
注記

- 1) 指定外の寸法公差は表1による。
 - 2) #印寸法は最小サービスマン間寸法とする。
 - 3) 取付用ネジはバインドタッピンネジ呼び径5×20を使用のこと。
- NOTE
1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
 2. #: MINIMUM SERVICE CLEARANCE.
 3. USE BIND TAPPING SCREWS Ø5x20 FOR FIXING THE UNIT.

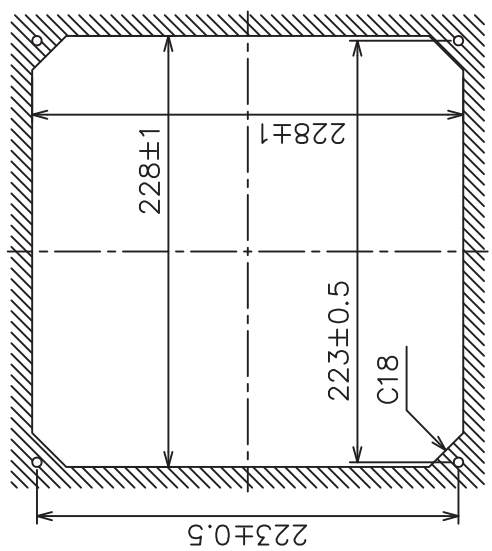


取付部断面 (尺度: 1/1)
SLICE OF FIXING (SCALE: 1/1)

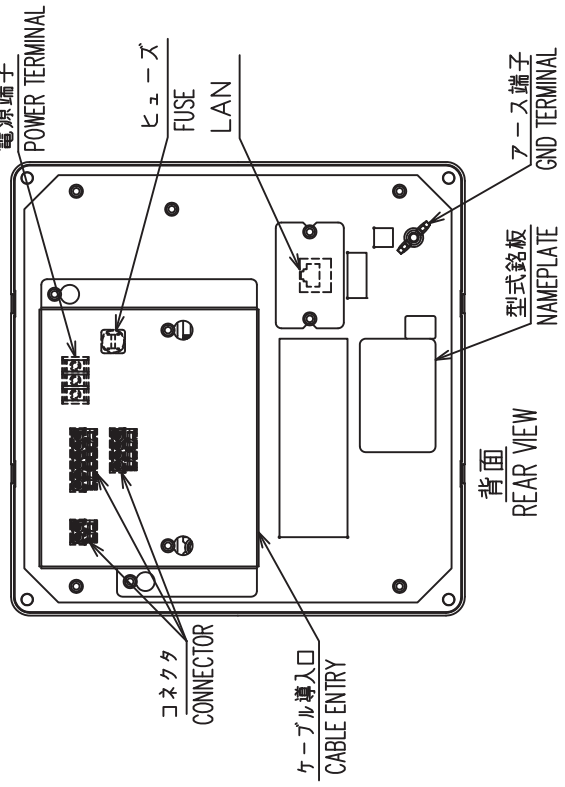
4-取付穴
PILOT HOLES



取付穴寸法 (屋内装備時)
CUTOUT DIMENSIONS (INDOOR INSTALLATION)

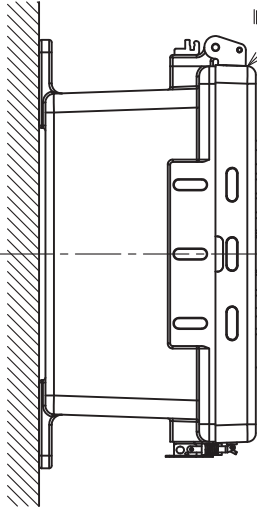


取付穴寸法 (屋外装備時)
CUTOUT DIMENSIONS (OUTDOOR INSTALLATION)

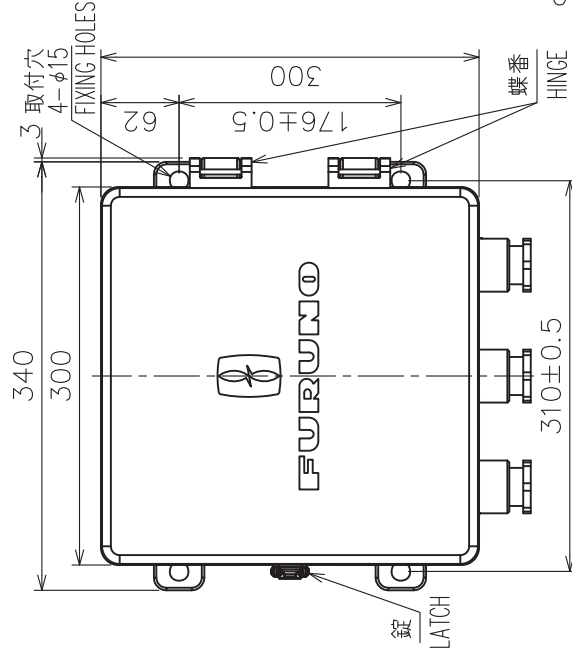


背面
REAR VIEW

DRAWN	17/Dec/2012	I.YAMASAKI	TITLE	DS-600
CHECKED	17/Dec/2012	H.MAKI	名称	指示器 (埋込装備)
APPROVED	18/Dec/2012	Y.NISHIYAMA	NAME	外寸図
SCALE	1/4	WASS 2.1 kg	NAME	DISPLAY UNIT (FLUSH MOUNT)
DWG.No.	C7264-G02-D	REF.No.	66-027-102G-6	OUTLINE DRAWING



扉 LID

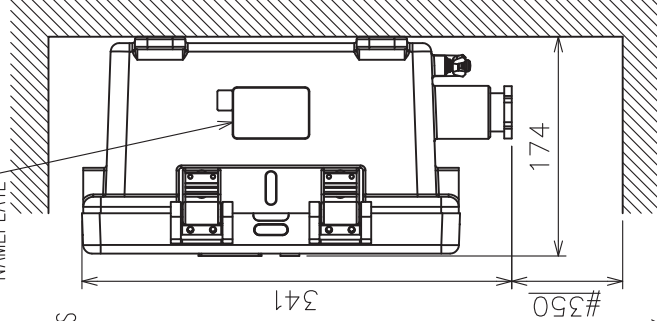


錠 LATCH

表 1 TABLE 1

寸法区分 (mm) DIMENSION	公差 (mm) TOLERANCE
L ≤ 50	±1.5
50 < L ≤ 100	±2.5
100 < L ≤ 500	±3

型式銘板
NAMEPLATE

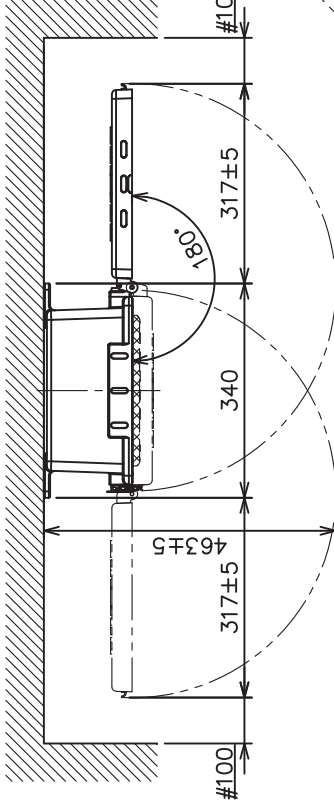


NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. #: MINIMUM SERVICE CLEARANCE.
3. USE M10 BOLTS AND SEAL WASHERS (03-001-3002) FOR FIXING THE UNIT.
4. EXCHANGE THE POSITION OF LATCH/HINGE TO CHANGE THE LID DIRECTION.

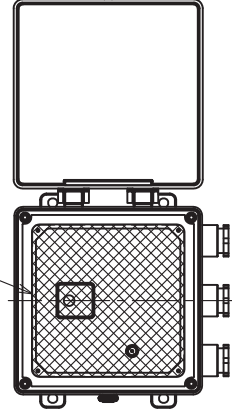
注 記

- 1) 指定外の寸法公差は表 1 による。
- 2) #印寸法は最小サービスクリアランスとする。
- 3) 取付ネジは M10 ボルト、シールワッシャー (03-001-3002) を使用のこと。
- 4) 錠と蝶番の取付位置を入れ替えて、扉の開閉方向を変更出来ます。



扉 右 (左) 開閉図 (尺度: 1/12)
OPENING THE LID LEFT/RIGHT (SCALE: 1/12)

DS-600/RD-50



ファラント用 スポンジ (防水用)
FLUSH MOUNT SPONGE
FOR WATERPROOFING

本体
MAIN UNIT

取付部断面 (尺度: 1/1)

SLICE OF FIXING (SCALE: 1/1)

扉 上 (下) 開閉図 (尺度: 1/12)
OPENING THE LID UP/DOWN (SCALE: 1/12)

DRAWN	17/Dec/2012 T.YAMASAKI	TITLE	DS-605
CHECKED	17/Dec/2012 H.MAKI	名称	防水箱
APPROVED		外寸図	
SCALE	1/6	NAME	WATERPROOF BOX
DWG.No.	C7264-G05-F	REF.No.	66-027-104G-3
			OUTLINE DRAWING

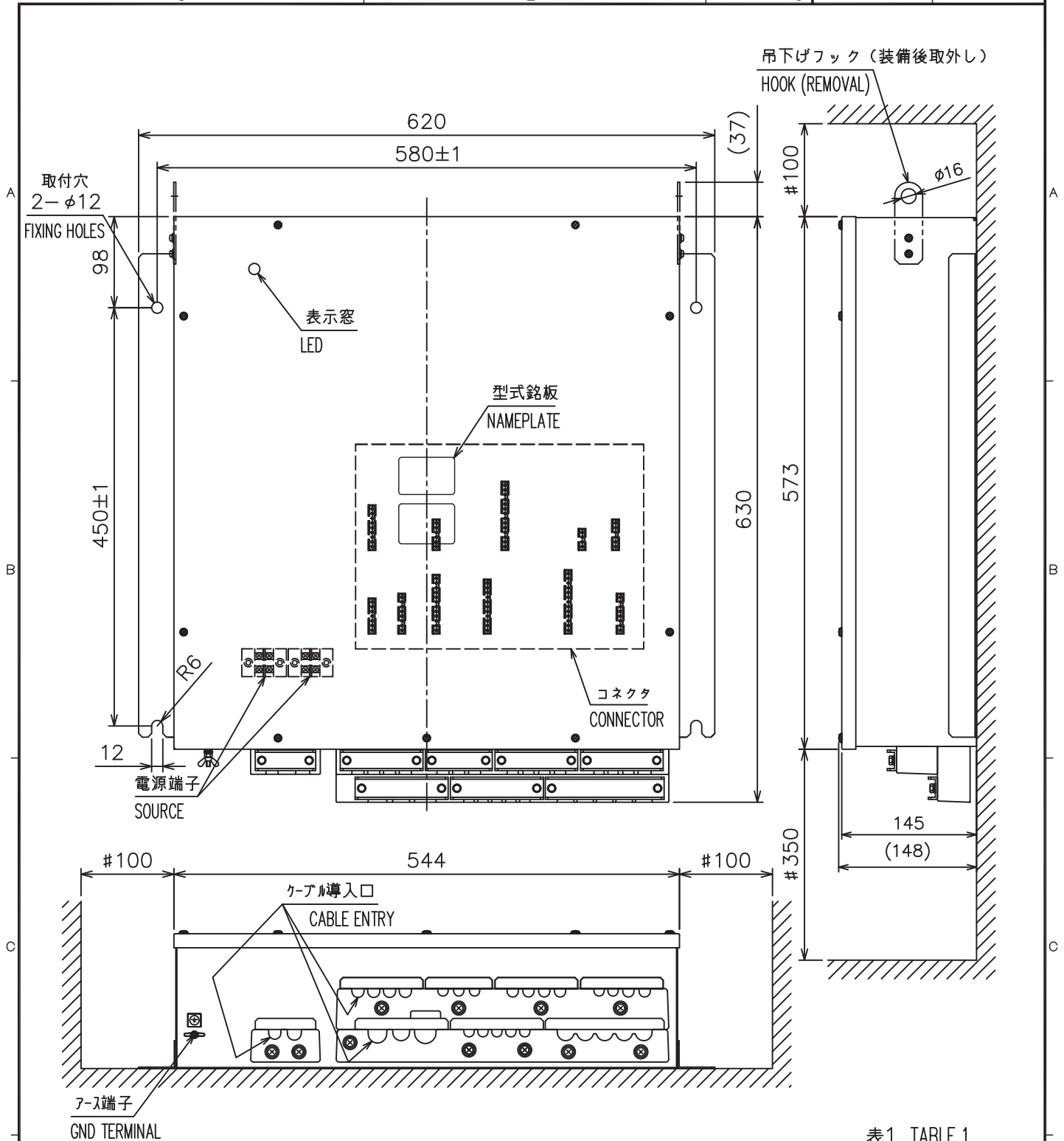


表1 TABLE 1

寸法区分 (mm) DIMENSION	公差 (mm) TOLERANCE
$L \leq 50$	±1.5
$50 < L \leq 100$	±2.5
$100 < L \leq 500$	±3
$500 < L \leq 1000$	±4

- 注記 1) 指定外の寸法公差は表1による。
 2) #印寸法は最小サービス空間寸法とする。
 3) 取付用ネジはM10ボルトを使用のこと。

- NOTE 1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
 2. #: MINIMUM SERVICE CLEARANCE.
 3. USE M10 BOLTS FOR FIXING THE UNIT.

DRAWN	30/Jun/2015 T.YAMASAKI	TITLE	DS-610
CHECKED	30/Jun/2015 H.MAKI	名称	分配器
APPROVED	30/Jun/2015 H.MAKI		外寸図
SCALE	1/6	MASS	20 ±10% kg
DWG. No.	C7264-G03- B	REF. No.	66-027-200G-1
		NAME	DISTRIBUTOR
			OUTLINE DRAWING

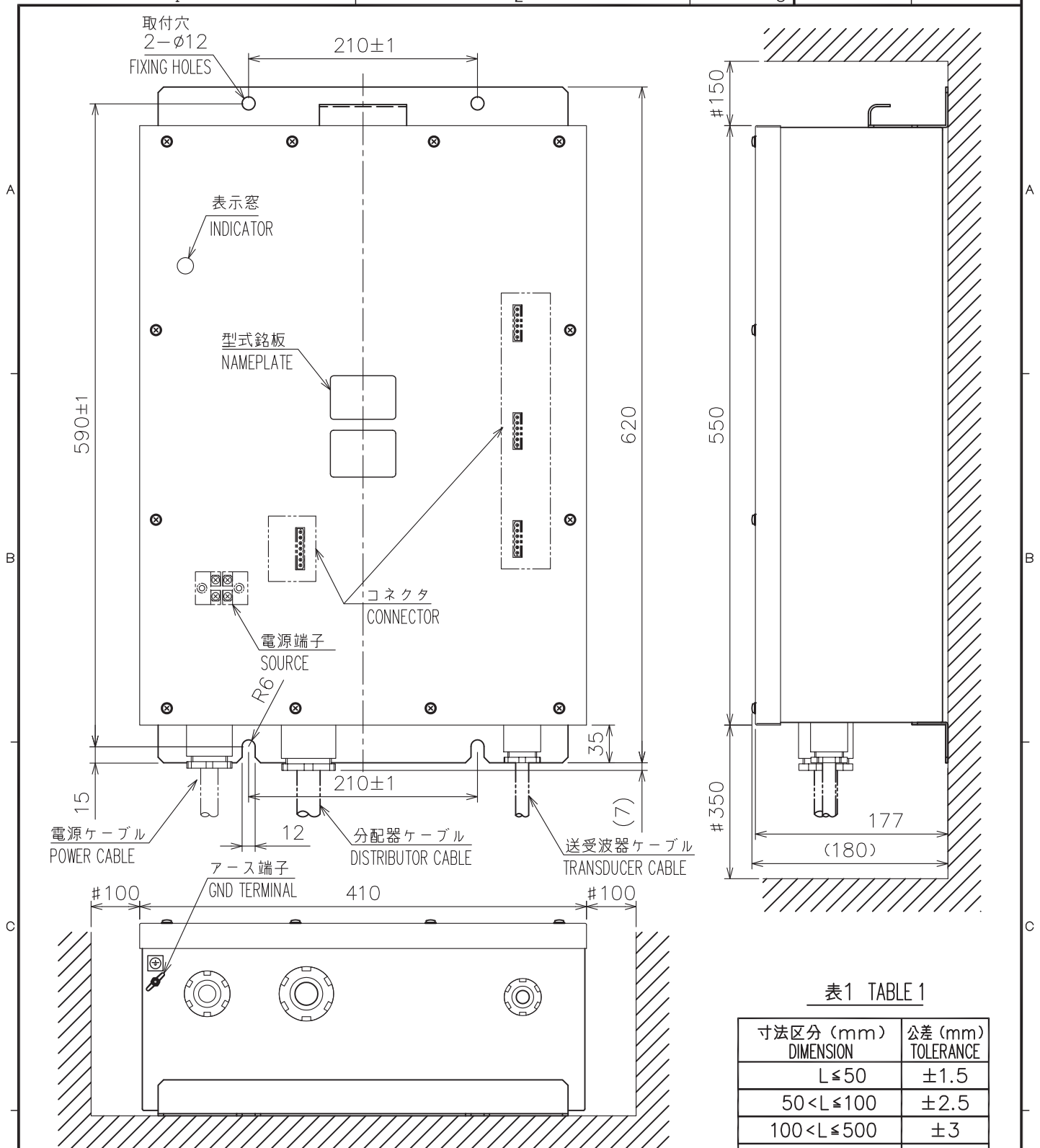


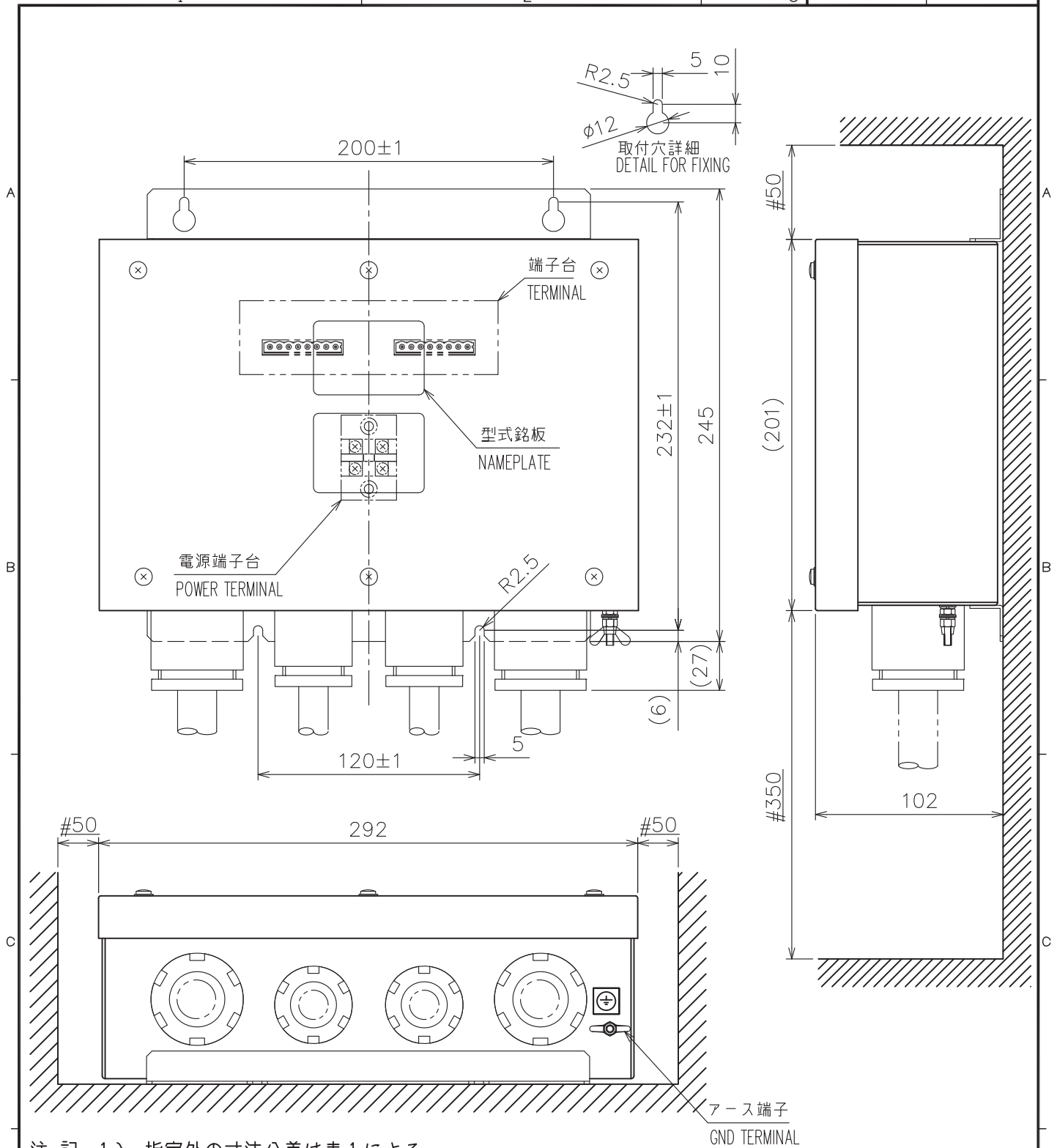
表1 TABLE 1

寸法区分 (mm) DIMENSION	公差 (mm) TOLERANCE
$L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3
$500 < L \leq 1000$	± 4

- 注記 1) #印寸法は最小サービス空間寸法とする。
2) 指定外の寸法公差は表1による。
3) 取付用ネジはM10ボルトを使用のこと。

- NOTE 1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. #: MINIMUM SERVICE CLEARANCE.
3. USE M10 BOLTS FOR FIXING THE UNIT.

DRAWN	30/Jun/2015 T.YAMASAKI	TITLE	DS-620
CHECKED	30/Jun/2015 H.MAKI	名称	送受信部
APPROVED	30/Jun/2015 H.MAKI	DS-60	外寸図
SCALE	1/5	MASS	19 ±10% kg
DWG. No.	C7264-G04-C	REF. No.	66-027-300G-1
		NAME	TRANSCIEVER UNIT OUTLINE DRAWING



- 注 記 1) 指定外の寸法公差は表 1 による。
 2) # 印寸法は最小サービス空間寸法とする。
 3) 取付用ネジはトラスタッピンネジ呼び径 4×20 を使用のこと。

- NOTE 1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
 2. #: MINIMUM SERVICE CLEARANCE.
 3. USE TAPPING SCREWS $\phi 4 \times 20$ FOR FIXING THE UNIT.

表1 TABLE 1

寸法区分 (mm) DIMENSION	公差 (mm) TOLERANCE
$L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3

DRAWN	1/Jul/2011 T.YAMASAKI	TITLE	DS-640
CHECKED	1/Jul/2011 H.MAKI	名称	接続箱
APPROVED	1/Jul/2011 Y.NISHIYAMA	DS-60	外寸図
SCALE	1/3	MASS	5.0 $\pm 10\%$ kg
DWG. No.	C7264-G06- B	REF. No.	66-027-400G-1
			NAME
			JUNCTION BOX
			OUTLINE DRAWING

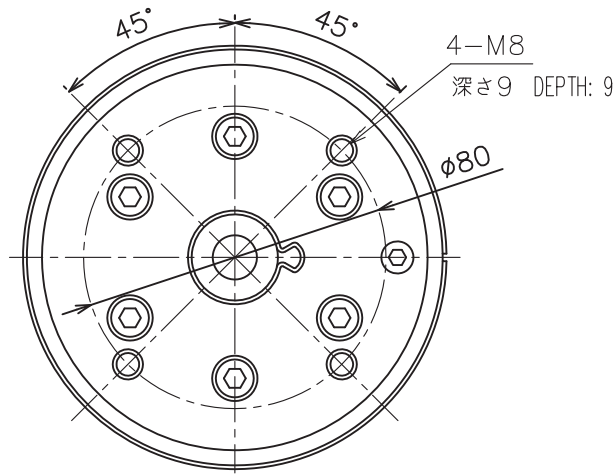
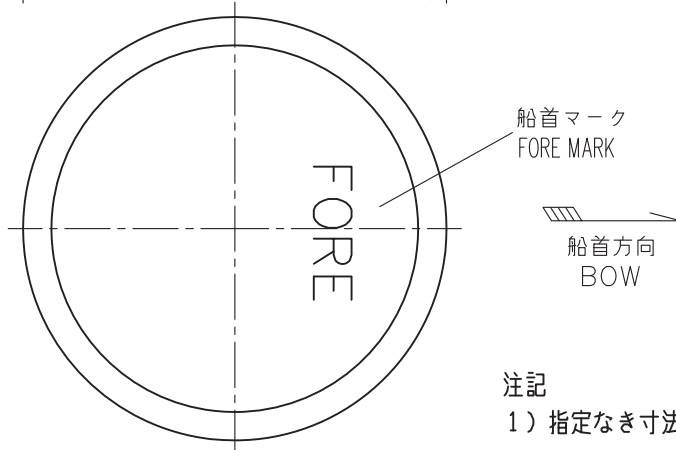
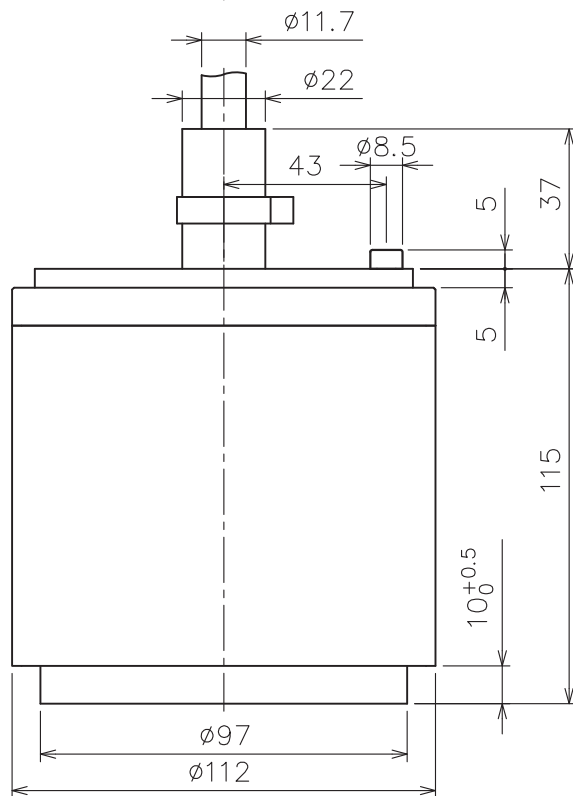


表 1 TABLE 1

寸法区分 (mm) DIMENSION	公差 (mm) TOLERANCE
$L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3

表 2 TABLE 2

ケーブル長 (m) CABLE LENGTH	質量 (kg $\pm 10\%$) MASS
31	9
41	11
51	13
61	14



注記

1) 指定なき寸法公差は表 1 による。

NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.

DRAWN	29/Mar/2011 T.YAMASAKI	TITLE	DS-630
CHECKED	29/Mar/2011 H.MAKI	名称	送受波器
APPROVED	29/Mar/2011 Y.NISHIYAMA	DS-60	外寸図
SCALE	1/2	MASS	表 2 参照 SEE TABLE 2
DWG. No.	C7264-G07- B	REF. No.	66-027-600G-1
			NAME TRANSDUCER OUTLINE DRAWING

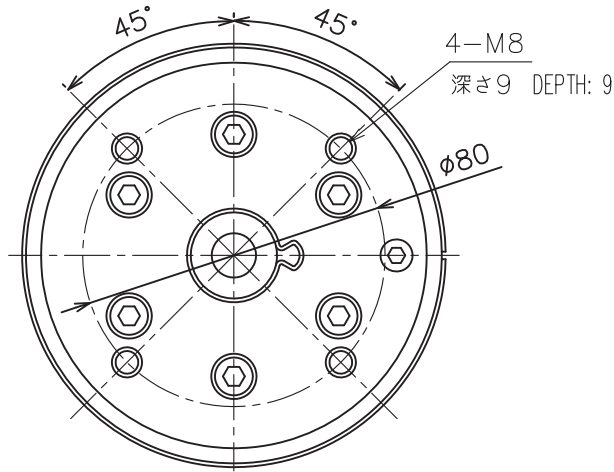
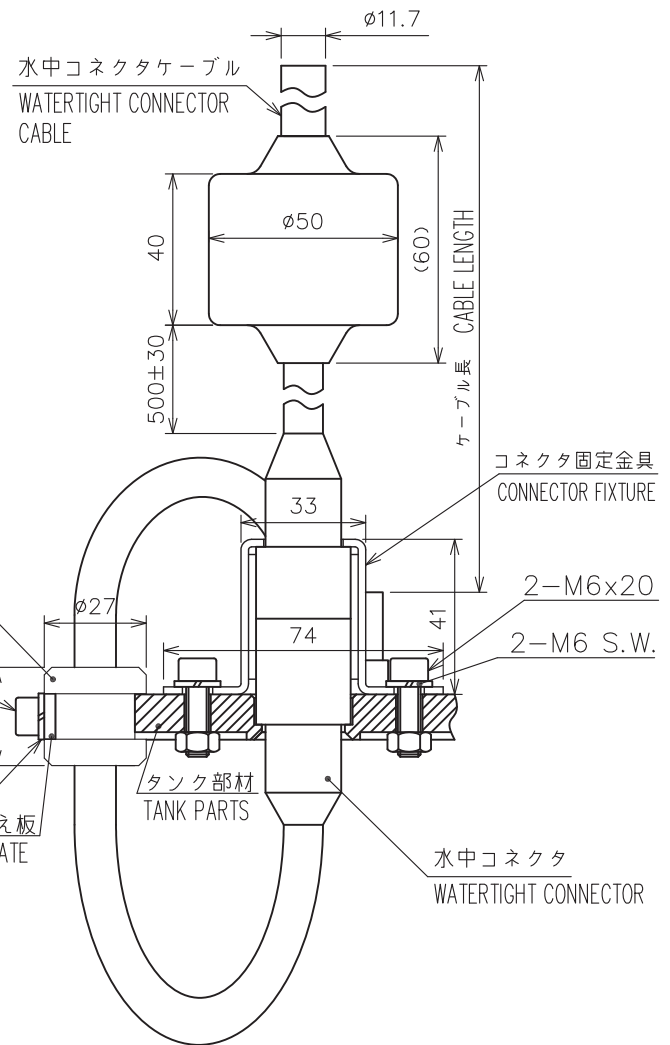
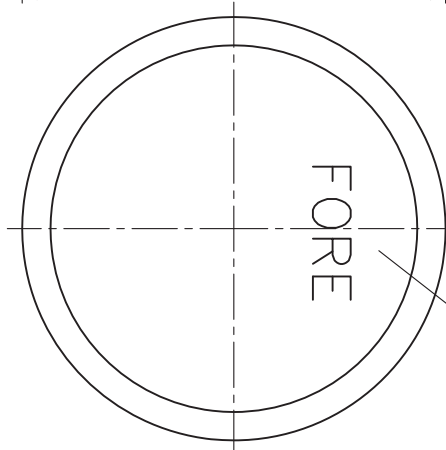
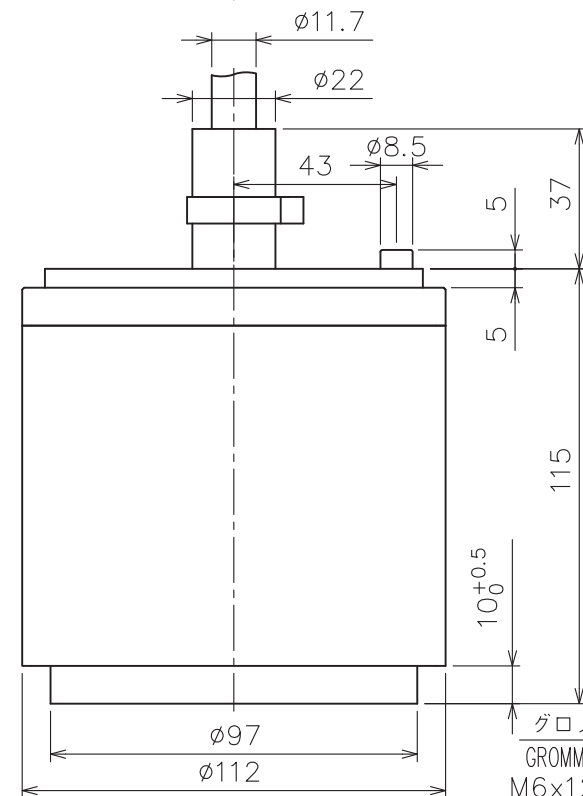


表 1 TABLE 1

寸法区分 (mm) DIMENSION	公差 (mm) TOLERANCE
$L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3

表 2 TABLE 2

ケーブル長 (m) CABLE LENGTH	質量 (kg $\pm 10\%$) MASS
31	9
41	11
51	13
61	14



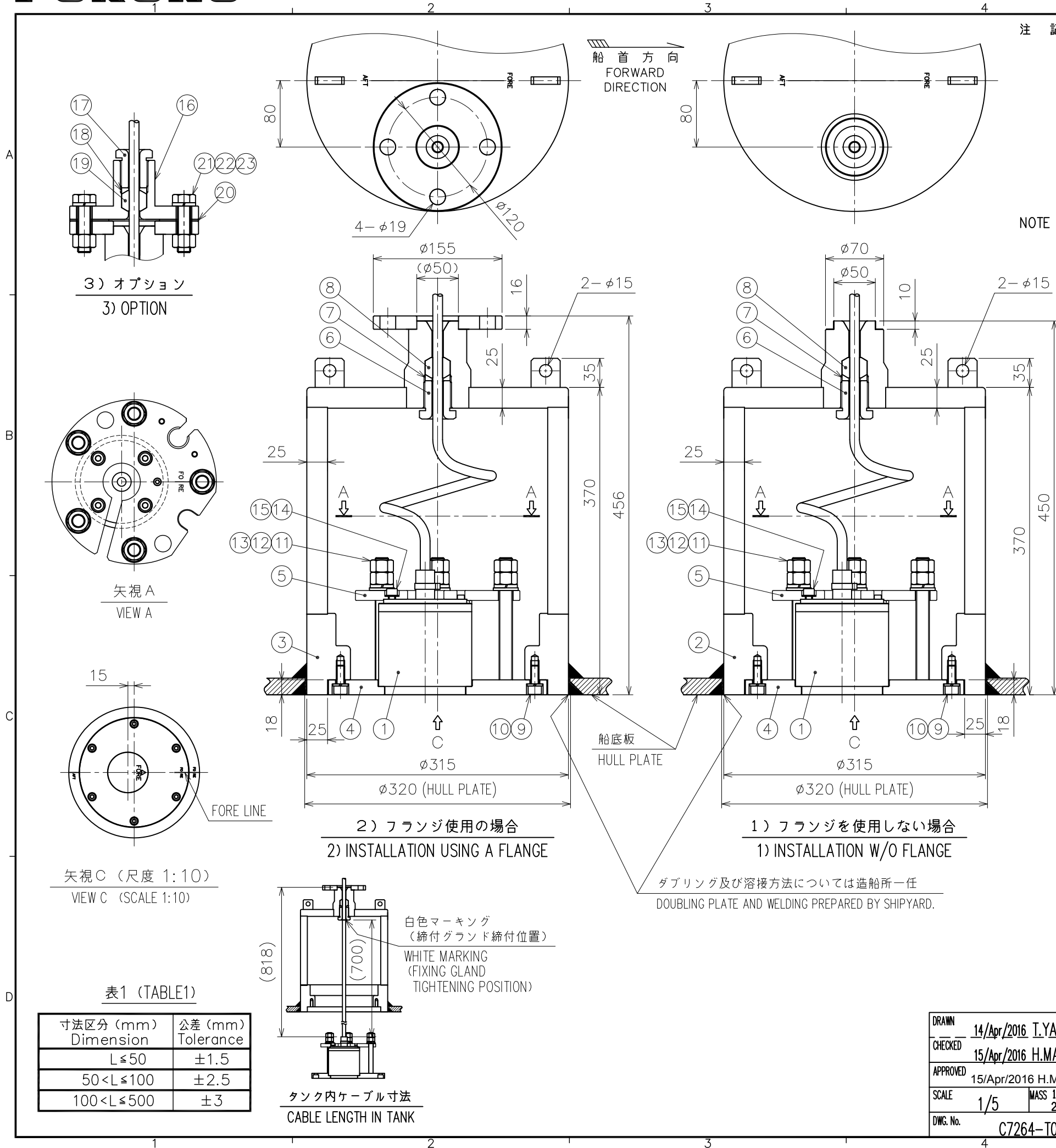
注記

1) 指定なき寸法公差は表1による。

NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.

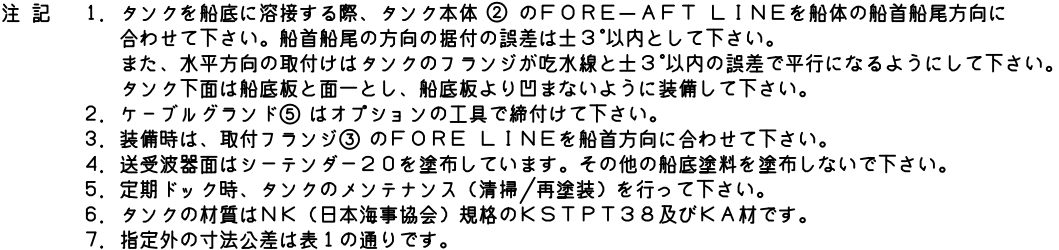
DRAWN 29/Mar/2011 T.YAMASAKI		TITLE DS-631
CHECKED 29/Mar/2011 H.MAKI		名称 送受波器
APPROVED 29/Mar/2011 Y.NISHIYAMA	DS-60	外寸図
SCALE 1/2	MASS 表2参照 SEE TABLE 2	NAME TRANSDUCER
DWG. No. C7264-G08-B	REF. No. 66-027-610G-1	OUTLINE DRAWING



- 注記
1. タンクを船底に溶接する際、タンク本体 ②③ のFORE-AFT LINEを船体の船首船尾方向に合わせて下さい。船首船尾の方向の据付の誤差は±3°以内として下さい。
また、水平方向の取付けはタンクのフランジが吃水線と±3°以内の誤差で平行になるようにして下さい。
タンク下面は船底板と面一とし、船底板より凹まないように装備して下さい。
 2. タンク溶接の際は、歪防止のため送受波器を外した状態の取付フランジ④を取付けて溶接して下さい。
 3. ケーブルグランド⑥はオプションの工具で締付けて下さい。
 4. 装備時は、取付フランジ④のFORE LINEを船首方向に合わせて下さい。
 5. 送受波器面はシーテnder-20 (ブラウン) を塗布しています。その他の船底塗料を塗布しないで下さい。
 6. 定期ドック時、タンクのメンテナンス (清掃/再塗装) を行って下さい。
 7. 船底タンクの材質はNK (日本海事協会) 規格のKSTPG370及びKA材です。
 8. 指定外の寸法公差は表1の通りです。
 9. 送受波器面のボルト周りの空間や隙間はシーラ剤で埋めてください。
- NOTE
1. ORIENT FORE-AFT LINE OF THE CASING ②③ IN PARALLEL WITH SHIP'S FORE-AFT LINE AND THE TOP OF THE CASING IN PARALLEL WITH WATER-LINE TO AN ACCURACY OF 3 DEGREE OR BETTER. THE TRANSDUCER TANK SHOULD BE WELDED FLUSH WITH SHIP'S HULL PLATE.
 2. TO AVOID DISTORTION BY HEAT, PUT FIXING FLANGE ④ WITHOUT TRANSDUCER ONTO CASING WHILE WELDING.
 3. CABLE GLAND ⑥ CAN BE TIGHTENED WITH THE OPTIONAL TOOL.
 4. ORIENT FORE LINE OF FIXING FLANGE ④ TOWARD FORE DIRECTION TO INSTALL.
 5. THE TRANSDUCER FACE IS COATED WITH SEATENDER20, DO NOT APPLY OTHER TYPE OF PAINT.
 6. CLEAN, RE-PAINT THE TANK AT DOCKING.
 7. MATERIAL OF TANK MEETS NK (NIPPON KAIJI KYOUKAI) STANDARD KSTPG370&KA.
 8. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
 9. FILL THE SPACES AROUND BOLT HEAD AND THE GAP ON TRANSDUCER FACE WITH SILICONE SEALANT.

23	六角ナット HEX. NUT	SUS316L	(4)	M16	オプション OPTION
22	バネ座金 SPRING WASHER	SUS316L	(4)	M16	オプション OPTION
21	六角ボルト HEX. BOLT	SUS316L	(4)	M16X60	オプション OPTION
20	シートガスケット SHEET GASKET	NON-ASBESTOS JOINT SHEET	(1)	10K-50A	オプション OPTION
19	ガスケット GASKET	CR	(1)	66-027-7007	オプション OPTION
18	座金 WASHER	SUS316L	(1)	66-027-7006	オプション OPTION
17	締付グランド FIXING GLAND	SUS316L	(1)	66-027-7005	オプション OPTION
16	フランジ ZINC RICH PRIMER	SS400	(1)	66-027-7011	オプション
15	シーラワッシャー SEAL WASHER	SUS304	4	W8	
14	六角穴付ボルト HEX.S.H.C.BOLT	SUS316L	4	M8X12	
13	平座金 FLAT WASHER	SUS316L	5	M16	
12	バネ座金 SPRING WASHER	SUS316L	5	M16	
11	六角ナット HEX. NUT	SUS316L	10	M16	
10	バネ座金 SPRING WASHER	SUS316L	6	M10	
9	六角穴付ボルト HEX.S.H.C.BOLT	SUS316L	6	M10X25	
8	ガスケット GASKET	CR	1	66-027-7007	
7	座金 WASHER	SUS316L	1	66-027-7006	
6	締付グランド FIXING GLAND	SUS316L	1	66-027-7005	
5	押え板 FIXING PLATE ZINC RICH PRIMER/BANNOH500	SS400	1	66-027-7004	
4	取付フランジ FIXING FLANGE ZINC RICH PRIMER/BANNOH500	SS400	1	66-027-7003	
3	フランジ付きタンク本体 CASING WITH FRANGE ZINC RICH PRIMER	KA/KSTPG370	1	66-027-7002	船級認定材 CLASSIFICATION SOCIETY APPROVED MATERIAL
2	タンク本体 CASING ZINC RICH PRIMER	KA/KSTPG370	1	66-027-7001	船級認定材 CLASSIFICATION SOCIETY APPROVED MATERIAL
1	送受波器 TRANSDUCER		1	DS-630	
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.No.	摘要 REMARKS

DRAWN	14/Apr/2016 T.YAMASAKI		TITLE	DS-660	
CHECKED	15/Apr/2016 H.MAKI		名称	船底タンク（水中コネクタなし）	
APPROVED	15/Apr/2016 H.MAKI			送受波器装備図	
SCALE	1/5	MASS 1) 96 ±10% 2) 100 kg	質量は、送受波器とオプションを除く MASS W/O TRANSDUCER AND OPTION	NAME	TRANSDUCER TANK (W/O WATERTIGHT CONNECTOR)
DWG. No.	C7264-T02-G		REF. No.	66-027-710G-6	TRANSDUCER INSTALLATION

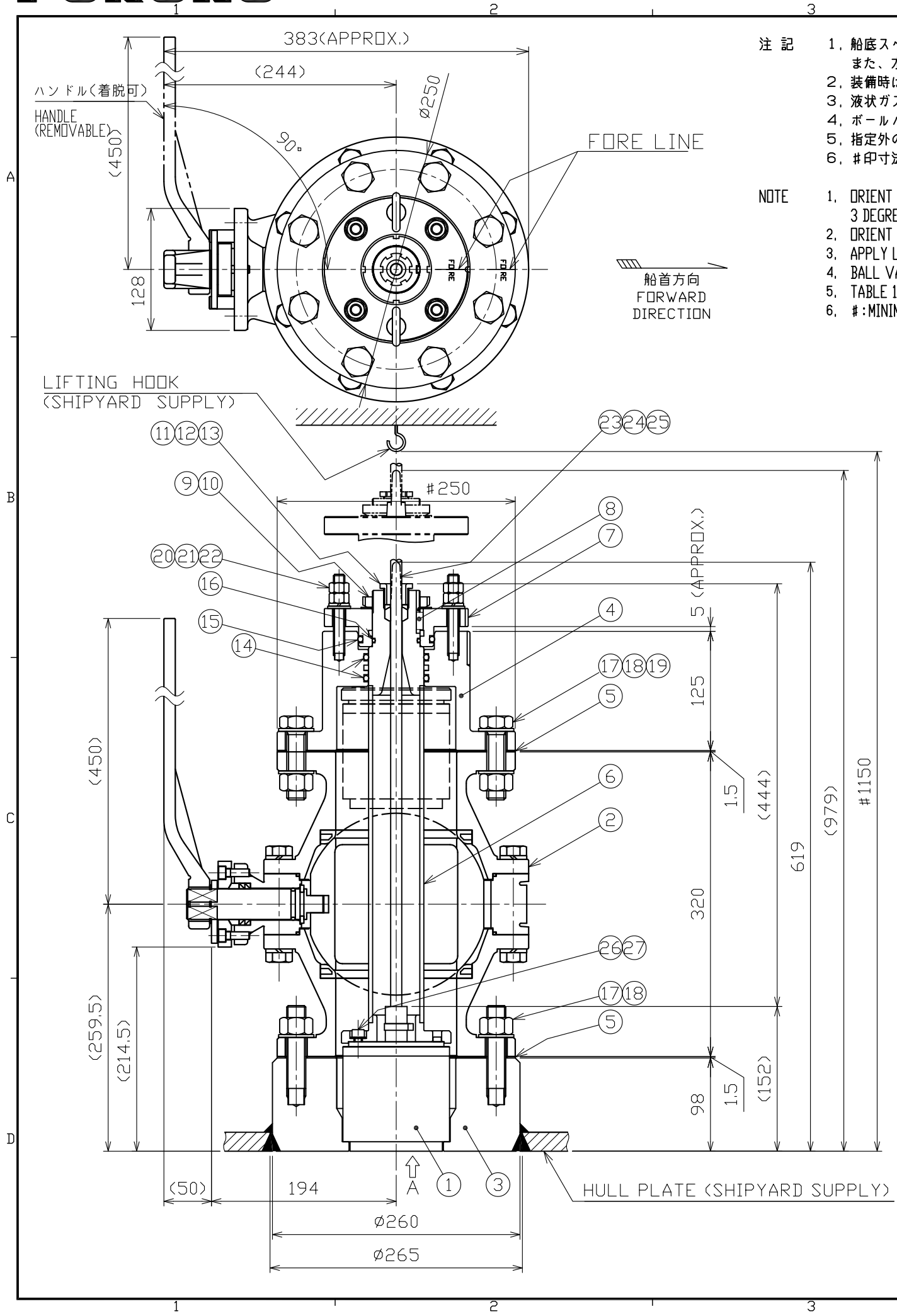


NOTE

1. ORIENT FORE-AFT LINE OF THE CASING ② IN PARALLEL WITH SHIP'S FORE-AFT LINE AND THE TOP OF THE CASING IN PARALLEL WITH WATER-LINE. ALIGNMENTS TO AN ACCURACY OF 3 DEGREE OR BETTER. THE TRANSDUCER TANK MUST BE WELDED FLUSH WITH SHIP'S HULL PLATE.
2. CABLE GLAND ⑤ CAN BE TIGHTENED WITH THE OPTIONAL TOOL.
3. ORIENT FORE LINE OF FIXING FLANGE ③ TOWARD FORE DIRECTION TO INSTALL.
4. THE TRANSDUCER FACE IS COATED WITH SEATENDER20. DO NOT APPLY OTHER TYPE OF PAINT.
5. CLEAN, RE-PAINT THE TANK AT DOCKING.
6. MATERIAL OF TANK MEETS NK (NIPPON KAIJI KYOKAI) STANDARD KSTPT38&KA.
7. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.

21	バネ座金 SPRING WASHER	SUS316L	2	M6	DS-631 装備時のみ DS-631 ONLY
20	六角穴付ボルト HEX.S.H.C.BOLT	SUS316L	2	M6X20	DS-631 装備時のみ DS-631 ONLY
19	コネクタ固定金具 CONNECTOR FIXING PLATE	SUS316L	1	66-027-6019	DS-631 装備時のみ DS-631 ONLY
18	バネ座金 SPRING WASHER	SUS316L	2	M6	DS-631 装備時のみ DS-631 ONLY
17	六角穴付ボルト HEX.S.H.C.BOLT	SUS316L	2	M6X12	DS-631 装備時のみ DS-631 ONLY
16	ケーブル押え板 CABLE FIXING PLATE	SUS316L	1	66-027-6022	DS-631 装備時のみ DS-631 ONLY
15	グロメット GROMMET	CR	1	66-027-6021	DS-631 装備時のみ DS-631 ONLY
14	シールワッシャー SEAL WASHER	SUS304	4	W8	
13	六角穴付ボルト HEX.S.H.C.BOLT	SUS316L	4	M8X12	
12	平座金 FLAT WASHER	SUS316L	5	M16	
11	バネ座金 SPRING WASHER	SUS316L	5	M16	
10	六角ナット HEX. NUT	SUS316L	10	M16	
9	バネ座金 SPRING WASHER	SUS316L	6	M10	
8	六角穴付ボルト HEX.S.H.C.BOLT	SUS316L	6	M10X25	
7	ガスケット GASKET	CR	1	66-027-7007	
6	座金 WASHER	SUS316L	1	66-027-7006	
5	締付グランド FIXING GLAND	SUS316L	1	66-027-7005	
4	押え板 FIXING PLATE ZINC RICH PRIMER/BANNOH500	SS400	1	66-027-7004	
3	取付フランジ FIXING FLANGE ZINC RICH PRIMER/BANNOH500	SS400	1	66-027-7003	
2	タンク本体 CASING ZINC RICH PRIMER	KA/KSTPT38	1	66-027-7301	船級認定材 CLASSIFICATION SOCIETY APPROVED MATERIAL
1	送受波器 TRANSDUCER		1	DS-630/631	
品番 ITEM	品 名 NAME	材 質 MATERIAL	数量 Q.TY	図 番 DWG.NO.	摘 要 REMARKS

DRAWN	3/Dec/2018	T.YAMASAKI		TITLE	DS-660
CHECKED	3/Dec/2018	H.MAKI		名称	船底タンク（スリーブ付）
APPROVED	4/Dec/2018	H.MAKI	DS-60		送受波器装備図
SCALE	1/5	MASS 100 ±10% kg	質量は、送受波器とオプションを除く MASS W/O TRANSDUCER AND OPTION	NAME	TRANSDUCER TANK (W/ SLEEVE)
DWG. No.	C7264-T04- D		REF. No.	66-027-730G-3	
			TRANSDUCER INSTALLATION		

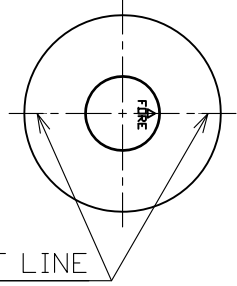


- 注 記
1. 船底スーサ ③ を船底に溶接する際、FORE-AFT LINEを船体の船首船尾方向に合わせて下さい。船首船尾の方向の据付の誤差は±3°以内として下さい。
また、水平方向の取付けは吃水線と±3°以内の誤差で平行になるようにして下さい。船底スーサー下面は船底板と面一とし、船底板より凹まないように装備して下さい。
 2. 装備時は、船底スーサ ③、上蓋 ④ およびフランジ ⑦ のFORE LINEを船首方向に合わせて下さい。
 3. 液状ガスケットTB1121を船底スーサ ③、上蓋 ④ のシール面、ガスケット ⑤ の両面、ボールバルブ ② のフランジ面に塗布して下さい。
 4. ボールバルブ ② は45°ピッチで任意の方向に取付け可能です。
 5. 指定外の寸法公差は表1の通りです。
 6. #印寸法は最小サービス空間寸法とする。

- NOTE
1. ORIENT FORE-AFT LINE OF THE SPACER③ IN PARALLEL WITH SHIP'S FORE-AFT LINE AND THE TOP OF THE SPACER IN PARALLEL WITH WATER-LINE TO AN ACCURACY OF 3 DEGREE OR BETTER. THE SPACER SHOULD BE WELDED FLUSH WITH SHIP'S HULL PLATE.
 2. ORIENT FORE LINES OF SPACER ③AND UPPER COVER④AND FLANGE⑦ TOWARD FORE DIRECTION TO INSTALL.
 3. APPLY LIQUID GASKETS TB1121 TO SEAL FACE OF SPACER③AND UPPER COVER④ AND TO BOTH FACES OF GASKET⑤ AND FLANGE OF BALL VALVE②.
 4. BALL VALVE② CAN BE ATTACHED IN ANY DIRECTION IN INCREMENT OF 45°.
 5. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
 6. #: MINIMUM SERVICE CLEARANCE.

表1 (TABLE1)

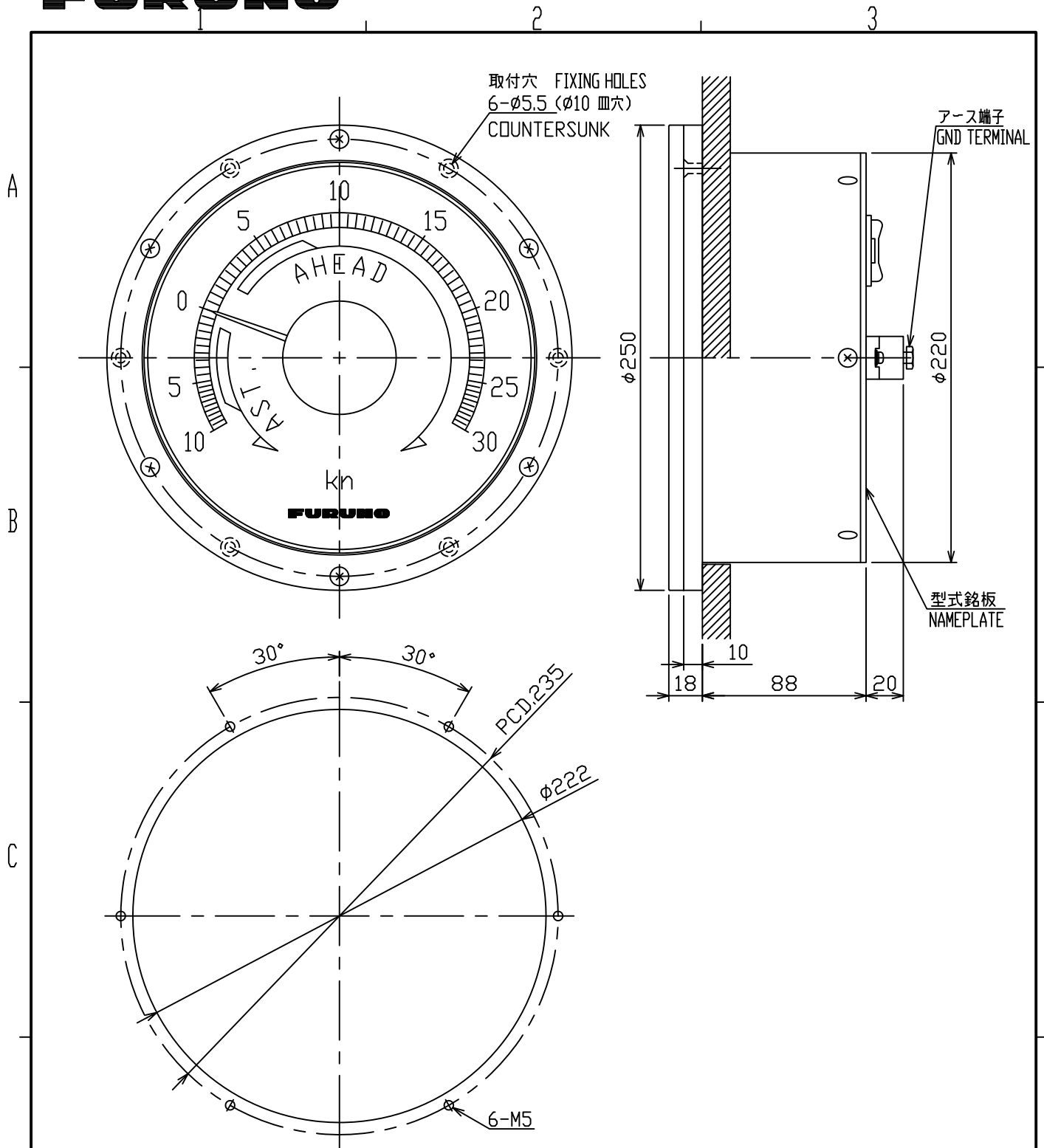
寸法区分 (mm) Dimension	公差 (mm) Tolerance
L ≤ 50	±1.5
50 < L ≤ 100	±2.5
100 < L ≤ 500	±3
500 < L ≤ 1000	±4



矢視 A (尺度: 1/10)
VIEW A (SCALE: 1/10)

27	シールワッシャー SEAL WASHER	SUS304	4	M8	送受波器付属品 TRANSDUCER ACCESSORY
26	六角穴付ボルト HEX.S.H.C.BOLT	SUS316L	4	M8X12	送受波器付属品 TRANSDUCER ACCESSORY
25	アイナット EYE NUT	SUS304	2	M10	
24	バネ座金 SPRING WASHER	SUS316L	2	M10	
23	六角穴付ボルト HEX.S.H.C.BOLT	SUS316L	2	M10X25	
22	平座金 FLAT WASHER	SUS316L	4	M12	
21	バネ座金 SPRING WASHER	SUS316L	4	M12	
20	六角ナット HEX. NUT	SUS316L	8	M12	
19	六角ボルト HEX. BOLT	SUS316L	8	M20X75	
18	平座金 FLAT WASHER	SUS316L	24	M20	
17	六角ナット HEX. NUT	SUS316L	16	M20	
16	Oリング O-RING	NBR	1	JIS B 2401 P44	
15	Oリング O-RING	NBR	1	JIS B 2401 P70	
14	Oリング O-RING	NBR	2	JIS B 2401 P58	
13	ガスケット GASKET	CR	1	66-027-7207	
12	座金 WASHER	SUS316L	1	66-027-7206	
11	締付グラウンド FIXING GLAND	C3604B	1	JIS F 8801 20 1a	
10	座金 WASHER	SPCC	1	AW10	
9	ナット NUT	SS400	1	AN10	
8	キー TURNING STOPPER	SUS304	1	JIS B 1301 P-B 8X7X18	
7	フランジ ZINC RICH PRIMER	SS400	1	66-027-7205	
6	シャフトBV SHAFT BV	SUS316L	1	66-027-7403	
5	シートガスケット SHEET GASKET	NON-ASBESTOS JOINT SHEET	2	66-027-7203	
4	上蓋 UPPER COVER ZINC RICH PRIMER	SS400	1	66-027-7402	
3	船底スーサ SPACER ZINC RICH PRIMER	KA	1	66-027-7201	船級認定材 CLASSIFICATION SOCIETY APPROVED MATERIAL
2	ボールバルブ BALL VALVE ZINC RICH PRIMER	FCD-S	1	66-027-7401 (JIS 10K-125A)	船級認定品 CLASSIFICATION SOCIETY APPROVED
1	送受波器 TRANSDUCER		1	DS-630	質量に含まず NOT INCLUDED IN MASS
品番 ITEM	品 名 NAME	材 質 MATERIAL	数量 QTY	図 番 DWG. NO.	摘 要 REMARKS

DRAWN	11/Nov/2021 T.YAMASAKI	TITLE	DS-662
CHECKED	11/Nov/2021 H.MAKI	名称	ボールバルブ
APPROVED	22/Feb/2022 H.MAKI	送受波器装備図	
SCALE	1/5 MASS 112 ±10% kg	NAME	BALL VALVE
DWG No.	C7264-T05-A	REF. No.	66-027-740G-0
			TRANSUCER INSTALLATION



注記

- 1) 指定なき寸法公差は表 1 による。
- 2) 取付には M5 皿ネジを使用のこと。

NOTE

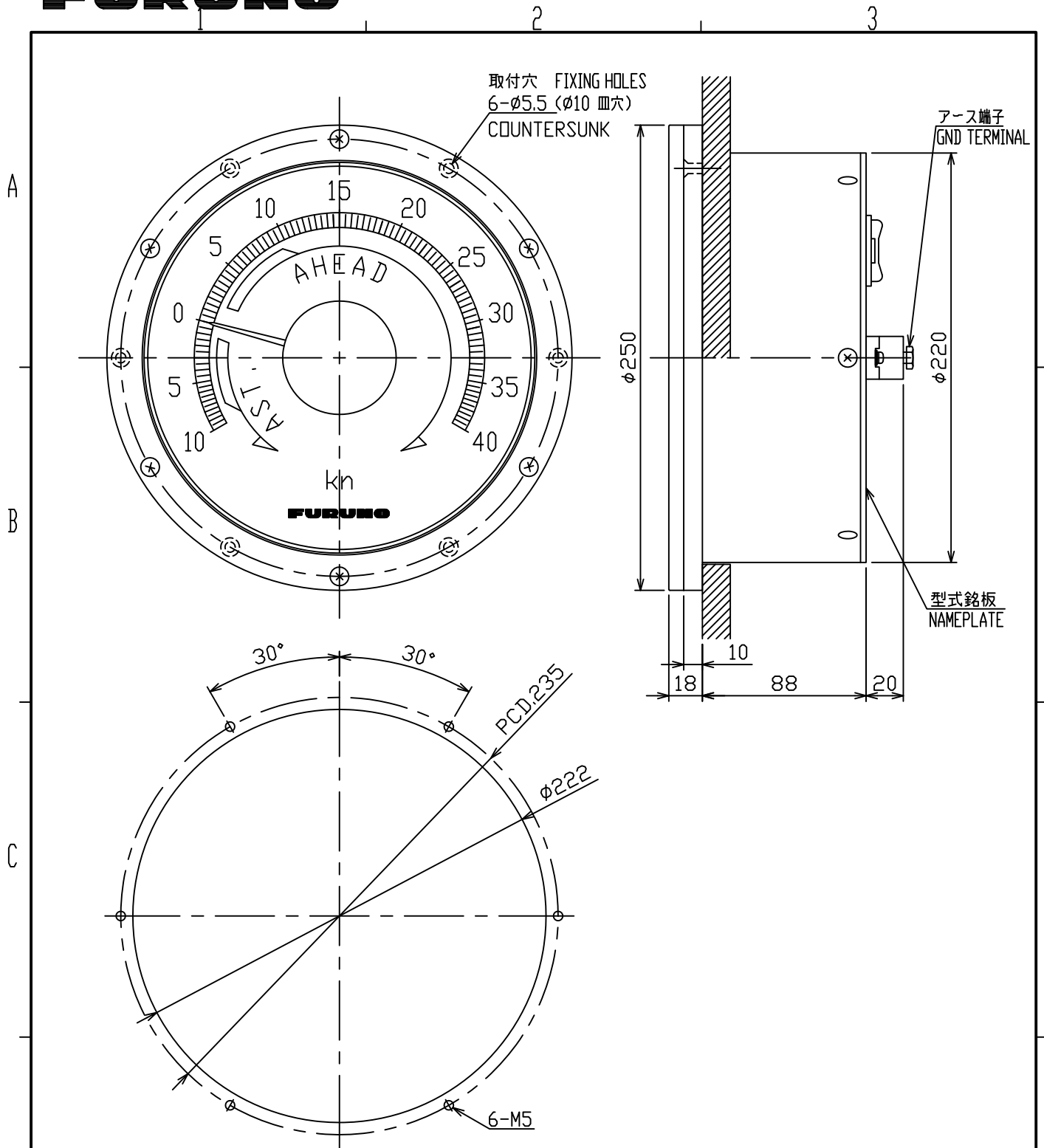
1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. USE COUNTERSUNK SCREWS M5 FOR FIXING THE UNIT.

取付穴寸法 CUTOUT DIMENSIONS

表 1 TABLE 1

寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
$0 < L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3

DRAWN 28/Oct/2011 T.YAMASAKI		TITLE FL-200S-1
CHECKED 28/Oct/2011 H.MAKI		名称 アナログ指示器 (埋込装備)
APPROVED 1/Nov/2011 Y.NISHIYAMA	DS-30/50/60/80	外寸図
SCALE 1/3	MASS 3.6 $\pm 10\%$ kg	NAME ANALOG INDICATOR (FLUSH MOUNT)
DWG. No. C7236-G28- B	REF. No. XG05-08009-01	OUTLINE DRAWING



注記

- 1) 指定なき寸法公差は表 1 による。
- 2) 取付には M5 皿ネジを使用のこと。

NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. USE COUNTERSUNK SCREWS M5 FOR FIXING THE UNIT.

取付穴寸法 CUTOUT DIMENSIONS

表 1 TABLE 1

寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
$0 < L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3

DRAWN	28/Oct/2011 T.YAMASAKI	TITLE	FL-200S-2
CHECKED	28/Oct/2011 H.MAKI	名称	アナログ指示器 (埋込装備)
APPROVED	1/Nov/2011 Y.NISHIYAMA	外寸図	
SCALE	1/3	NAME	ANALOG INDICATOR (FLUSH MOUNT)
DWG. No.	C7236-G30-B	REF. No.	XG05-08025-01
			OUTLINE DRAWING

FURUNO

2

3

表1 TABLE 1

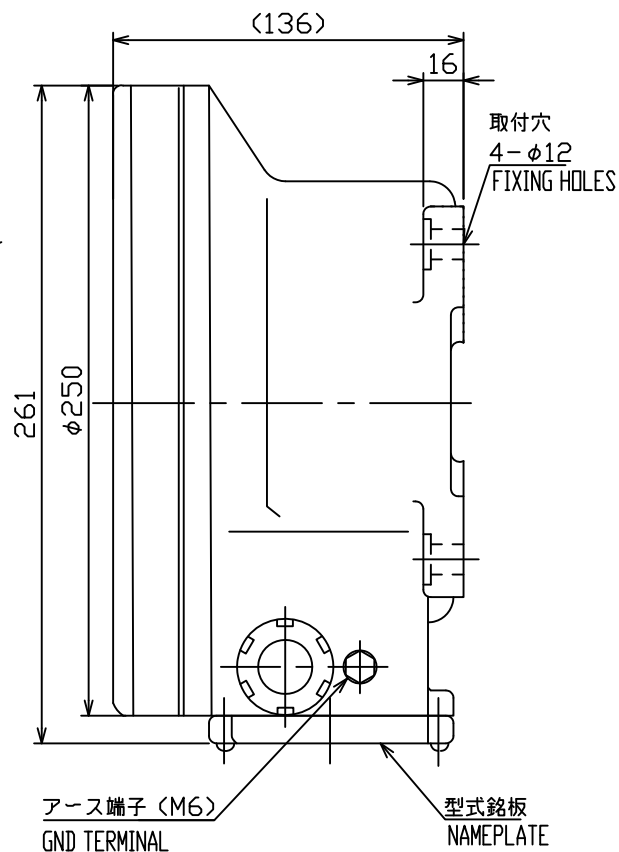
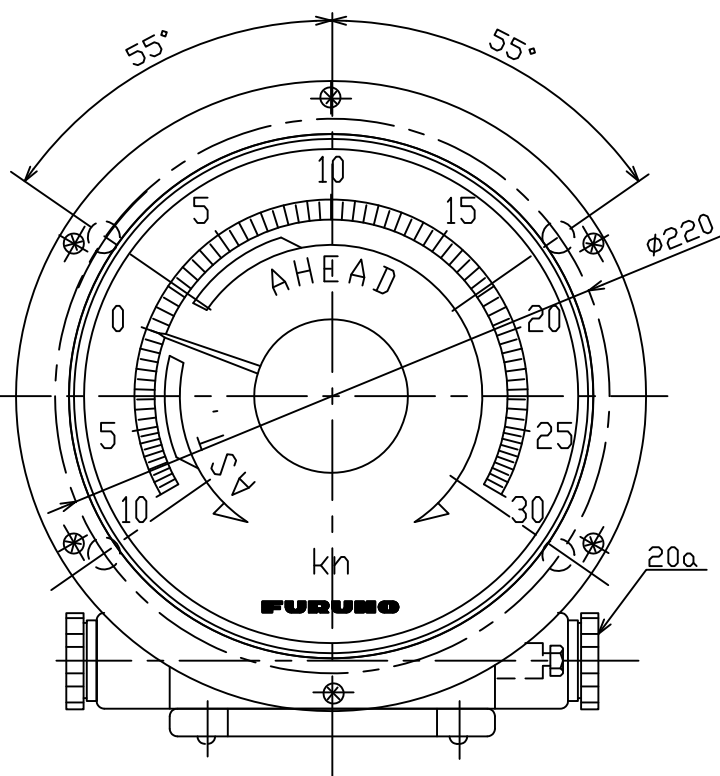
寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
$0 < L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3

A

B

C

D



注記

- 1) 指定なき寸法公差は表1による。
2) 取付にはM10ボルトを使用のこと。

NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. USE M10 BOLTS FOR FIXING THE UNIT.

DRAWN	28/Oct/2011 T.YAMASAKI		TITLE	SL-200-1
CHECKED	28/Oct/2011 H.MAKI		名称	アナログ指示器 (壁掛装備)
APPROVED	1/Nov/2011 Y.NISHIYAMA	DS-30/50/60/80		外寸図
SCALE	1/3	MASS 5.8 ±10% kg	NAME	ANALOG INDICATOR (BULKHEAD MOUNT)
DWG. No.	C7236-G29- B	REF. No.	XG05-08010-01	OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

表1 TABLE 1

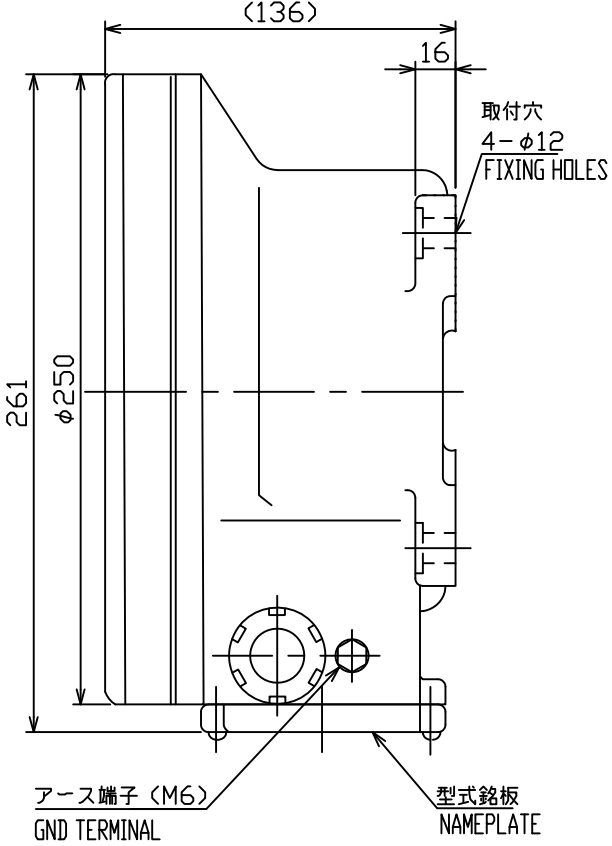
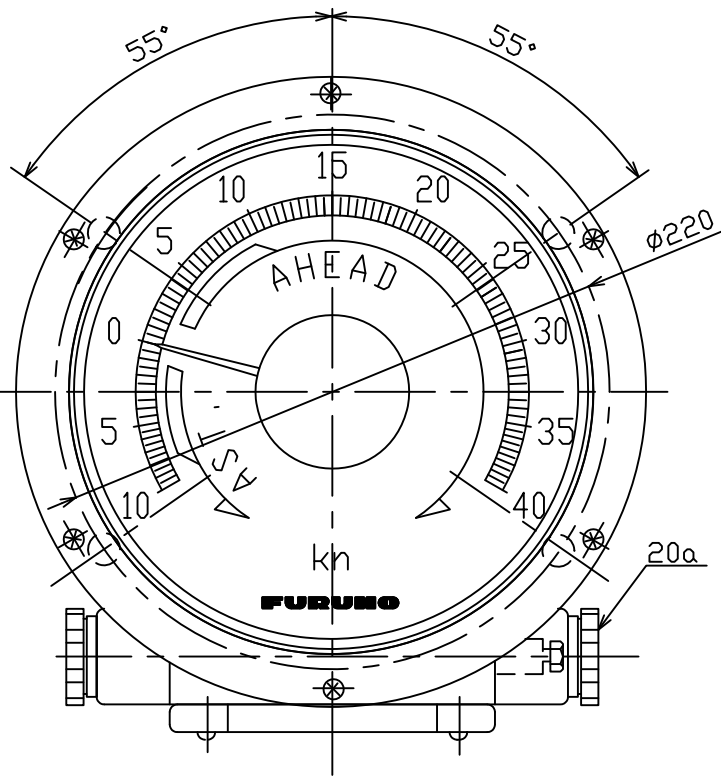
寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
$0 < L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3

A

B

C

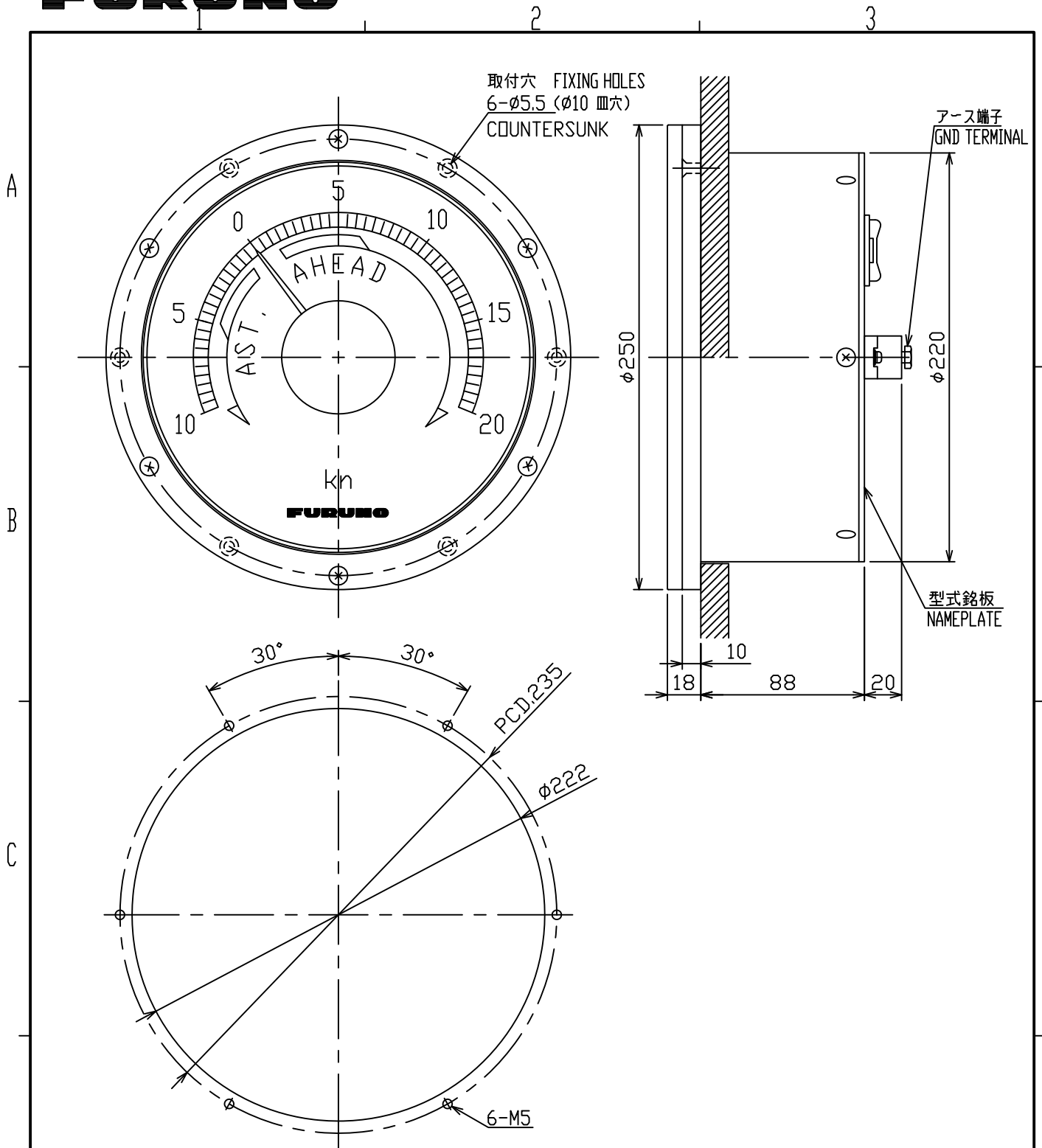
D



注記
1) 指定なき寸法公差は表1による。
2) 取付にはM10ボルトを使用のこと。

NOTE
1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. USE M10 BOLTS FOR FIXING THE UNIT.

DRAWN 28/Oct/2011 T.YAMASAKI		TITLE SL-200-2
CHECKED 28/Oct/2011 H.MAKI		名称 アナログ指示器（壁掛装備）
APPROVED 1/Nov/2011 Y.NISHIYAMA	DS-30/50/60/80	外寸図
SCALE 1/3	MASS 5.8 ±10% kg	NAME ANALOG INDICATOR (BULKHEAD MOUNT)
DWG. No. C7236-G31- B	REF. No. XG05-08026-01	OUTLINE DRAWING



注記

- 1) 指定なき寸法公差は表 1 による。
- 2) 取付には M5 皿ネジを使用のこと。

NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. USE COUNTERSUNK SCREWS M5 FOR FIXING THE UNIT.

取付穴寸法 CUTOUT DIMENSIONS

表 1 TABLE 1

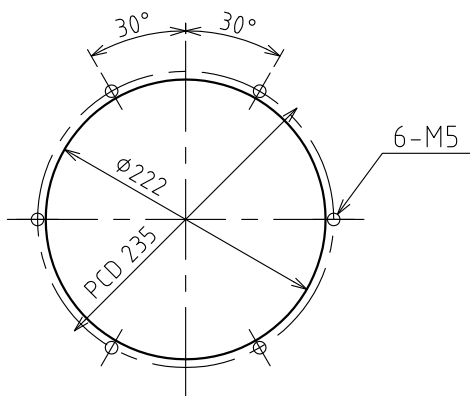
寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
$0 < L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3

DRAWN	28/Oct/2011 I.YAMASAKI	TITLE	FL-200S-3
CHECKED	28/Oct/2011 H.MAKI	名称	アナログ指示器 (埋込装備)
APPROVED	1/Nov/2011 Y.NISHIYAMA	外寸図	
SCALE	1/3	NAME	ANALOG INDICATOR (FLUSH MOUNT)
DWG. No.	C7236-G32- B	REF. No.	XG05-09007-01
			OUTLINE DRAWING

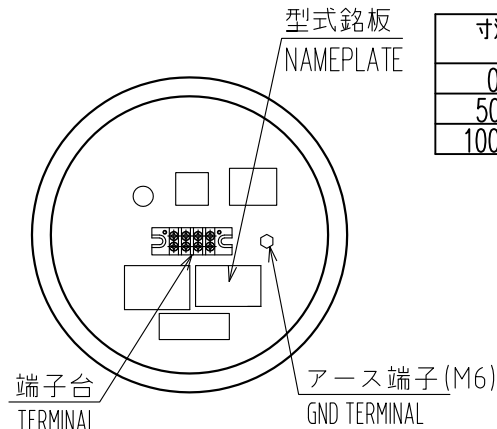
表1 TABLE 1

寸法区分 (mm) DIMENSION	公差 (mm) TOLERANCE
$0 < L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3

A



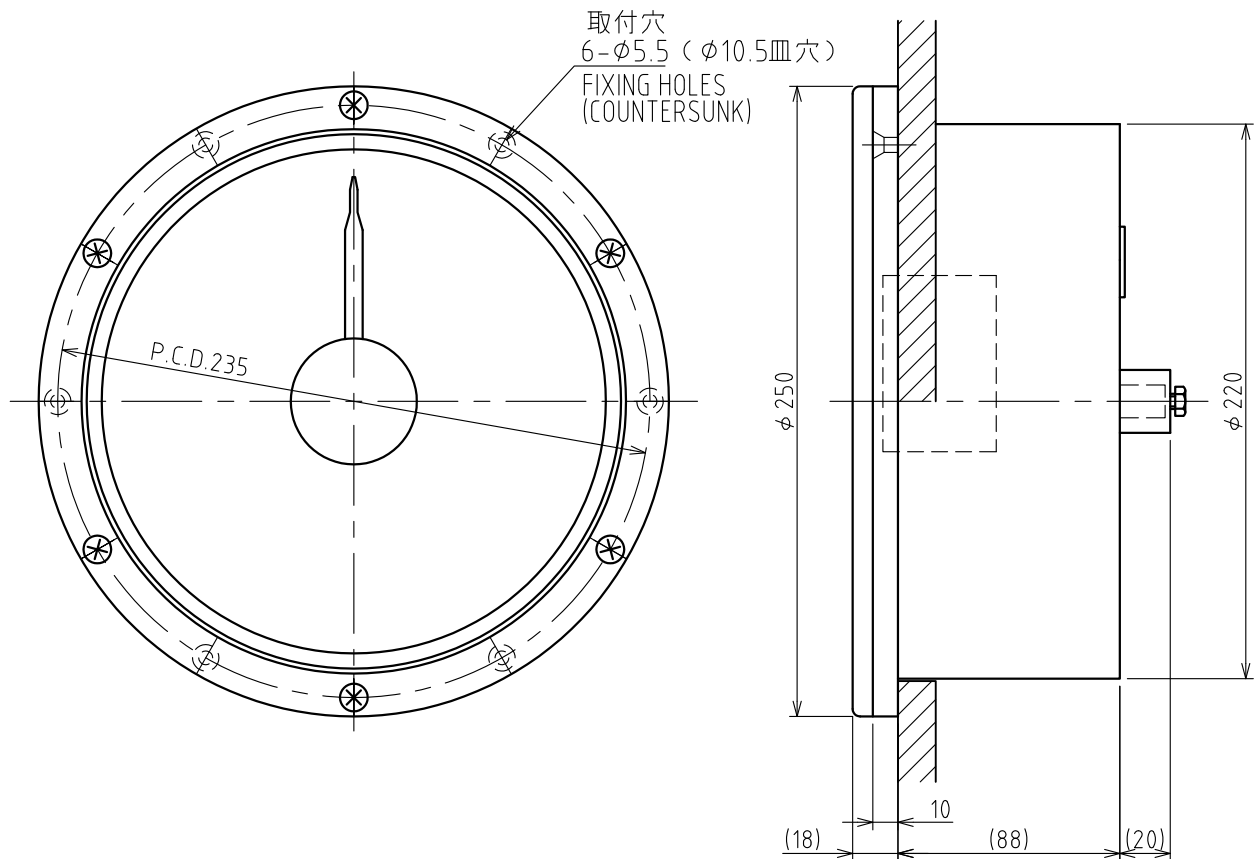
取付穴寸法 (尺度: 1/6)
CUTOUT DIMENSIONS (SCALE: 1/6)



背面 (尺度: 1/6)
REAR VIEW (SCALE: 1/6)

B

C



注記

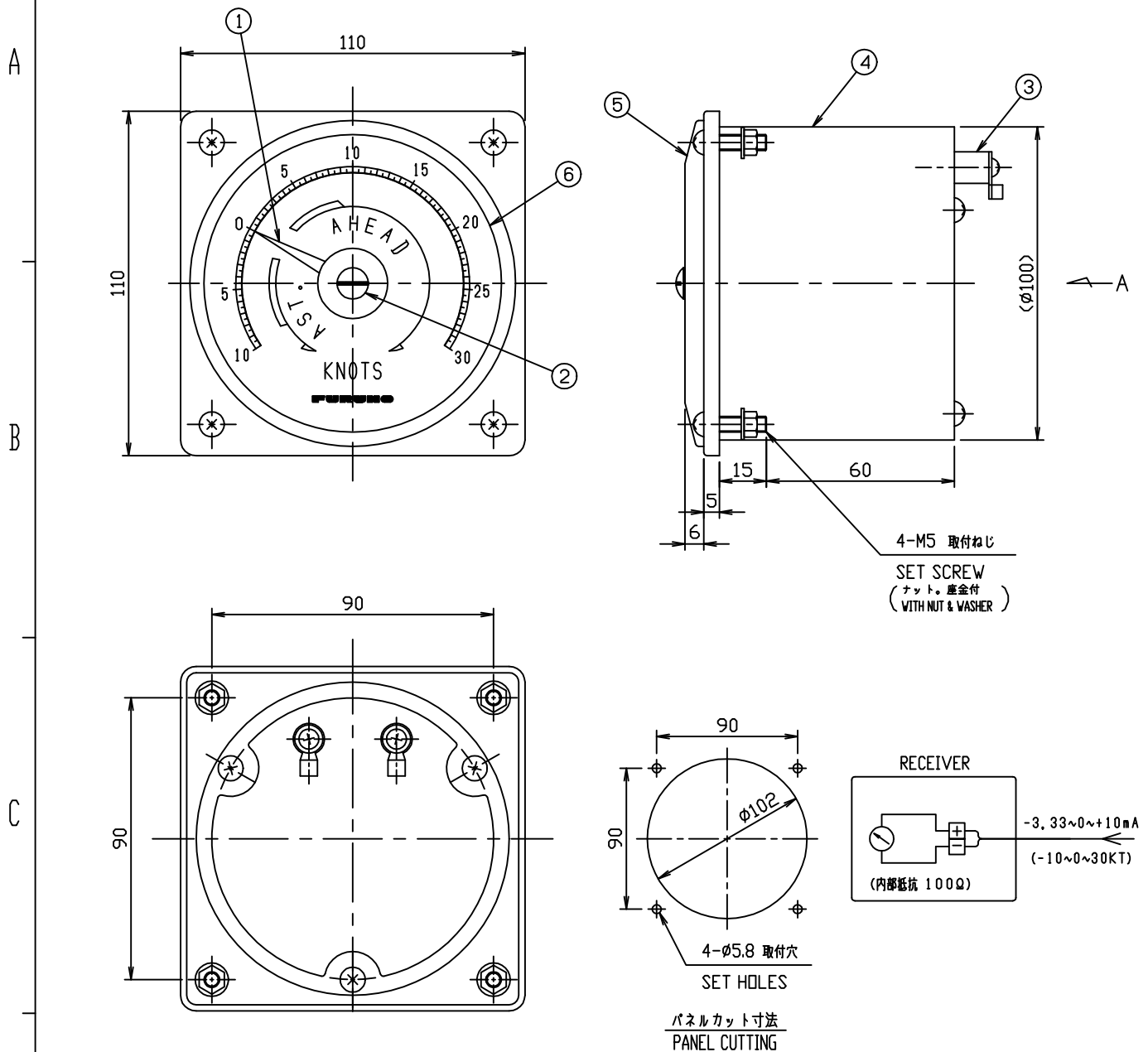
- 1) 指定なき寸法公差は表1による。
- 2) 取付には皿ネジφ5を使用のこと。

NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. USE CONTERSUNK SCREWS $\phi 5$ FOR FIXING THE UNIT.

D

DRAWN	16/Dec/2016 T.YAMASAKI		TITLE	FL-200S-1W
CHECKED	16/Dec/2016 H.MAKI		名称	アナログ指示器 (埋込装備)
APPROVED	22/Dec/2016 H.MAKI			外寸図
SCALE	1/3	MASS 3.6 $\pm 10\%$ kg	NAME	ANALOG INDICATOR (FLUSH MOUNT)
DWG. No.	C7247-G19- A	REF. No.	XG05-10011-01	OUTLINE DRAWING



A 矢視図
A VIEW

6	目盛板 DIAL PLATE		1		
5	フタ COVER	PLASTIC	1		
4	ケース本体 CASE		1		
3	端子盤 TERMINAL BOARD		2		
2	0°調整 ZERO ADJUSTER		1		
1	指針 POINTER		1		
品番 ITEM	品名 NAME	材質 MATERIAL	数量 QTY	図番 DWG. NO.	摘要 REMARKS

DRAWN
Jun. 27' 01 T. YAMASAKI

CHECKED
Jun. 27' 01 Y. KIMURA

APPROVED
Jun. 27' 01 Y. KIMURA

SCALE
1/2 MASS $\pm 10\%$
1.2 kg

DWG.No. C7213-G02-C

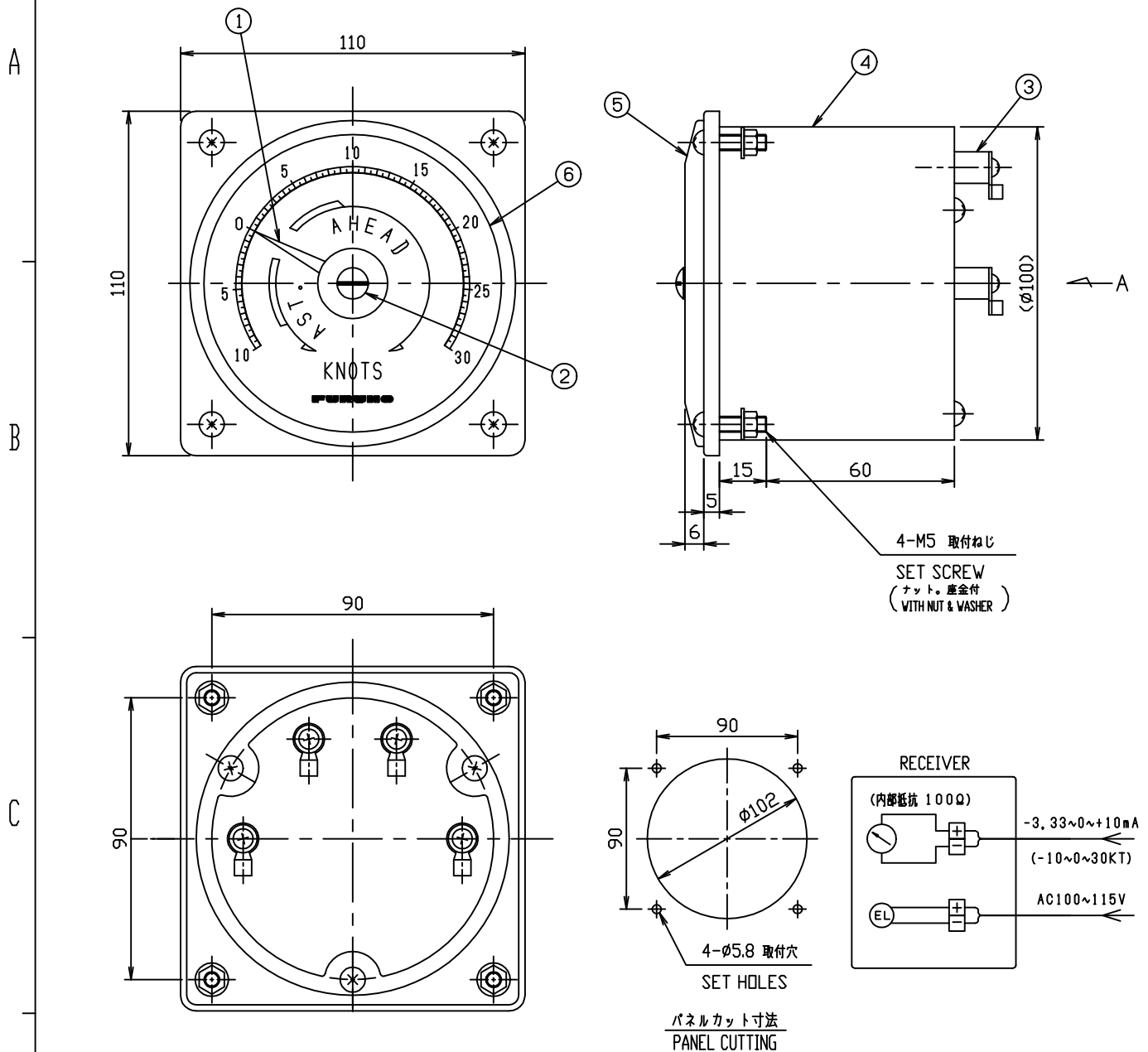
TITLE
FE-90

名称
アナログ指示器 (パネル埋込型)

外寸図

NAME
ANALOG DISPLAY (FLUSH MOUNT)

OUTLINE DRAWING



A 矢视图

A VIEW

6	目盛板 DIAL PLATE		1		
5	フタ COVER	PLASTIC	1		
4	ケース本体 CASE		1		
3	端子盤 TERMINAL BOARD		2		
2	“0”調整 ZERO ADJUSTER		1		
1	指針 POINTER		1		
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG. NO.	摘要 REMARKS

DRAWN
Jun. 27' 01 T. YAMASAKICHECKED
Jun. 27' 01 Y. KIMURAAPPROVED
Jun. 27' 01 Y. KIMURASCALE
1/2 MASS ±10%
1.4 kg

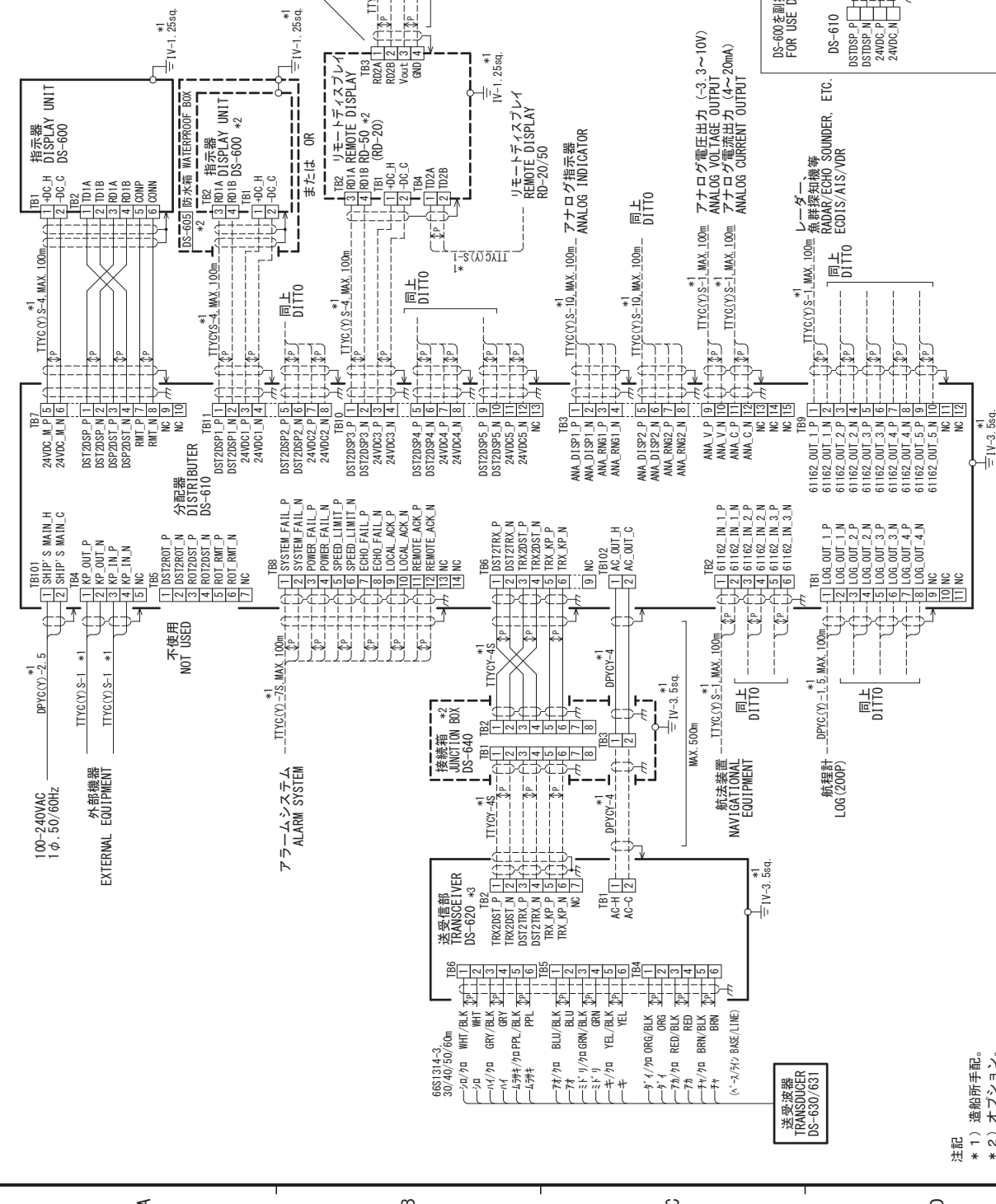
DWG.No. C7213-G03-B

TITLE
FL-90名称
アナログ指示器 (パネル埋込型)

外寸図

NAME
ANALOG DISPLAY (FLUSH MOUNT)

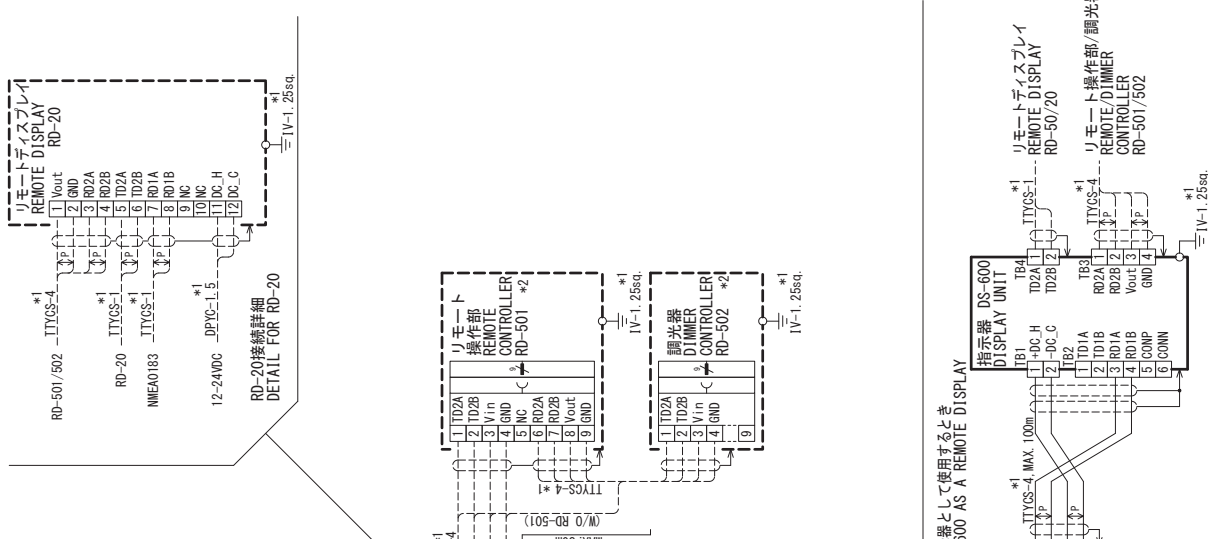
OUTLINE DRAWING





注記
 * 1) 造船所手配。
 * 2) オプション。
 * 3) 振動やジョックの少ないところに装備してください。バウスラスター（サイドスラスター）ルームなど振動の多い場所に装備する場合は、防振装置（造船所手配）を使用してください。

NOTE
 *1: SHIPYARD SUPPLY.
 *2: OPTION.
 *3: INSTALL THE UNIT IN A PLACE WHERE IS LITTLE VIBRATION OR SHOCK. WHEN INSTALLING WITH A LOT OF VIBRATION SUCH AS A BOW THRUSTER (SIDE THRUSTER) ROOM, USE A VIBRATION ISOLATION DEVICE (SHIPYARD SUPPLY).



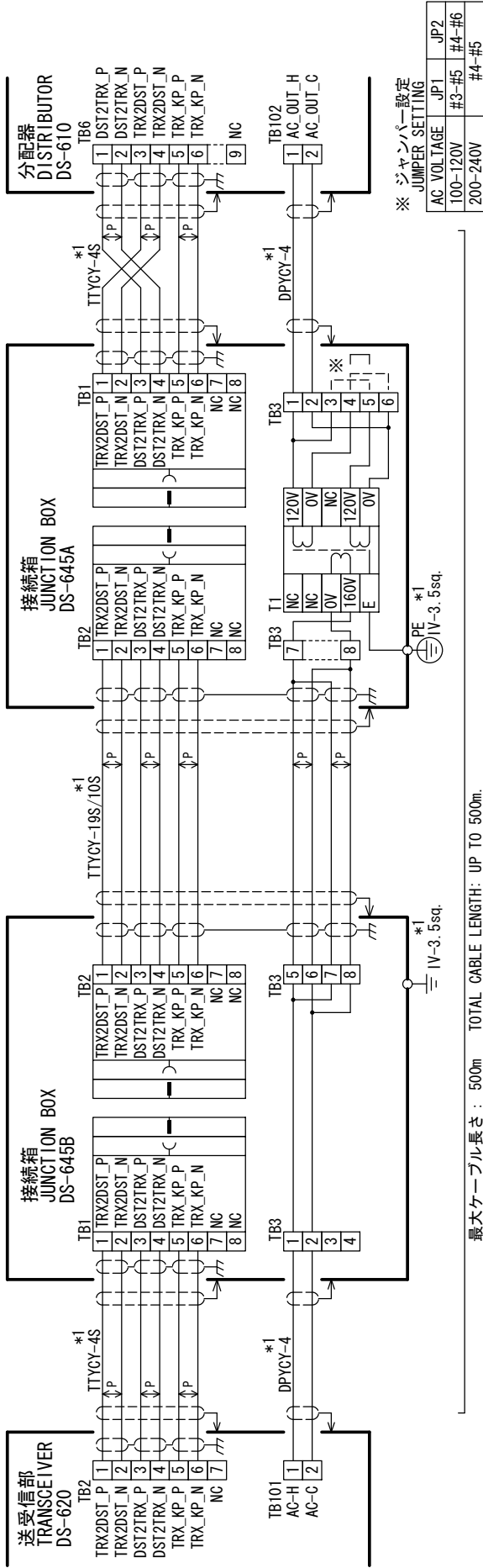
* 3) 振動やショックの少ないところに装備してください。バウスラスター（サイドスラスター）ルームなど振動の多い場所に装備する場合は、防振装置（造船所手配）を使用してください。

NOTE

*1: SHIPYARD SUPPLY.
 *2: OPTION.
 *3: INSTALL THE UNIT IN A PLACE WHERE IS LITTLE VIBRATION OR SHOCK. WHEN INSTALLING WITH A LOT OF VIBRATION SUCH AS A BOW THRUSTER ROOM, USE A VIBRATION ISOLATION DEVICE (SHIPYARD SUPPLY).

DRAWN	21/Jul/2022	I. YAMASAKI	TITLE	DS-60
CHECKED	21/Jul/2022	H. MAKI	名称	ドップラソナー
APPROVED	22/Jul/2022	H.WAKI		相互結線図
SCALE	MASS	kg	NAME	DOPPLER SONAR
DWG No.	C7264-C01- Q	REF. No.	66-031-0001-1	

INTERCONNECTION DIAGRAM



最大ケーブル長さ : 500m TOTAL CABLE LENGTH: UP TO 500m.

注記

* 1) 造船手配。

NOTE

*1: SHIPYARD SUPPLY.

DRAWN	19/Apr/2012 T. YAMASAKI	TITLE	DS-645A/B
CHECKED	19/Apr/2012 H. MAKI	名称	接続箱
APPROVED	27/Apr/2012 Y. NISHIYAMA	相互結線図	
SCALE	MASS kg	NAME	JUNCTION BOX
DWG. No.	C7264-C02- C	REF. No.	66-031-4501-0
		INTERCONNECTION DIAGRAM	