CHAPTER 12

INSTALLATION AND FITTING

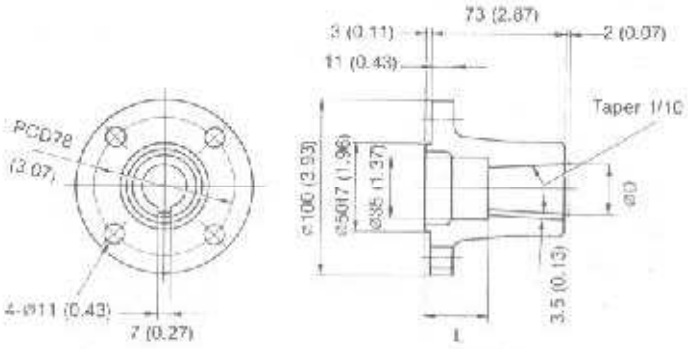
1. Propeller and Stern Arrangement

1-1 Propeller and shaft diameter

Model	Reduction ratio	Output (HP/rpm)	Propeller shaft (rpm)	Propeller, 3-blade	
				Dia.(in.)	Pitch(in.)
YSM8	1.95	5/2200	1127	14	9
		6/2600	1332	13	8-1/2
		7/3200	1639	12	7-1/2
YSM8G	2.93	5/2200	751	18	12
		6/2600	888	16-1/2	11
		7/3200	1093	15	10
YSM12	1.96	8/2200	1113	15	10
		9/2600	1316	14	9
		10/3000	1518	13	8-1/2
YSM12G	3.06	8/2200	718	19	15
		9/2600	849	18	13
		10/3000	980	17	12

1-2 Propeller shaft coupling

(1) Standard (for YSM8-Y, YSM12-Y)

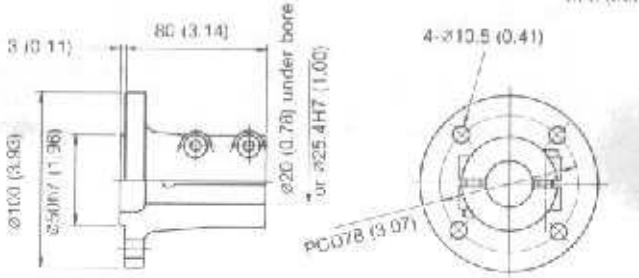


mm (in.)

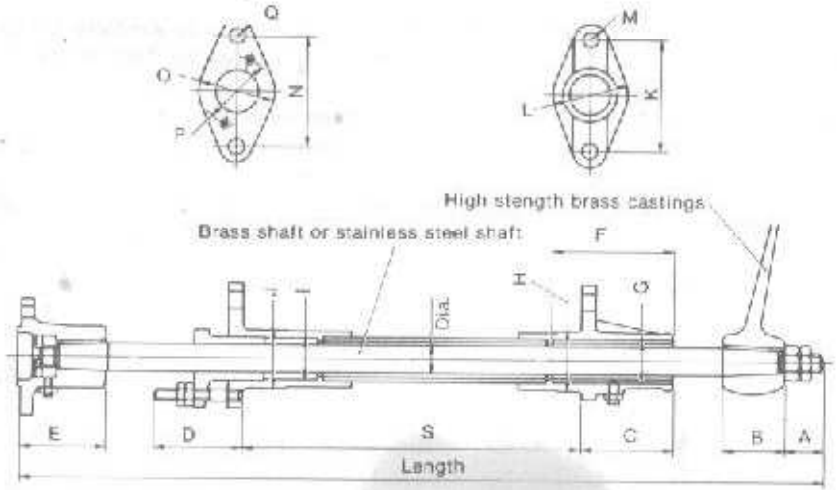
Model	YSM8	YSM8G	YSM12	YSM12G
⁰D	22(0.86)	25(0.98)	25(0.98)	28(1.10)
L	43(1.69)	34(1.33)	34(1.33)	34(1.33)

(2) Option (for all model)

mm (in.)



1-3 Propeller shaft and stem tube.



mm

MODEL	Dia.	Length	S (standard)	A	B	C	D	E	F	G	H	I	J	K	L	M·Q	N	O	P
YSM8	22	1800	400	32	52	65	57	54	88	35	46	35	46	90	60	2-14ø Holes, 1/2" Coach screw	90	60	54
YSM8G YSM12	25	2000	500	32	52	75	76	73	100	38	50	38	50	100	65	2-14ø Holes, 1/2" Coach screw	100	65	62
YSM12G	28	2400	600	40	60	80	75	73	110	41	56	41	56	110	75	2-18ø Holes, 5/8" Coach screw	110	75	70

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2. Engine Installation

2-1 Engine room

The overall layout of the engine room is planned for easy inspection, servicing and handling of the engine, front power take-off and auxiliary machinery.

Do not overlook the position and space of the fuel tank, battery and Kingston cock and their related piping, wiring and remote control cables in the engine room layout. Thoroughly study all the equipment and apparatuses to be installed, and consult the shipyard and make a paper plan to provide optimum engine room space.

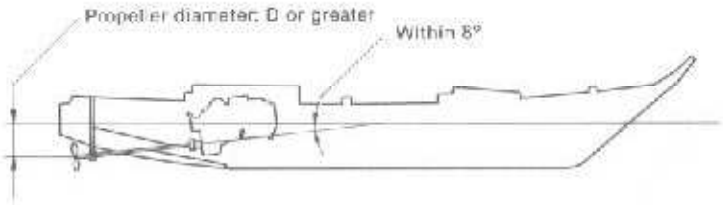
The engine room conditions required to handle the engine will be covered below.

(1) Ventilation inside engine room
Since an increase in the engine room temperature causes a reduction in the intake air volume and thus a drop in engine output, ventilation inside the engine room must be ample.

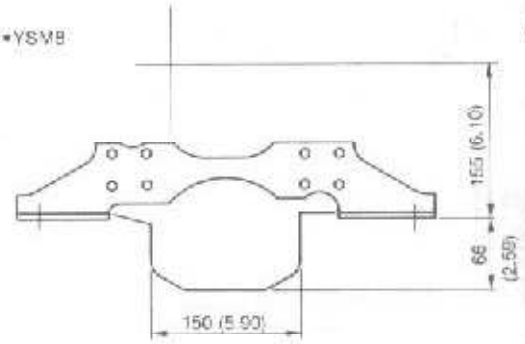
(2) Space must be sufficient to move the propeller shaft flange face toward the stern when disassembling the clutch, changing the gear, etc.

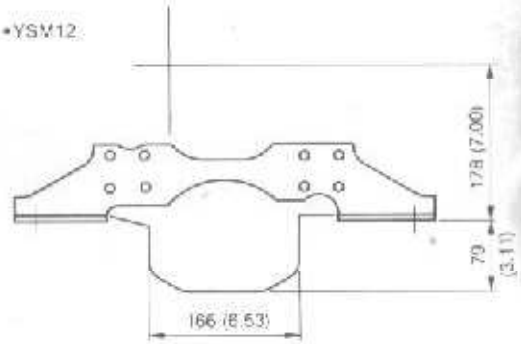
2-2 Engine bed

(1) Although the installation angle of the engine differs with the hull shape and engine installation position, it must be 8° or less when the vessel is cruising. If the tilt exceeds 8°, the output will decrease, the exhaust gas will color without the speed rising, vessel speed will fall or the parts will wear abnormally, and oil consumption will increase.



(2) Engine bed shall be designed so that there is no contact between the bottom of the engine and the hull.



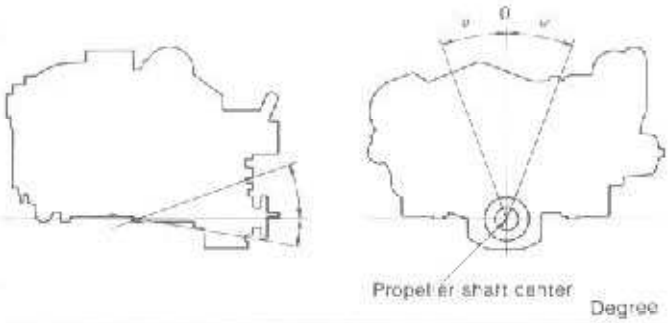


(3) Sufficient space must be available for easy setting of the wrench to the reamer bolt on the propeller shaft joint.

(4) The bed must be constructed so that a wrench can be set at the bottom of the engine base to retighten the engine mounting bolts.

(5) Make the bed such that the propeller shaft and engine drive shaft are in a straight line.

2-3 Engine installation angle



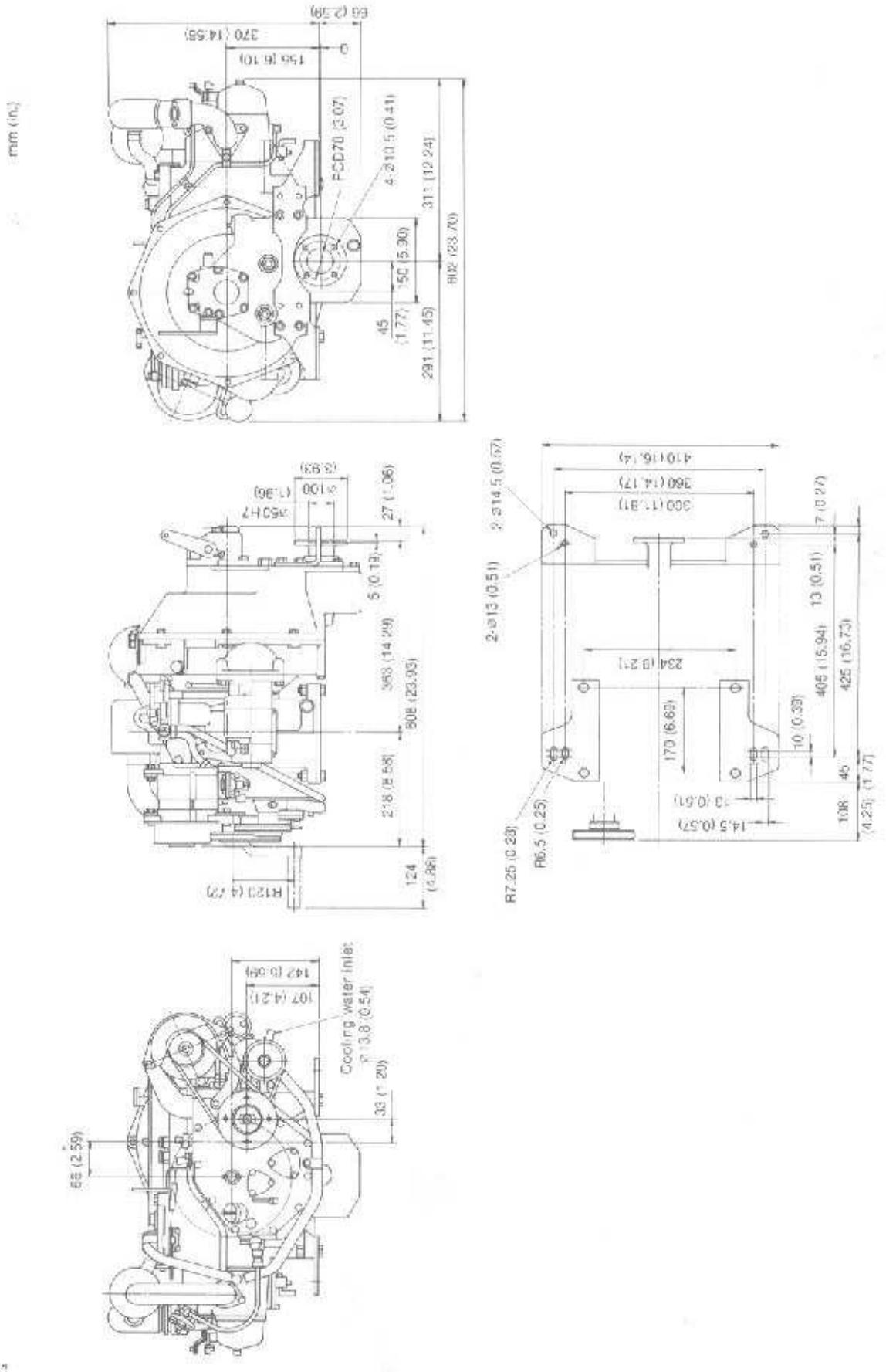
Degree

Degree	Inclination under operation		Allowable installation angle (max.)
	Constant	Peak	
α	25	35	—
β	20	35	15
γ	10	15	5

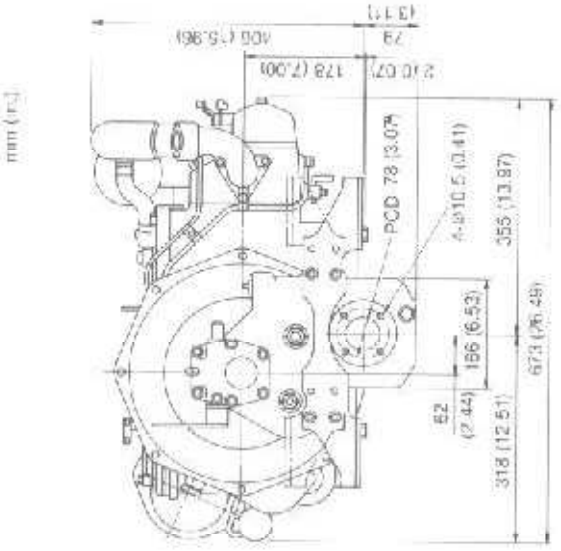
2-4 Dimensions

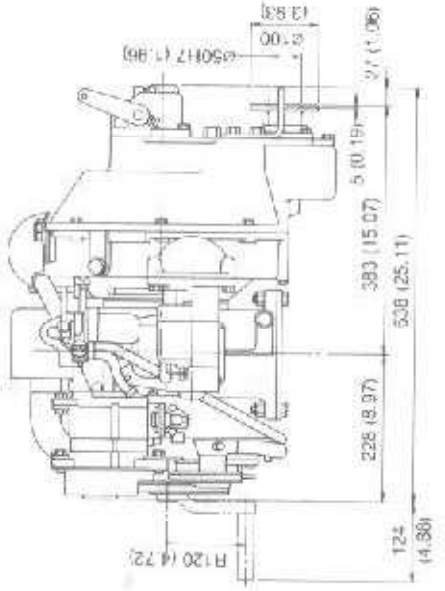
(1) YSM8-R

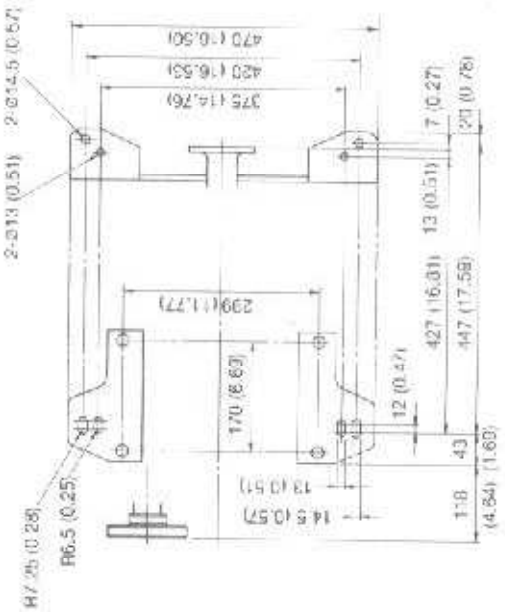
mm (in.)

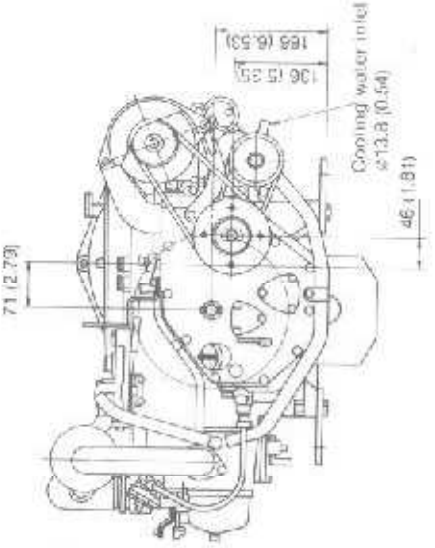


(2) YSM12-R

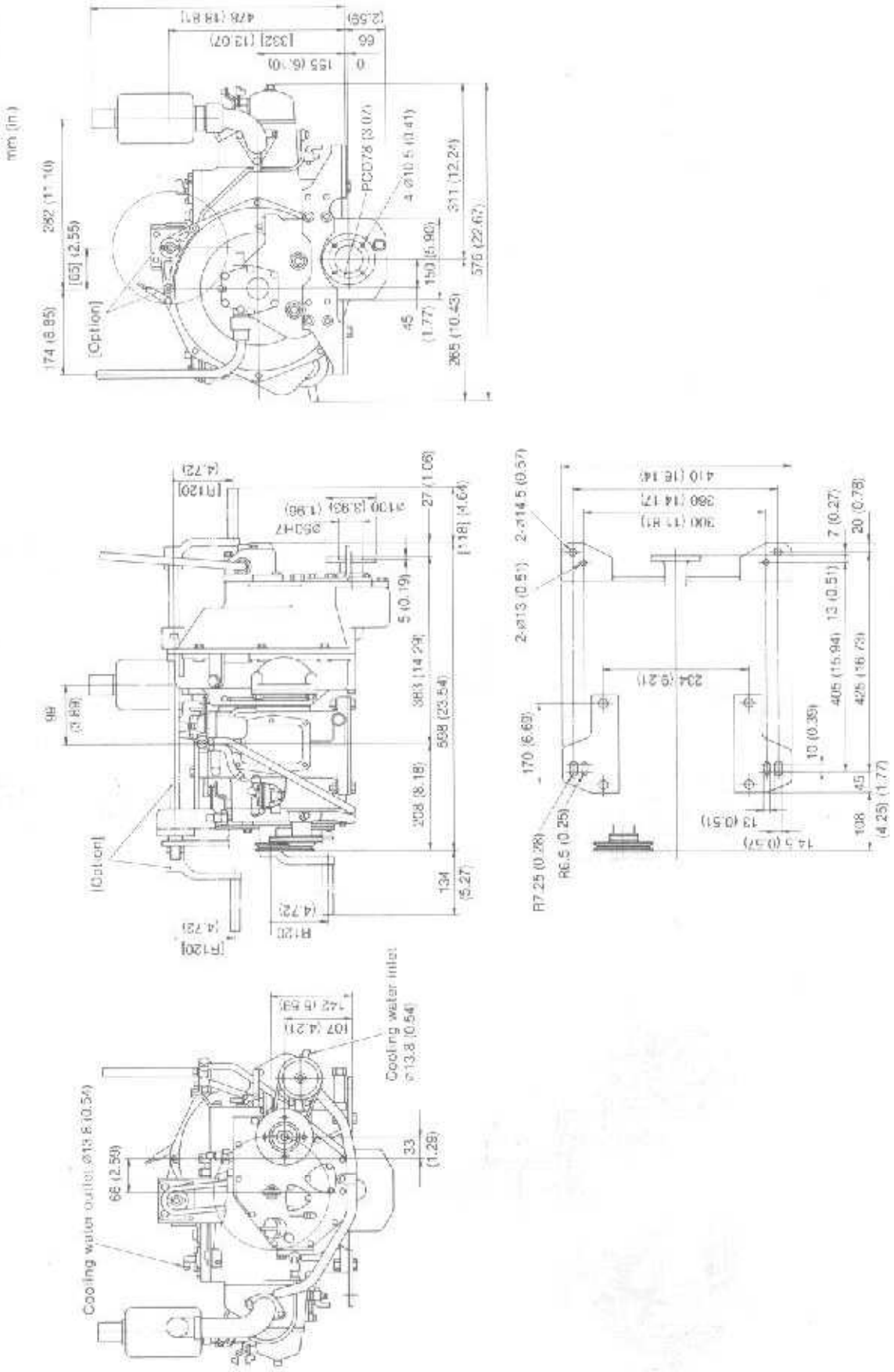

178 (7.00)
PCD 78 (3.07)
4-ø10.5 (0.41)
355 (13.97)
166 (6.53)
62 (2.44)
318 (12.51)
673 (26.49)


ø50H7 (1.96)
5 (0.19)
383 (15.07)
538 (25.11)
228 (8.97)
R120 (4.72)
124 (4.88)

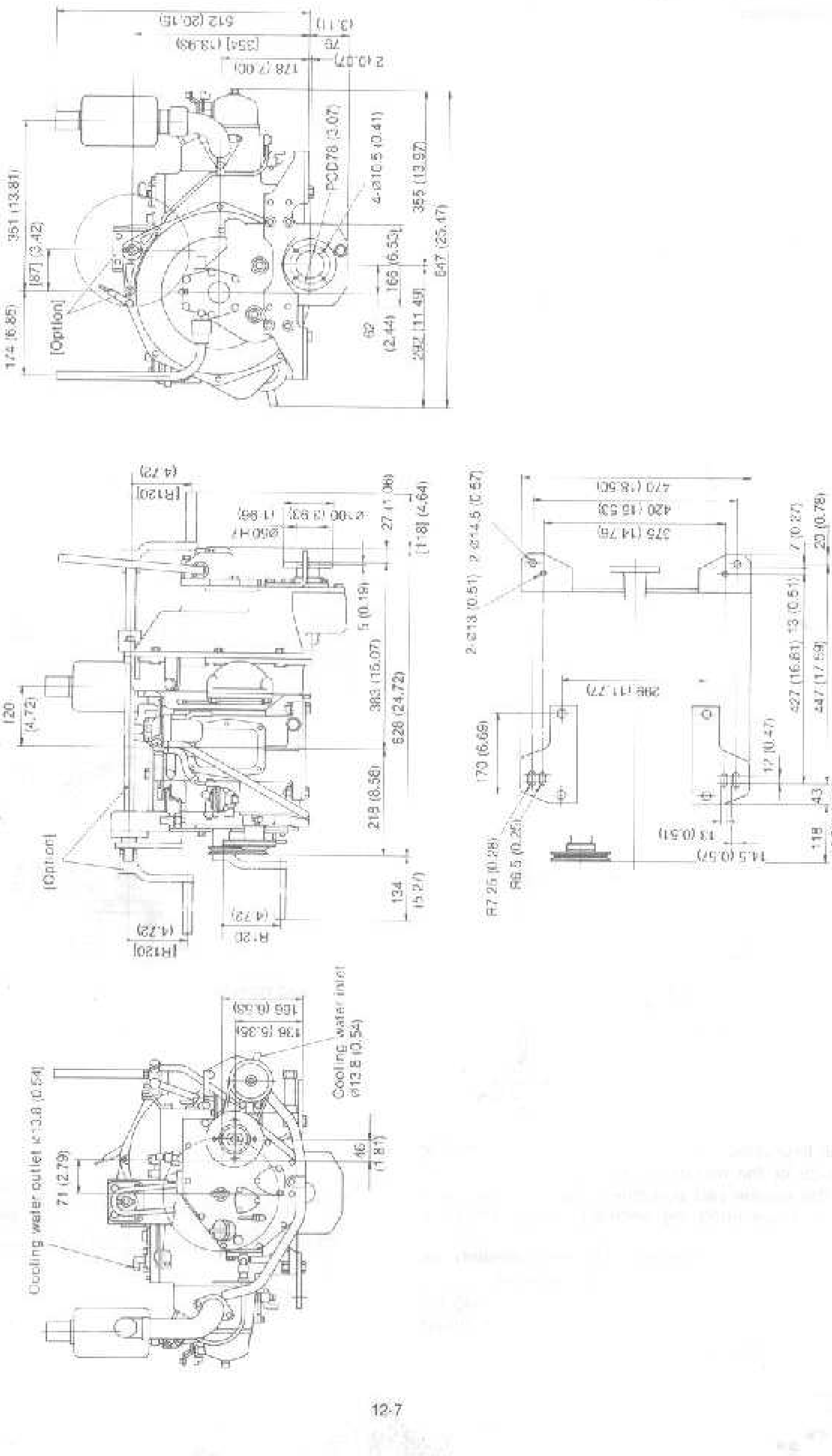

2-ø14.5 (0.57)
470 (18.50)
420 (16.53)
375 (14.76)
2-ø13 (0.51)
7 (0.27)
13 (0.51)
299 (11.77)
427 (16.81)
447 (17.59)
170 (6.69)
12 (0.47)
13 (0.51)
14.5 (0.57)
43
123 (4.84) (1.69)
R6.5 (0.25)
R7.25 (0.28)


165 (6.50)
136 (5.35)
Cooling water inlet
ø13.8 (0.54)
46 (1.81)
71 (2.79)

(3) YSM8-Y

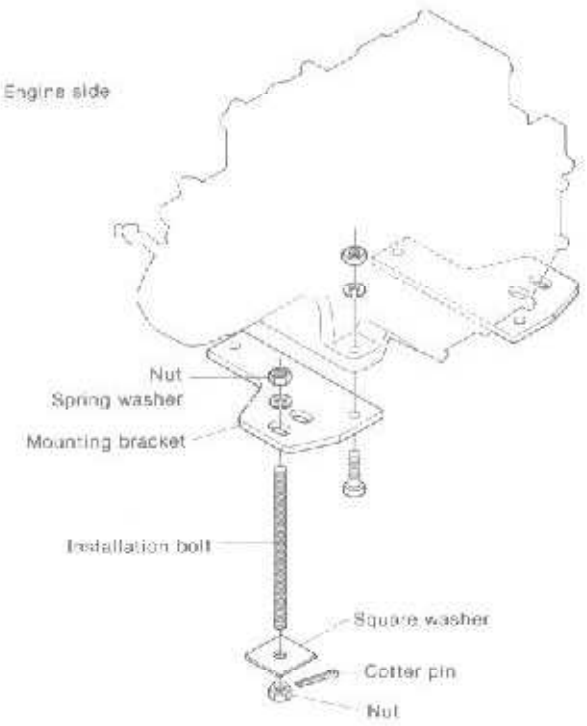

mm (in)
[Option]
PCD78 (3.07)
4-ø10.5 (0.41)
Cooling water inlet
ø13.8 (0.54)
Cooling water outlet ø13.8 (0.54)

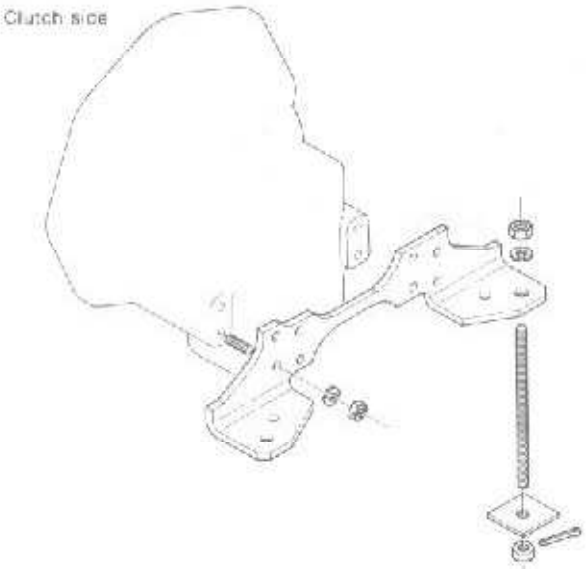
(4) YSM12-Y


mm (in.)
[Option]
Cooling water outlet ø13.8 (0.54)
Cooling water inlet ø13.8 (0.54)

2-5 Engine installation method

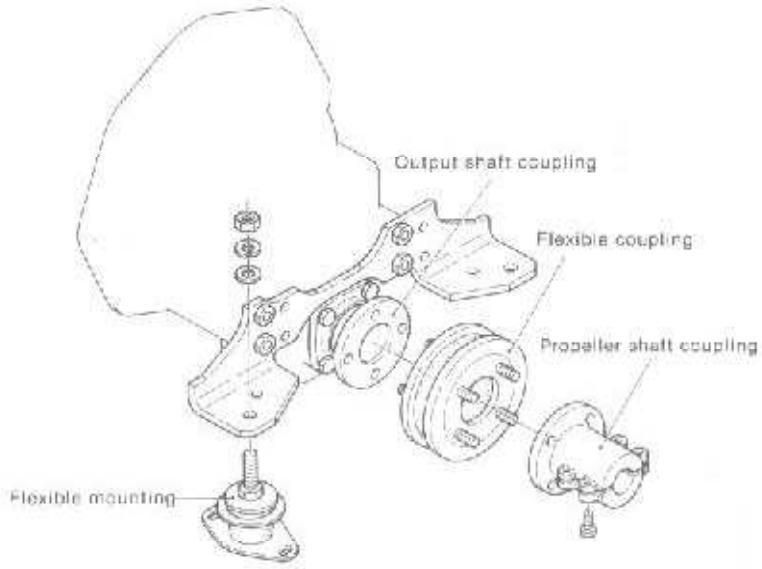
2-5.1 Fixed installation



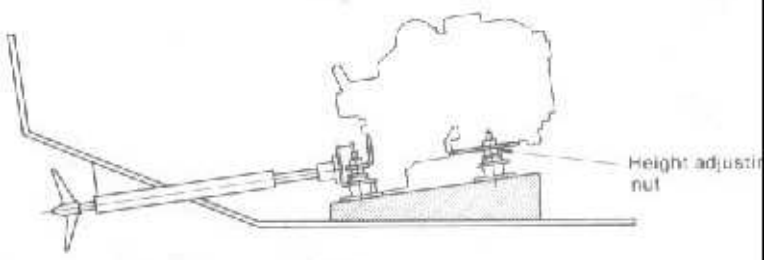


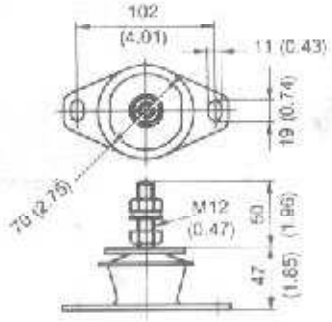
(1) In order to provide sufficient contact area between the underside of the mounting leg and the engine bed, finish the engine bed surface so that it is even and fasten the mounting leg securely using hexagonal bolts.
(2) Tighten the bolts uniformly. Do not unevenly or excessively tighten bolts that are not centered.
(3) Adjust the shim on the underside of the mounting leg so that the propeller shaft is coupled with the thrust shaft in a straight line.

2-5.2 Flexible mounting

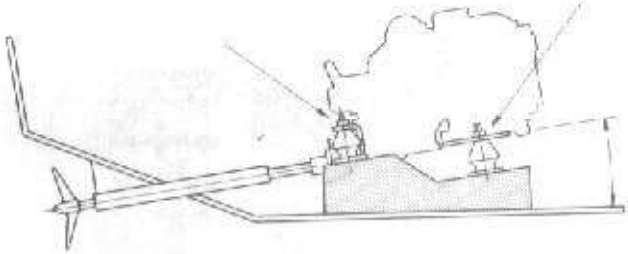


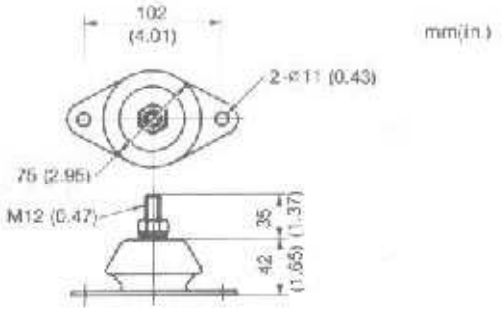
(1) Ajustable type flexible mounting





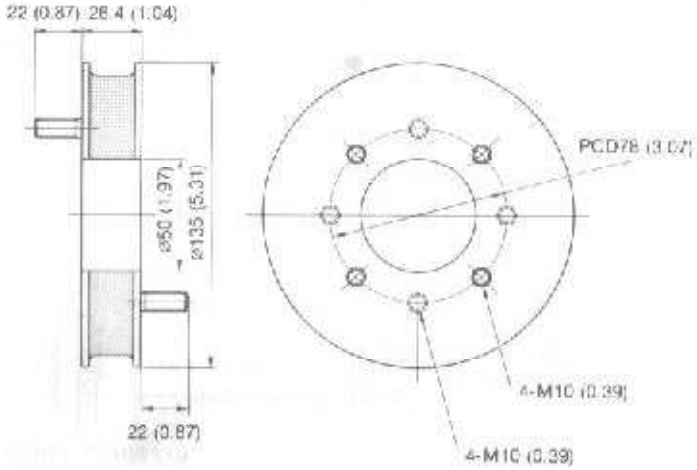
(2) Fixed type flexible mounting





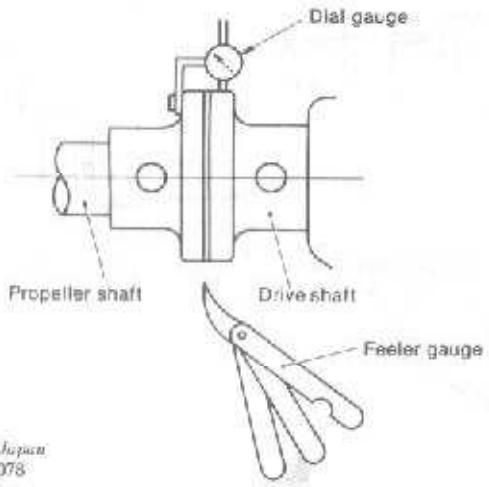
(3) Flexible coupling
When the engine is installed with flexible mountings a flexible coupling must always be used at the propeller shaft coupling.

NOTE: Install only after the drive shaft coupling and propeller shaft coupling have been centered.



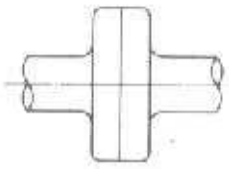
2-6 Centering

2-6.1 Coupling mating face measurement

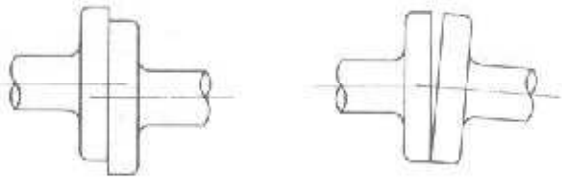


Before installing the propeller shaft in the engine (intermediate shaft when there is an intermediate shaft), make sure that the couplings of both shafts are centered. When the center of the engine is too high, adjust by cutting the engine bed, and when the engine is too high, adjust by inserting plates.

GOOD

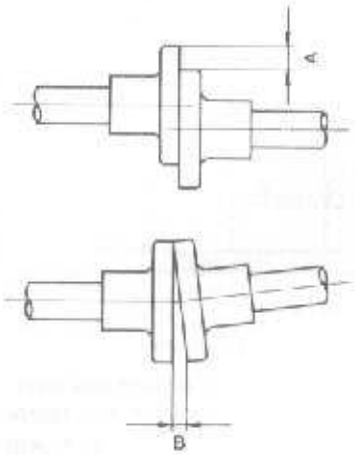


BAD



(a) Install a dial gauge on the propeller shaft coupling and measure the circumference versus drive shaft coupling center run-out (at four equally spaced points around the circumference).

(b) Then lock the drive shaft, turn the propeller shaft and dial gauge, and measure the outside periphery of the drive shaft and adjust to the value measured at (a) above.



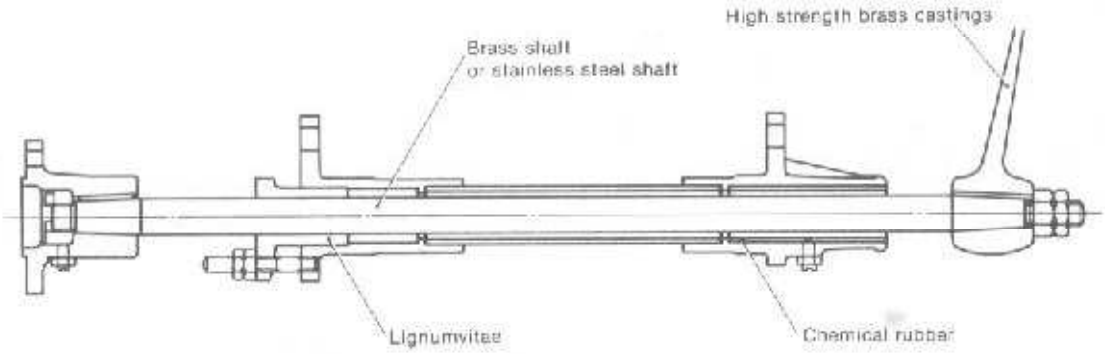
Coupling misalignment A	0.05 mm or less (0.002in.)
Coupling face run-out B	0.2 mm or less (0.0079in.)

2-6.2 After launching the vessel, check whether the drive shaft and propeller shaft are aligned.

3. Stern Equipment

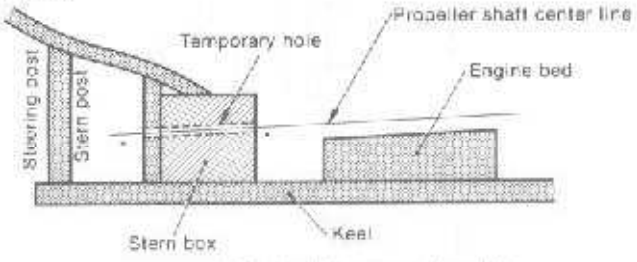
3-1 Stern tube installation

The bearing at the point at which the stern equipment passes through the hull is called the stern tube. The propeller shaft is supported by inserting lignumvitae (wood), cutless bearing (rubber) and other support materials. The propeller shaft is inserted into the stern tube and the bow end is connected to the intermediate shaft or drive shaft, while the propeller shaft is installed in the stern end taper.



(a) Initial drilling

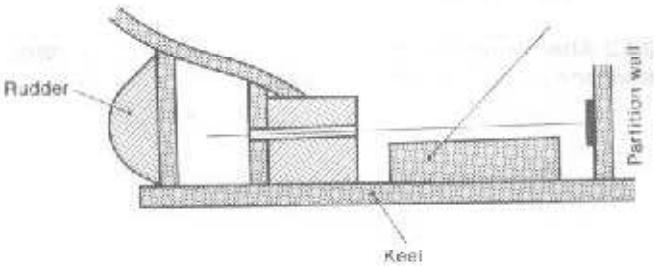
Bore a 30 ~ 40 mm diameter temporary hole smaller than the stern tube through the hull as shown in the drawing

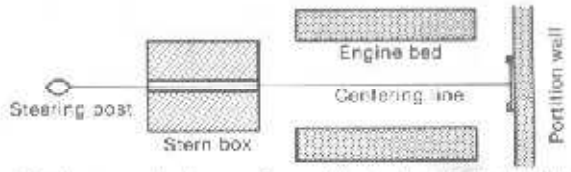


* Set the hole center, then drill

(b) Passing the centering line through the temporary hole

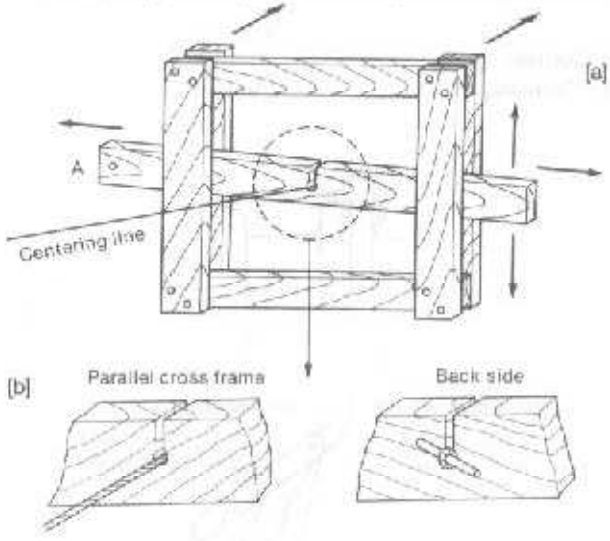
Pass the centering line through the temporary hole and fasten one end to the steering post and the other end to the engine room wall as shown below (The line should be tight.)





Make a parallel-cross frame (below) and attach it to the engine room wall. Then insert plate A, which carries the centering line, so that it is movable in all directions to allow correction of the line's position.

Fasten the line as illustrated in below [b] for easy removal. The empty hole in plate A (after the line is removed) permits pencil marking-off or center peep.



(c) Centering
Measure the dimensions between various points and the centering line and set the temporary position of the engine in accordance with the dimensions given in the drawing.
(1) Measure the dimension between the centering line and the top of the engine bed to determine the installation level and height of the crankshaft center line, then measure the clipping margins of the engine bed.
(2) Measure the dimensions between the centering line and the inside surface of the engine bed.
(3) At the flywheel and clutch, measure the dimensions between the centering line and the ship's bottom to check that the clutch case, engine oil pan, and flywheel clear the ship's bottom or sleepers.
(4) Then temporarily fix the centering line adjusting plate A.

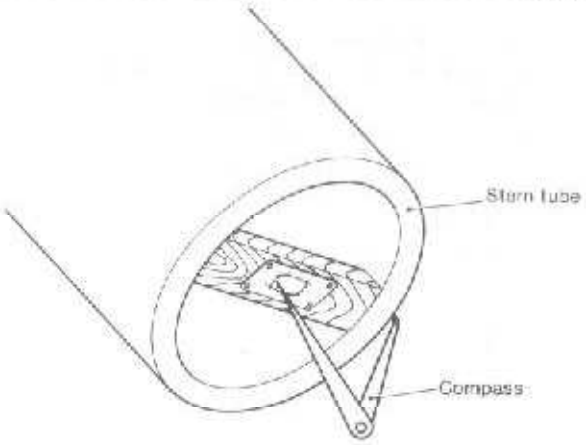
NOTE 1: Since centering based on the stern tube hole is performed on land, ample engine bed chipping allowances under the center line must be provided to allow for possible distortion after launching.

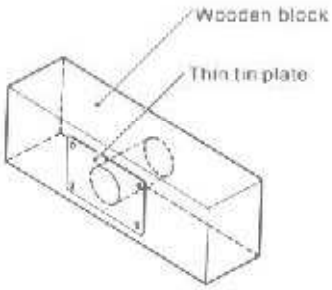
NOTE 2: If the flywheel, oil pan or clutch case touch the ship's bottom or any sleeper, raise the shaft center. However, in this case, the engine installation angle must be no more than 8°.

NOTE 3: The engine should be installed on as horizontal a plane as possible. Remember, propeller efficiency is highest when the engine is horizontal.

(d) Final drilling
After temporary centering, mark off one stern tube hole on each side of the stern box based on the centering line, and then bore holes that exactly fit the stern tube (no play).

(e) Stern tube installation
(1) Remove the centering line, but either leave the frame of parallel crosses or mark off its center position on the front wall of the engine room
(2) Insert the stern tube, check for interference, and temporarily tighten.
(3) Centering for stern tube installation
(a) Prepare a wooden block having a center hole covered with a thin tin plate.
Hammer the block into the propeller side of the stern tube, obtain the center point with a compass and then make a small hole at this point with a nail or the line. Pass one end of the centering line through the hole and fasten the other end to the empty hole in plate A (3-1 (b)).



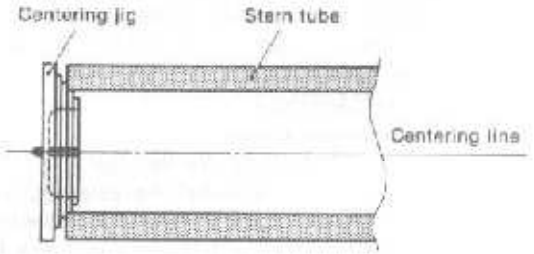


NOTE 1: The center deflection of the stern tube is 3 ~ 4 times greater at the front of the engine bed. Therefore, sufficient care must be exercised.

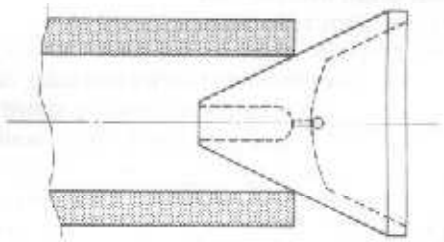
NOTE 2: If the stern tube holes are so large that stern tube play is excessive, tighten the stern tube to the correct position and mark that position so that the tube can be replaced correctly.

Check that the centering line is at the center of the stern tube at the inside flange. If not, center by moving either the stern tube or the centering line.

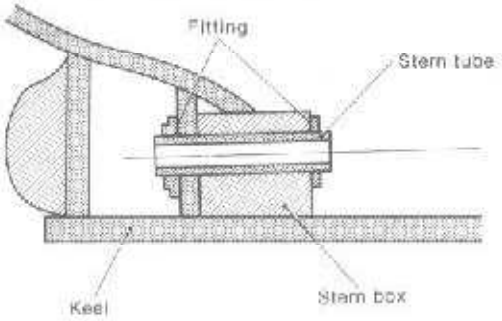
(b) When centering the propeller side of the stern tube, the use of a centering jig with various outside diameters that fit the stern tube (below) will prove very convenient.



A tapered jig can be made for an infinite variety of stern tube inside diameters.

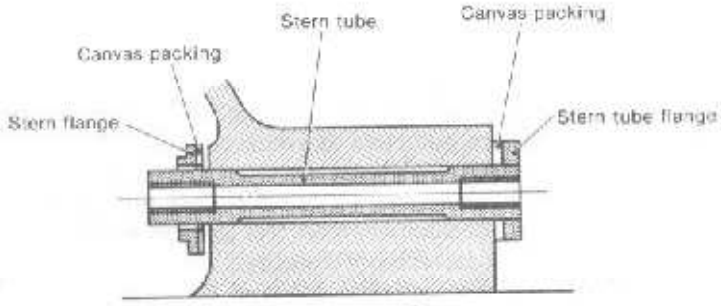


(4) Fitting of stern tube tightening surface
Pay careful attention to the rectangularity between the stern tube and stern tube tightening surface of the stern box when fitting.



NOTE: If the stern tube and stern tube tightening surface of the stern box are not exactly rectangular, the stern tube will bend when tightened, causing overheating, seizing, abnormal lignumvitae wear and other troubles.

(5) Attaching the stern tube



(a) Paint the outside of the stern tube with rust-preventive paint.
(b) Paint the stern tube flange and the surface of the stern box with white paint, and attach the canvas packings.
(c) Install the stern tube.
(d) Paint the outside of the stern post and the stern tube flange with white paint, and install the canvas packing and the stern flange.
Also paint the screw holes with white paint and tighten the screws.
(e) Attach the clamp for the stern tube chemical rubber tube and install the fastening wire.
(f) Drive in the coach screws to lock the inside and outside stern tube flanges and lock the stern flange nuts.

3-2 Propeller shaft installation

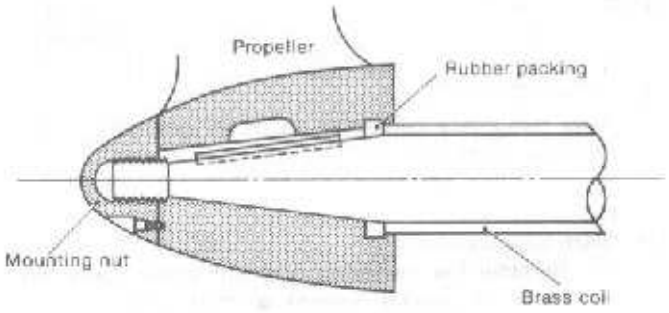
After fitting the stern tube packing gland to the propeller shaft, fit the propeller shaft to the stern tube by hand. Before fitting the propeller shaft to the stern tube, clean the interior of the stern tube and coat the lignumvitae with grease. When suspending the propeller shaft with a rope when inserting the shaft, the rope must not contact the rubber coil directly. Since propeller shaft insertion is performed at the narrowest part of the hull, be careful not to damage the brass coil and rubber coil. After inserting the propeller shaft, check the clearance between the stern tube and shaft while turning the shaft.

Insert the waterproof packing at the stern tube packing gland. Use braided string boiled in grease as the packing. Do not use a long coil, but rings cut one at a time, such as piston rings. When inserting the packing, the notches must alternate.

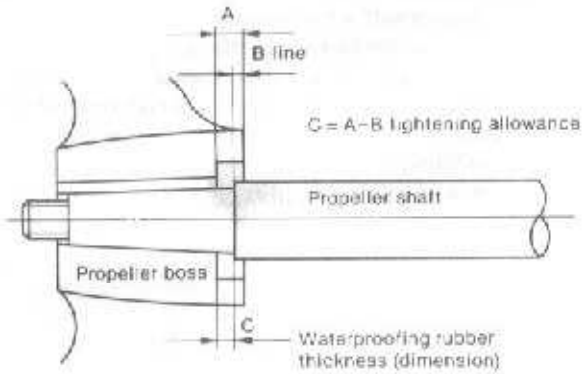
Tighten the packing uniformly while measuring the distance from the stern tube face to the gland face so that the packing gland is not tightened unevenly.

3-3 Propeller installation

(1) First, remove the shaft key, coat the shaft with red lead or bearing blue, fit the propeller shaft, and mark the position of the propeller on the brass coil. Then check the propeller shaft and propeller hole contact—if the contact is poor, correct. Poor contact and play during use will damage the key and key groove. After repairing, install the propeller and mark its position on the brass coil.
Then remove the propeller, insert the key on the shaft and fit and tighten the propeller. However, before this, check whether the marks made after repair match. If they do not, the key is touching and must be removed and cut.



(2) Measuring the dimensions of the waterproofing rubber between the propeller shaft and propeller.

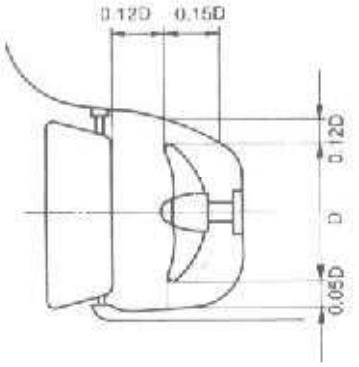


Insert the propeller onto the propeller shaft and mark the end of the propeller on the brass coil. The difference between the A dimension and B dimension in the figure is the waterproof rubber dimension, but a slight tightening allowance must be made.

(3) Propeller position

With the propeller installed, the ship's full speed will not be obtained if the spacing between the propeller and hull is not equal to, or greater than, the value given in the figure.

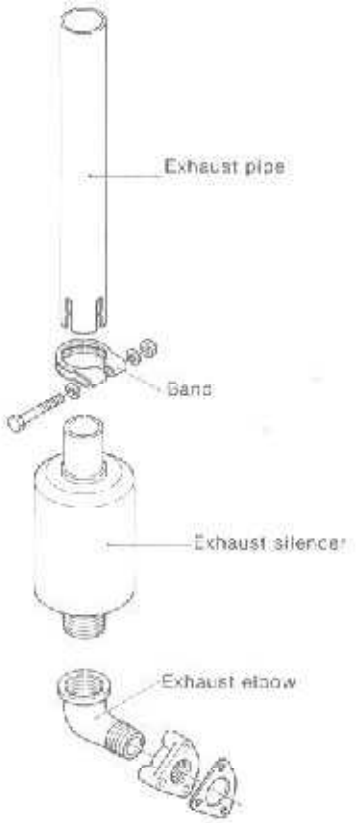
The position of the propeller section shaft center must be at least the diameter of the propeller from the surface of the water with the ship fully loaded.

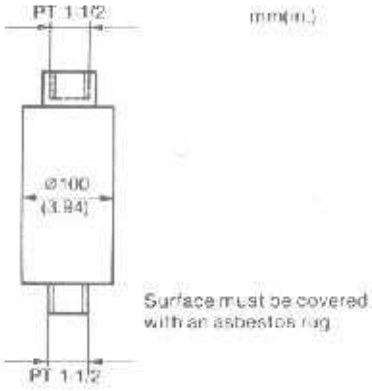


4. Interior Piping and Wiring

4-1 Exhaust pipe

4-1.1 Exhaust silencer installation



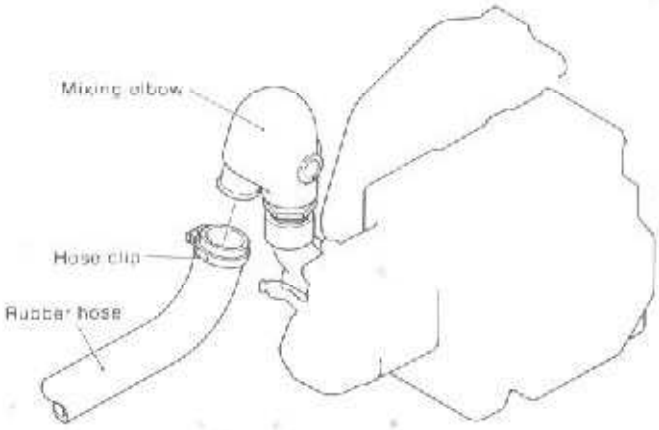


(1) Installation method and dimensions
- Install the exhaust silencer either directly to the exhaust elbow installed on the exhaust manifold or on the exhaust pipe.
- When the silencer is installed in the exhaust pipe, use an exhaust pipe socket.
- In the case of a horizontal exhaust, use a horizontal exhaust elbow.

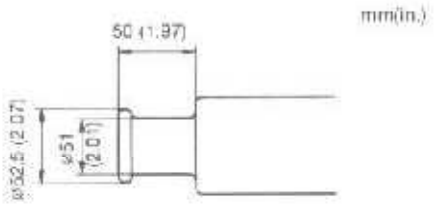
(2) Precautions
1) Always use an exhaust elbow when the direction of the exhaust must be changed.
2) Clamp the pipe to the hull at suitable positions.
3) Decide the exhaust silencer installation position according to the structure of the hull, but since the silencer reaches a high temperature, it should protrude past the cabin.
4) When piping the exhaust, the prevention of heat damage and fire must be considered because the exhaust is hot. Always cover the surface of the exhaust pipe with a rug.
5) Take measures to prevent rain from entering the exhaust pipe when the ship is moored.
6) Avoid long piping. When the piping must be long and the change of direction large, use large diameter pipe.

4-1.2 Mixing elbow installation

(1) Installation method and dimensions

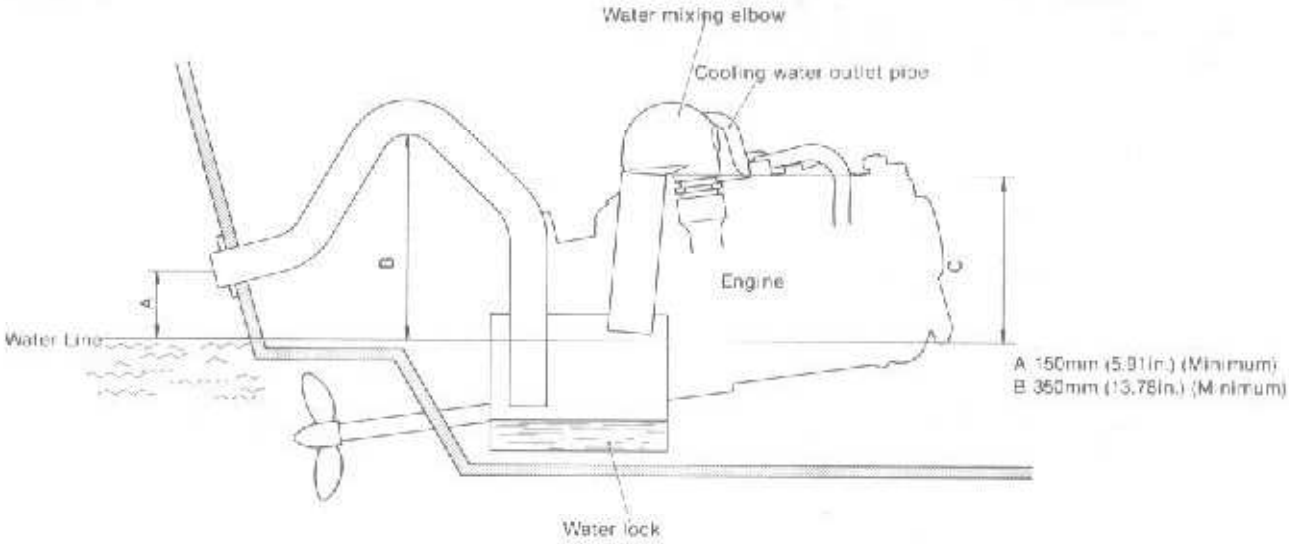


▪ Rubber hose connection dimensions

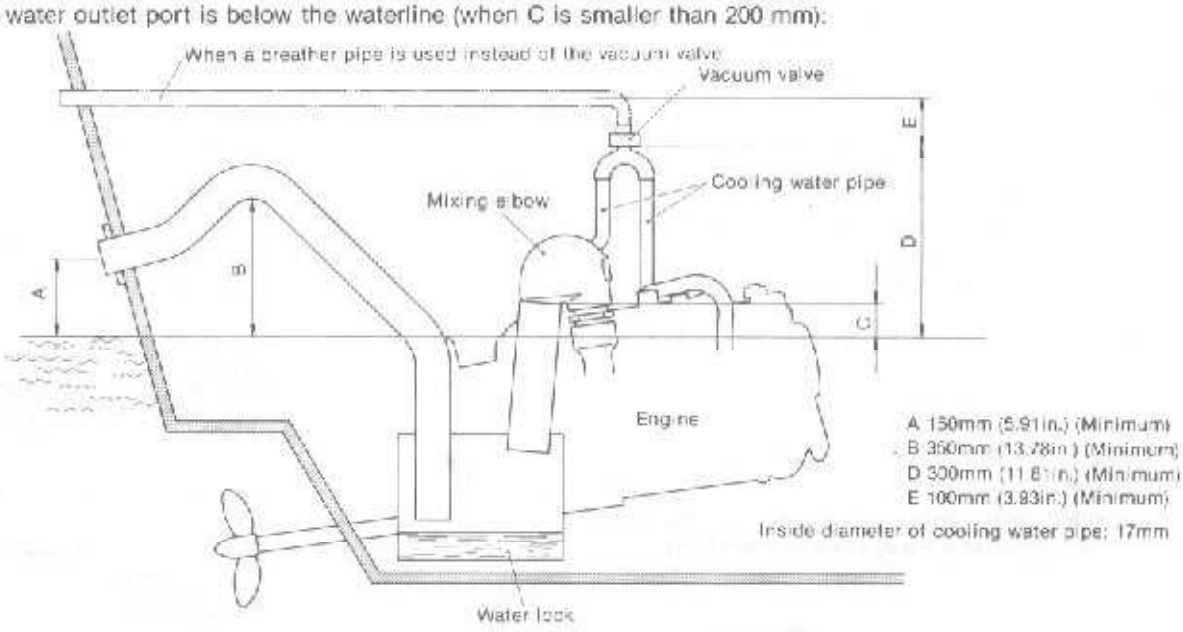


Rubber hose
Inside diameter: 50.8 mm
Outside diameter: 63 ~ 70 mm
Hose clip: 65 ~ 70 mm

When the outlet port of the cooling water is above the waterline (when C is greater than 200 mm):



When the cooling water outlet port is below the waterline (when C is smaller than 200 mm):

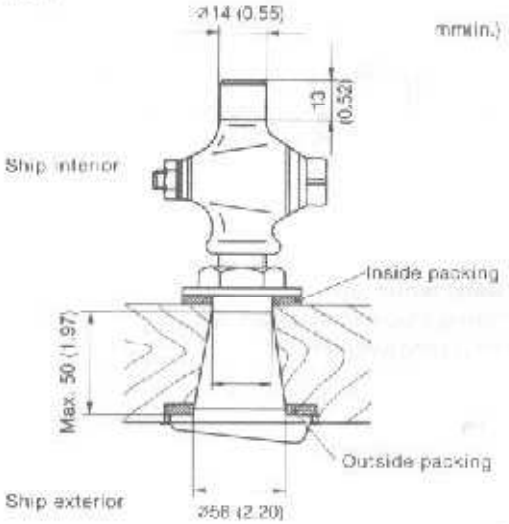


4-2 Cooling water pipe

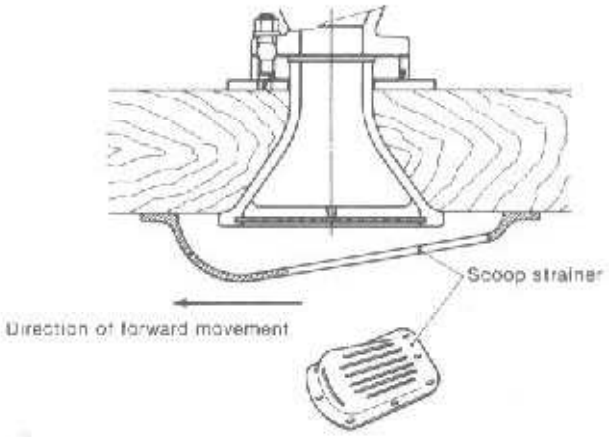
4-2.1 Kingston cock (R-type:option)

(1) Installation

- Determine the position of the Kingston cock by the position of the cooling water pipe and the direction of the cooling water pump inlet joint.
- Finish the contact face of the Kingston cock hole drilled in the ship's bottom by grinding.
- Install the cock using canvas on the outside of the hull and canvas or rubber packing on the inside.

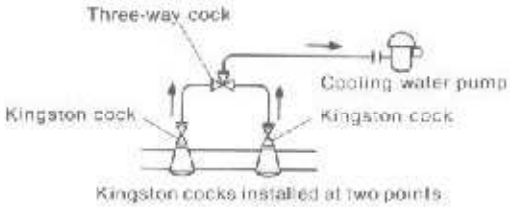


(2) Scoop strainer
The inlet section should have a double bottom to prevent troubles stemming from a lack of cooling water caused by the sucking in of vinyl sheets etc., at the Kingston cock inlet port. Install the strainer so that the large area of the scoop strainer faces away from the direction of the ship's forward movement, as shown in the figure.



(3) Piping
- Use rubber hose for piping from the Kingston cock to the cooling water pump.
  Rubber hose size: Inside diameter x outside diameter x length = 13 × 20 × l (mm)
  Hose clip size: ø22 mm
- The piping must be as straight as possible and bends must not be severe—diameter must be 100 mm or greater.

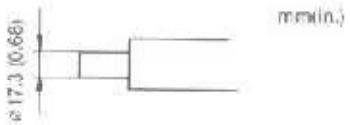
(4) When two Kingston cocks are used
When one of the Kingston cocks becomes clogged, operation can be switched to the other while the clogged cock is being cleaned, even during operation. In this case, use a 3-way cock for switching.



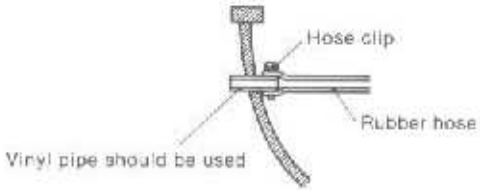
4-2.2 Cooling water outlet pipe

(1) When a mixing elbow is installed, refer to the exhaust rubber hose piping section.

(2) When the mixing elbow is not used, connect a rubber hose to the cooling water outlet fixture so that the cooling water is purged directly from the ship.

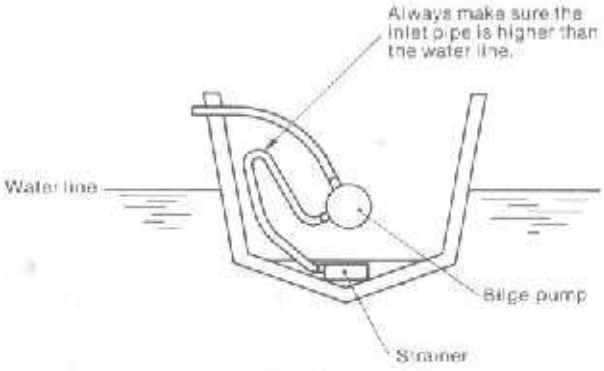


outlet fixture



Rubber hose size: Inside diameter × outside diameter × length = 17 × 24 × l (mm) Hose clip: 2pcs.

4-2.3 Bilge pipe piping precautions



If the Kingston cock is not closed, water will enter from the cock.

4-3 Fuel tank and fuel piping

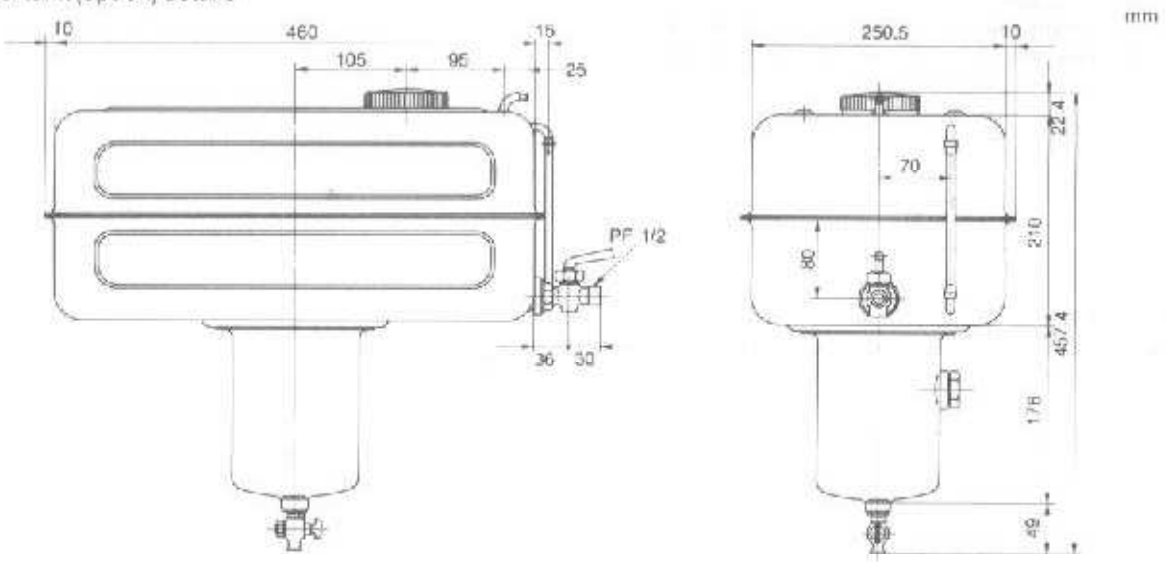
4-3.1 Fuel tank

(1) Clean the interior of the fuel tank with light oil and install the tank in the hull.

(2) The fuel tank must be positioned so that fuel is easy to add, fuel level is easy to check, and draining is easy. Moreover, take engine maintenance and inspection into consideration when deciding fuel tank position.

(3) A fuel pump is installed as standard, but the fuel tank should be installed at the highest possible point as near the engine as possible.

(4) Fuel tank (option) details

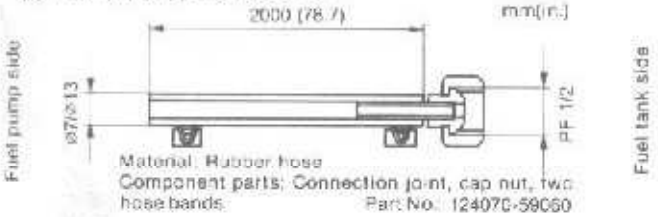


4-3.2 Fuel piping

(1) The hose must be as straight as possible.
Minimum bend diameter: 50mm

(2) Be careful that the fuel piping does not touch the exhaust pipe or other hot parts.

(3) Fuel pipe (option) details.



4-4 Electrical system

4-4.1 Battery installation and wiring

(1) Select a battery position which meets electrical wiring requirements.
The battery must be positioned for easy checking of the electrolyte level.

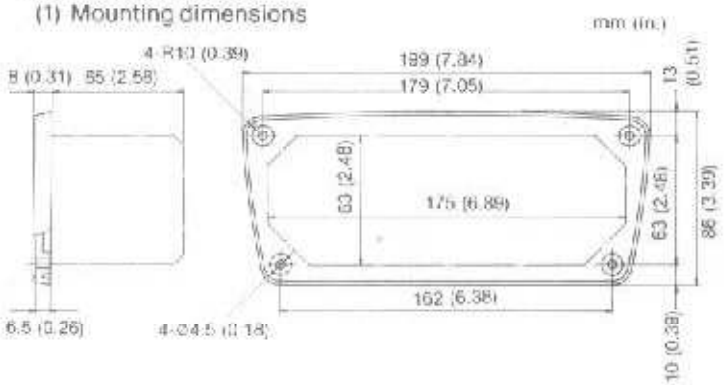
(2) Install the battery on the battery mounting frame.

(3) Connect the wiring securely so that there is no voltage drop, and cover the terminals for protection.

(4) Select battery cables (battery—starter ground, battery—battery switch, battery switch—starter) having a total resistance of less than 0.002Ω.

4-4.2 Instrument panel

(1) Mounting dimensions

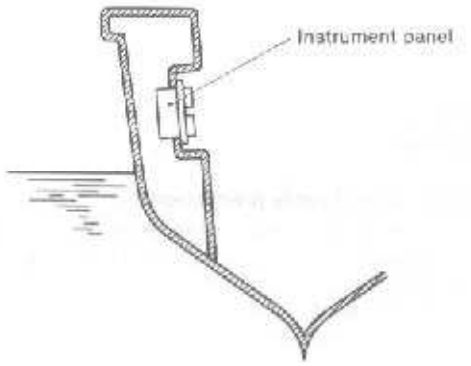


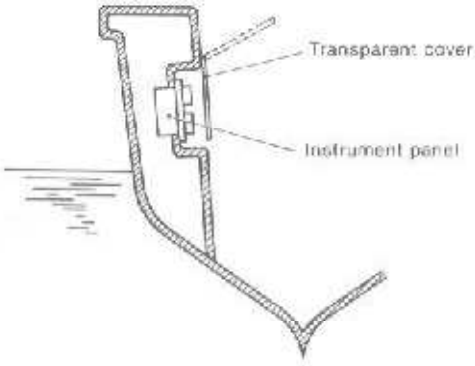
Drill the mounting holes and bolt holes in accordance with the instrument panel mounting diagram.

(2) Installation location and dimensions
The instrument panel should be installed in the cabin, but if it is installed outside, pay careful attention to the following points.

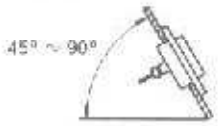
1) Install in a location where there is no danger of the panel being splashed by sea water.

2) When the instrument panel is installed where it may be splashed by sea water, install it in a recessed position or install a cover.





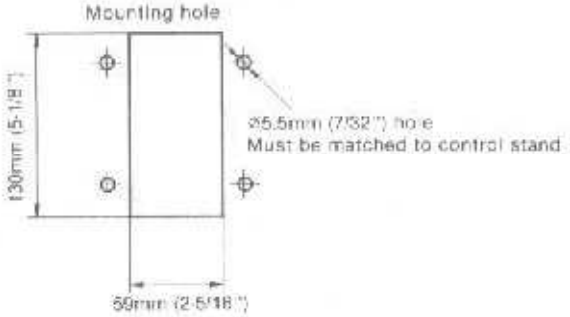
3) Installation angle
The instrument panel must be installed at an angle of between 45° and 90° to prevent indicating errors.



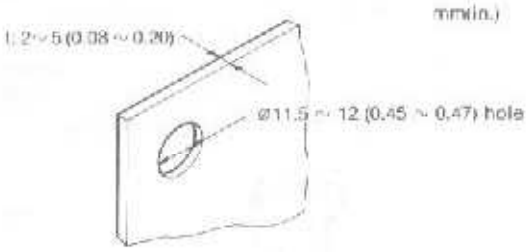
4-5 Remote control

4-5.1 Remote control stand installation dimensions

(1) Morse one-handle remote control (MT)



(2) Engine stop remote control, decompression remote control



Common to both stop remote control and decompression remote control

4-5.2 Remote control cable precautions

The remote control push-pull cable must be as straight as possible. Numerous bends will increase the operating load and shorten the life of the cable.

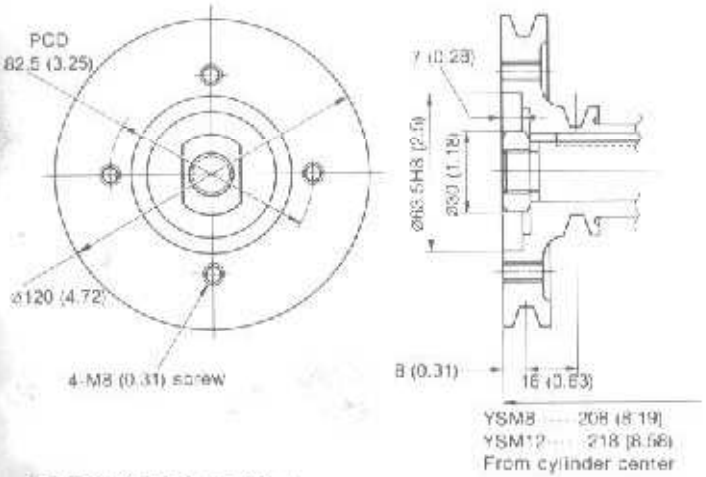
5. Front Power Take-Off

Power to drive the deck machinery and small generator, pump, compressor, etc. can be taken from the front of the engine.
Power take-off capacity, drive system selection and the quality of installation centering have a considerable effect on the engine, and care must be exercised.

5-1 Front power take-off details

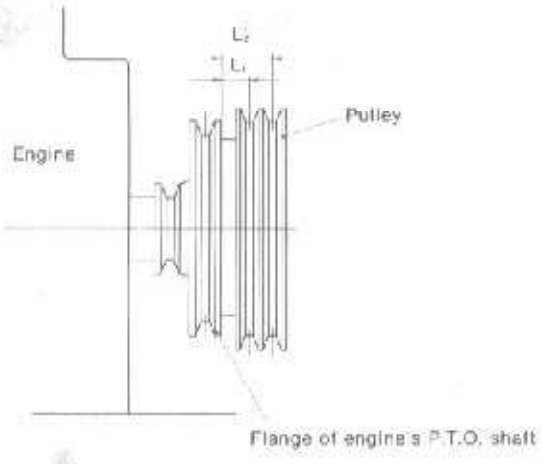
A crankshaft V-pulley is used as the front power take-off coupling.

(mm/in.)



5-2 Front drive system

Power is transmitted sideways via V-belt without the use of outside bearings.



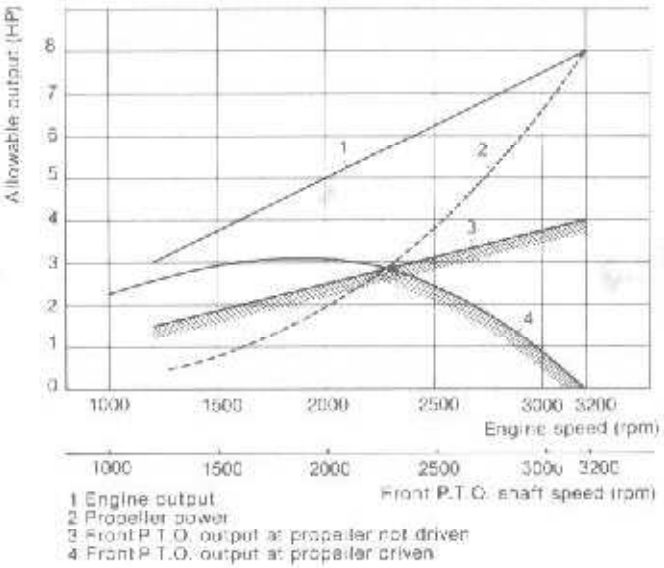
Caution: Dimension of L1: less than 20mm
Dimension of L2: less than 40mm

5-3 Front power take-off general precautions

(1) With belt drive, the belt tension must be adjusted so that an excessive load is not applied to the drive shaft.

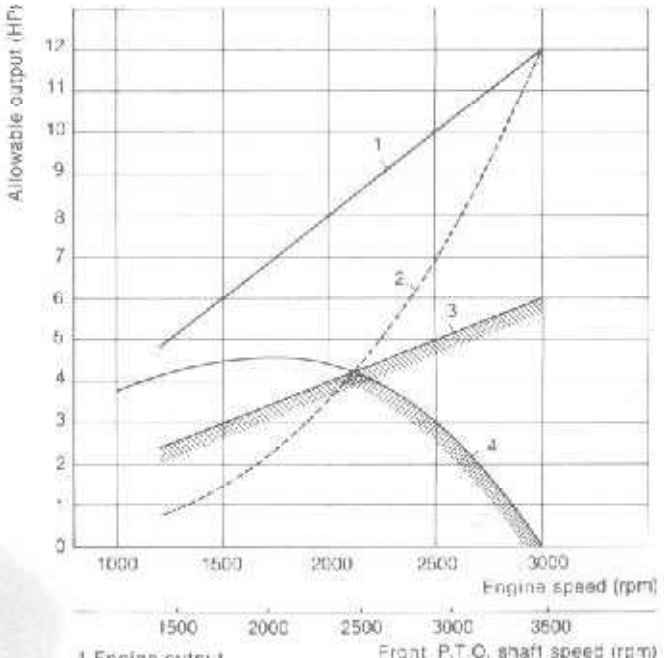
Regardless of the horsepower rating taken out, make the diameter of the pulley on the working machine side as large as possible and set the number of engine rotations to high-speed. (Use of the engine for hours at a low speed gives rise to hunting, etc. If the diameter of the pulley is large, the V-belt is becomes more durable.

YSM8



1 Engine output
2 Propeller power
3 Front P.T.O. output at propeller not driven
4 Front P.T.O. output at propeller driven

YSM12



1 Engine output
2 Propeller power
3 Front P.T.O. output at propeller not driven
4 Front P.T.O. output at propeller driven