ZANAR

OPERATION MANUAL

SD20&31

YANMAR

INSTALLATION AND OPERATION MANUAL

SAIL-DRIVE

MODEL SD20 & 31

FOREWORD

This Installation and Operation Manual describes Sail-Drive Models SD20 & 31, Serial No. 0001 and after.
For engine handling and operation, refer to the respective operation manuals for Engine Models, 1GM10, 2GM20, 30GM30 and 3JH2CE, 3JH2-TCE, 4JH2CE. However, instructions on marine gear box are not necessary as they are included.

MANUAL No.	97-SD20&31-2E
DATE	SEPTEMBER. 97

YANMAR "SAIL-DRIVE"

Model: SD20 & 31

INSTALLATION
&
OPERATION MANUAL

Applicable Engine Model: 1GM10C, 2GM20C, 3GM30C, 3JH2CE, 3JH2-TCE, 4JH2CE

IMPORTANT MANUAL INFORMATION

In the Instalastion and Operation Manual particularly important information is distinguished in the following ways:

The Safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

⚠ WARNING

WARNING – Hazards or unsafe practices which COULD result in severe personal injury or death when the proper precaution is not followed.

⚠ CAUTION

CAUTION – Hazards or unsafe practices which could result in minor personal injury or product or property damage when an advice on safety bandling or the proper precaution is not followed.

⚠ WARNING

SAFETY INFORMATION

Boating safety is your responsibility. You must use common sense and good judgement when operating a boat of any time. Keep the following in mind when operating or servicing your Yanmar Sail Drive.

1. Before operating your boat you must know the laws and regulations relating to the use of sail boat. Be sure you know the "RULES OF THE LOAD".
2. Read this Installation and Operation Manual and the boat's owner's manual (if supplied) carefully before attempting to use your boat.
3. Always wear a personal floatation device ("life jacket") when boating.
4. Do not drink alcohol or consume drugs before or while operating your boat.
5. Batteries generate explosive hydrogen gas.
   - Keep batteries away from fire, sparks, or open flames.
   - Do not use jumper cables and another battery to start the engine. Remove the battery and recharge on shore.
   - Charge the battery only off the boat and only in a well ventilated area.
6. For replacement parts, be sure to use our genuine parts or specified parts.

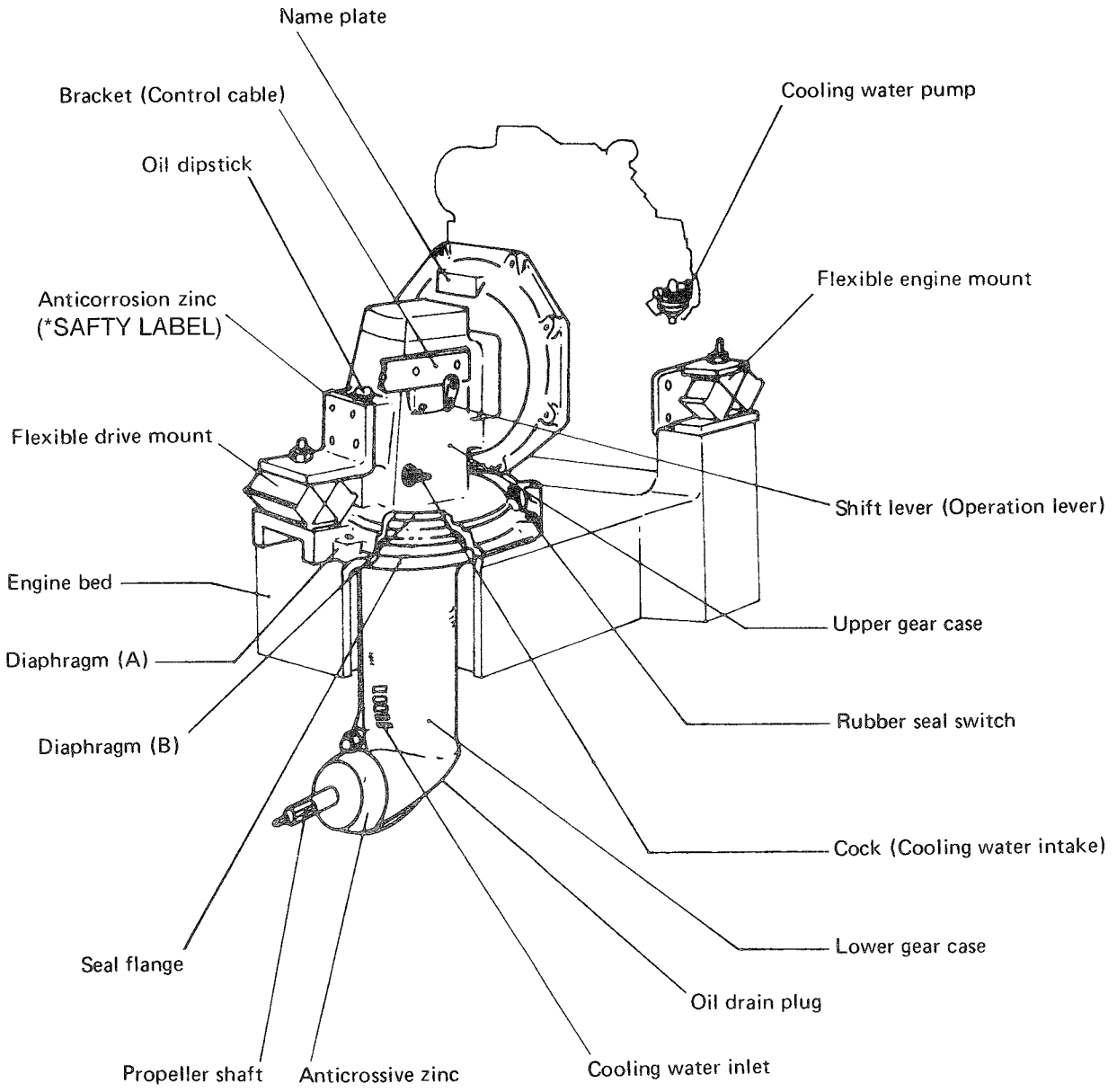
YANMAR "SAIL-DRIVE"

Model: SD20 & 31

INSTALLATION MANUAL

Applicable Engine Model : 1GM10C, 2GM20C, 3GM30C, 3JH2CE, 3JH2-TCE, 4JH2CE

1. Name of Parts



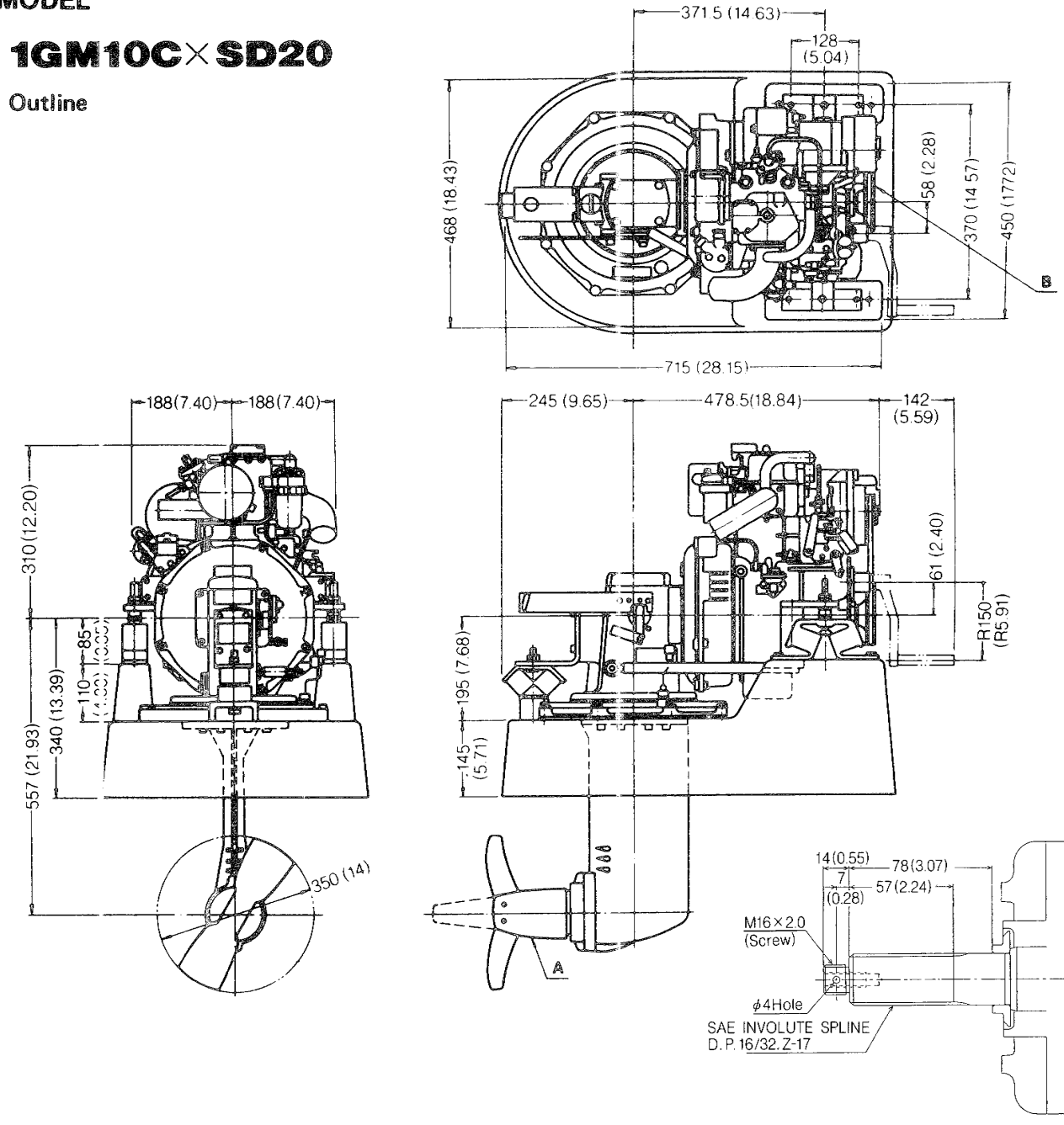
*SAFTY LABEL

reference P38.

MODEL

1GM10C×SD20

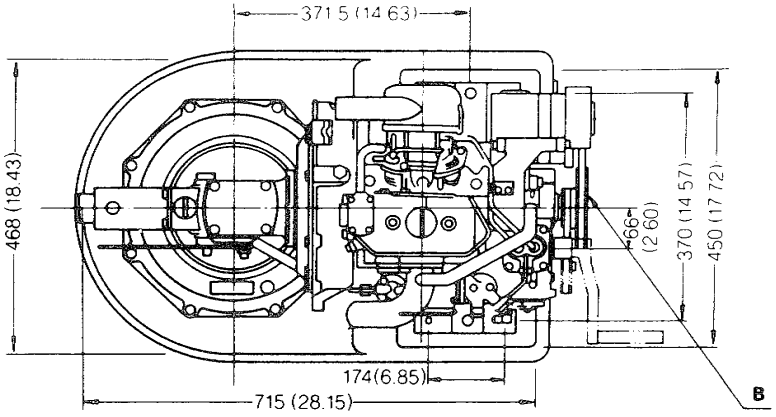
Outline

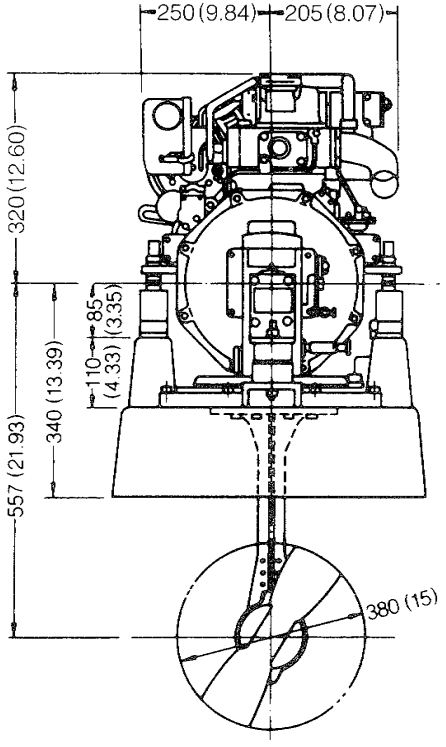


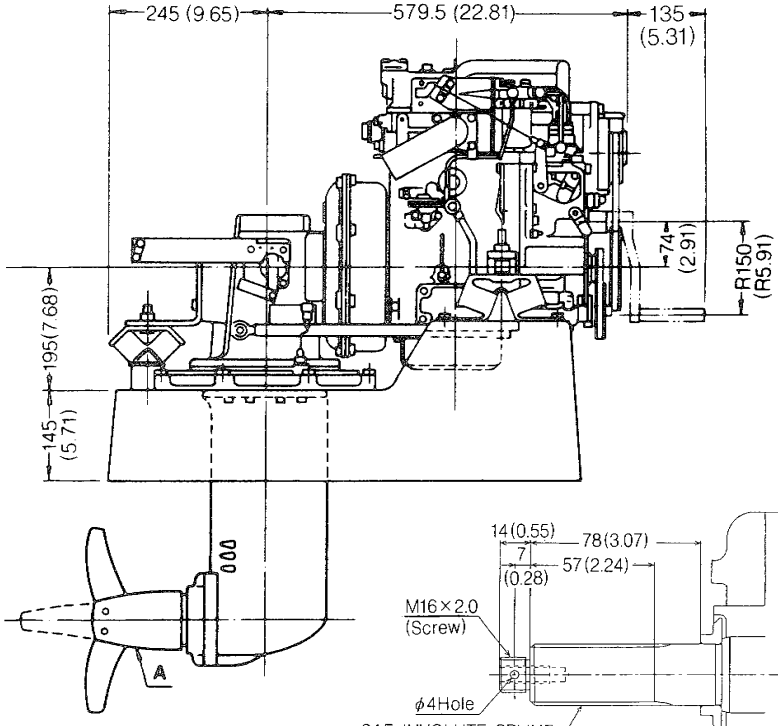
MODEL

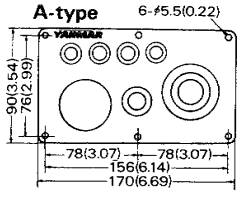
2GM20C×SD20

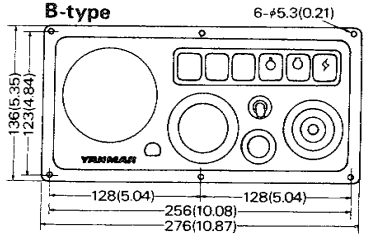
Outline

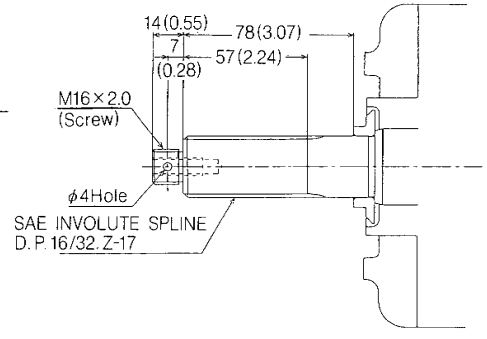








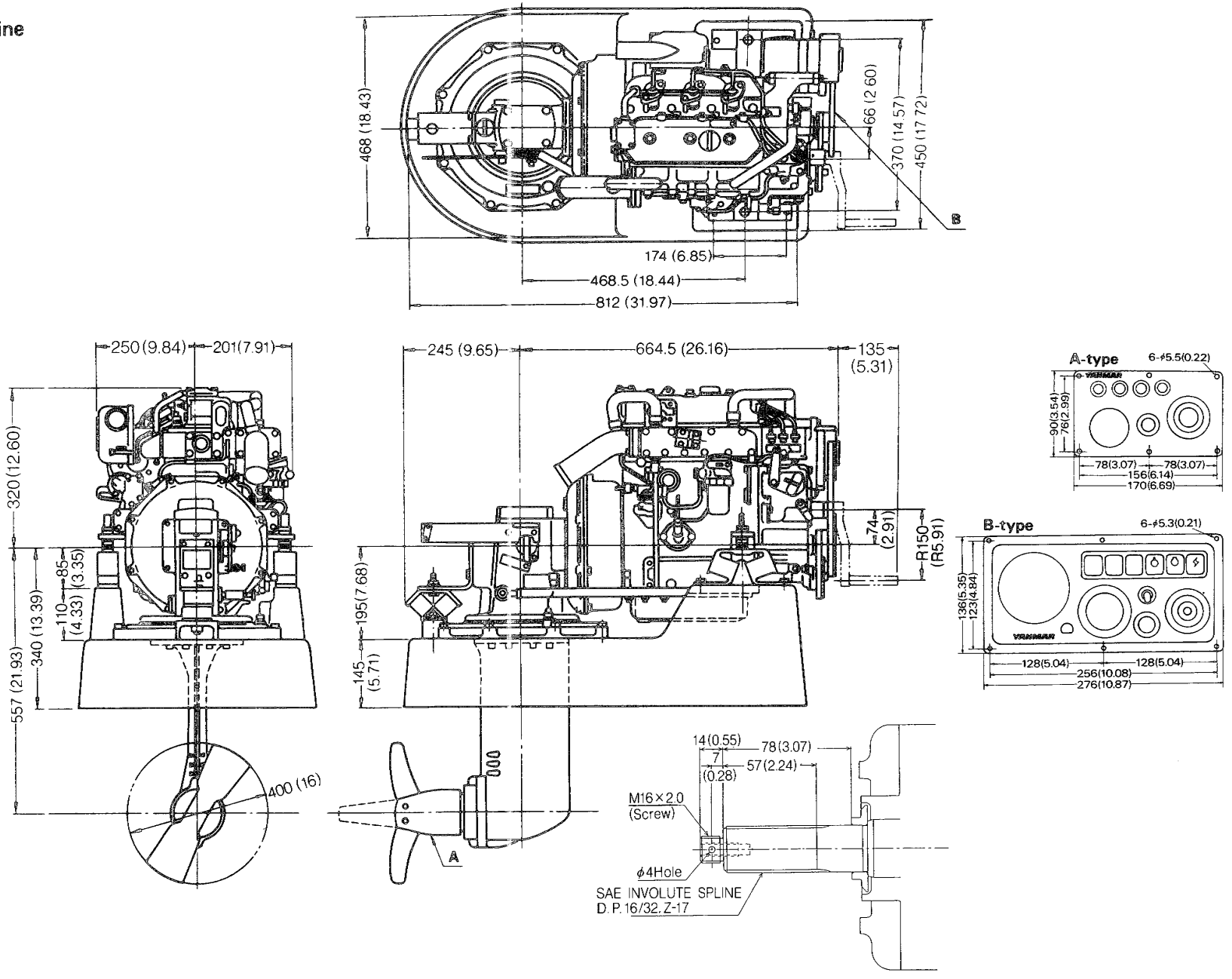




MODEL

3GM30C×SD20

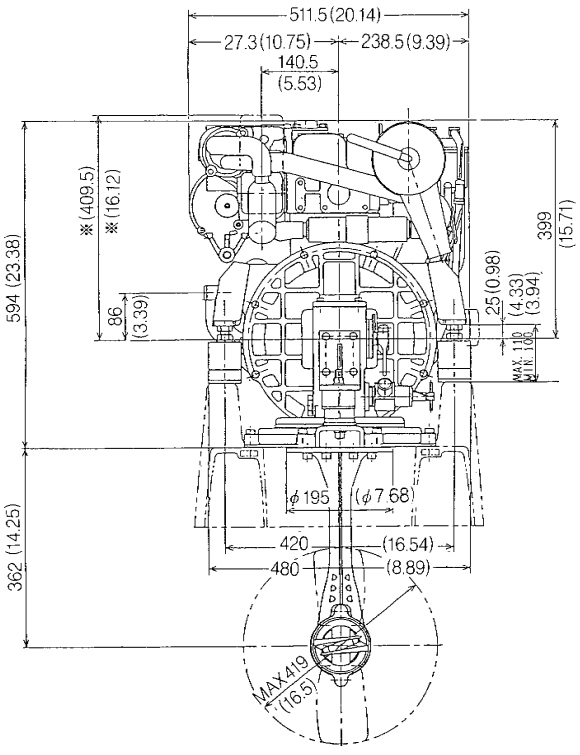
Outline

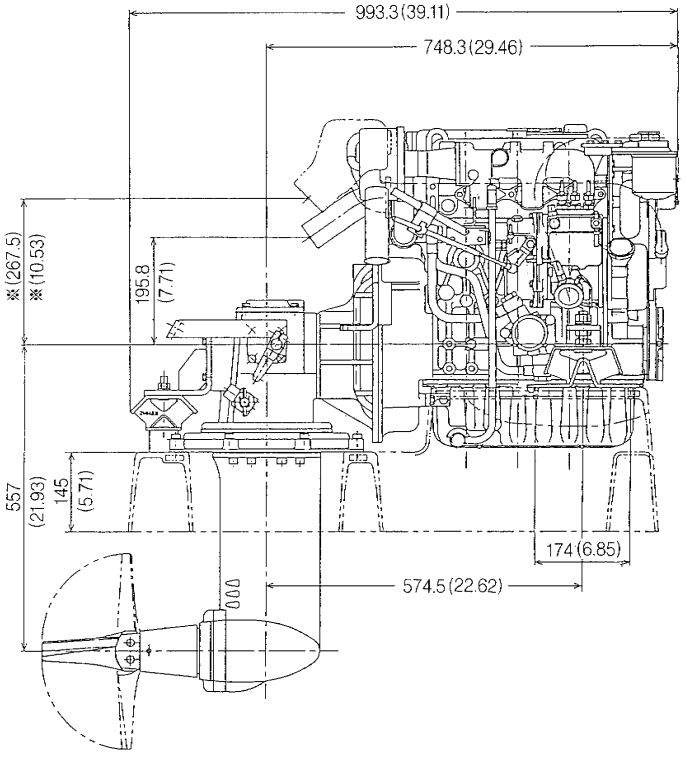


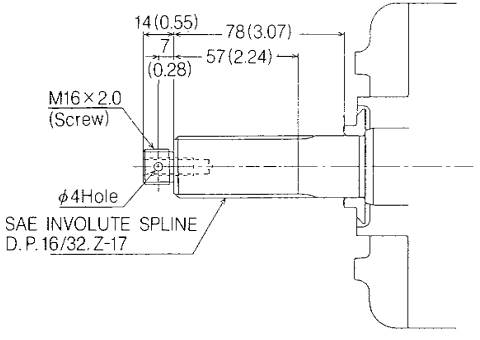
MODEL

3JH2CE × SD31

Outline







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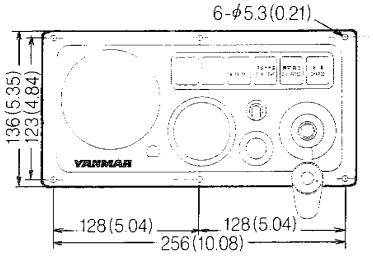

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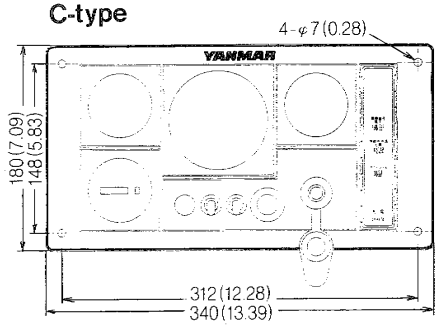
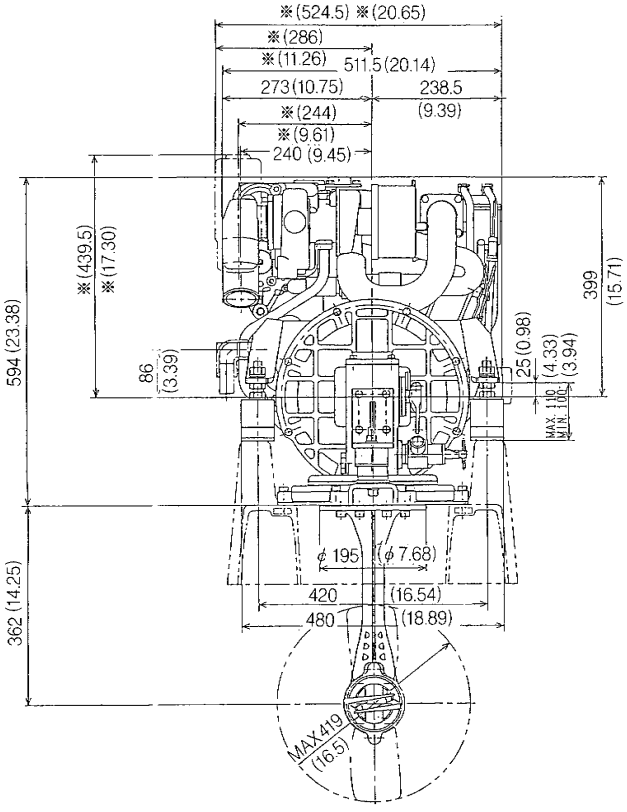
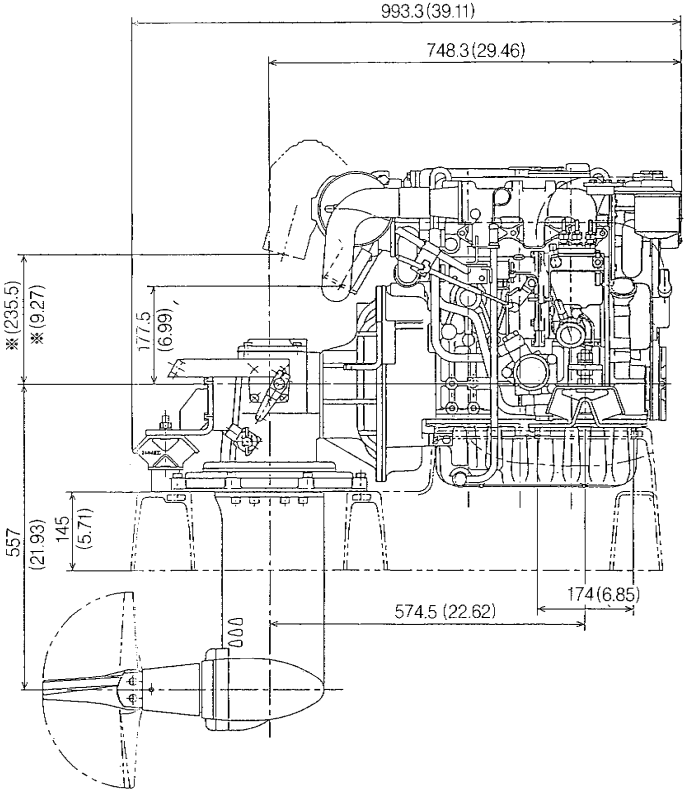


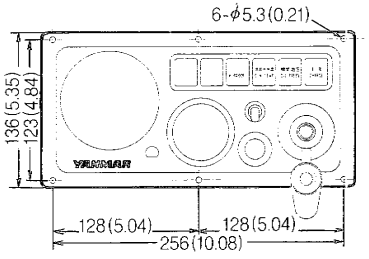
MODEL

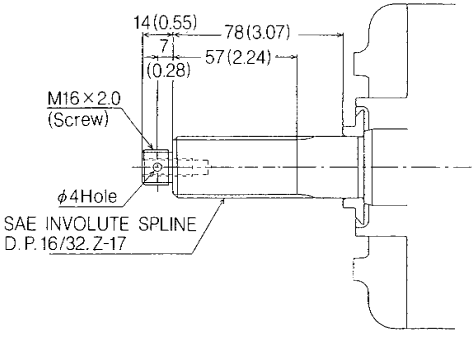
3JH2-TCE×SD31

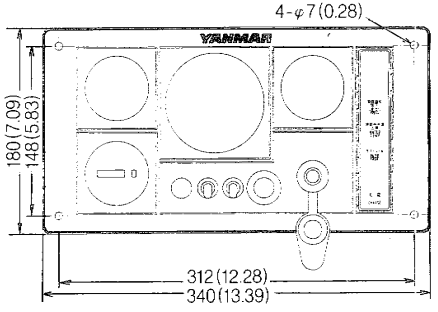
Outline







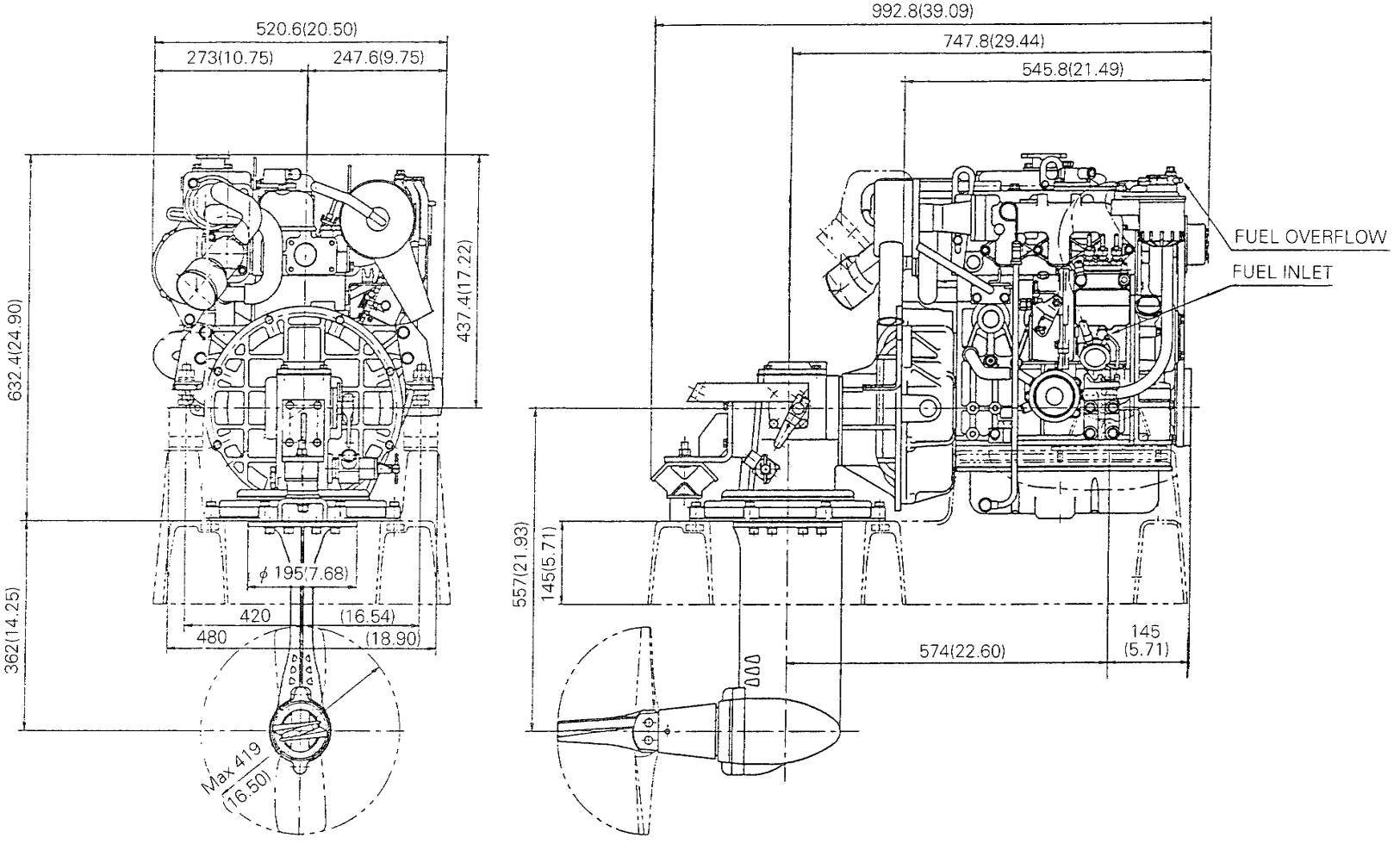




MODEL

3JH3CE×SD31

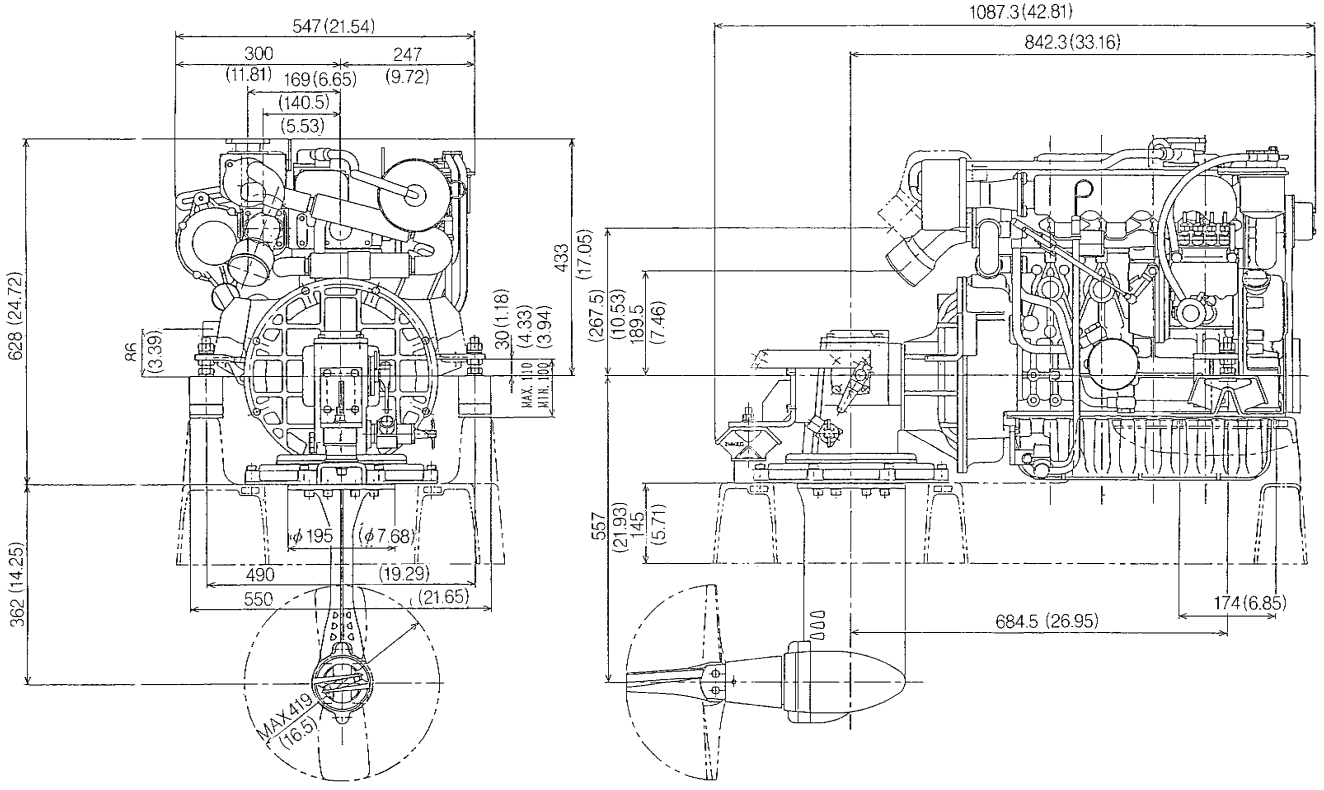
Outline

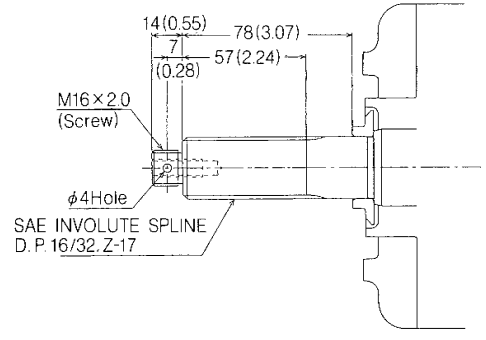


MODEL

4JH2CE × SD31

Outline





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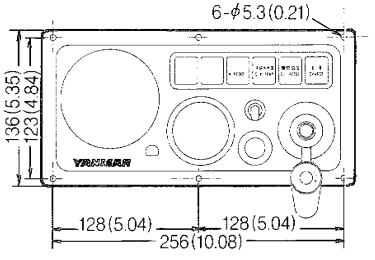

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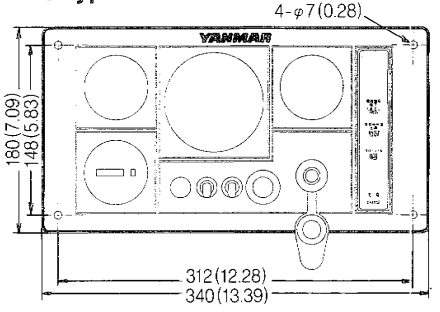
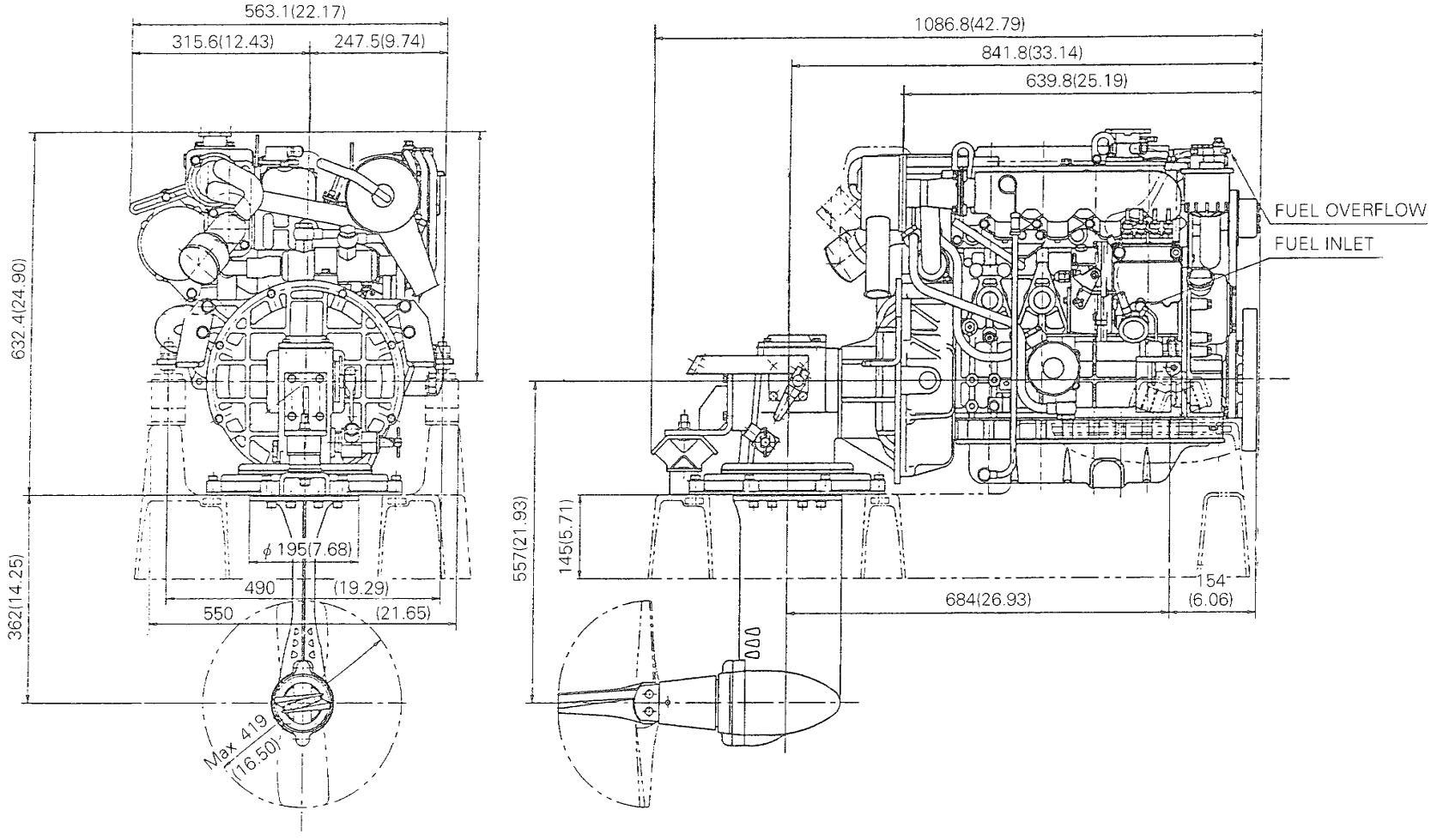


MODEL

4JH3CE×SD31

Outline

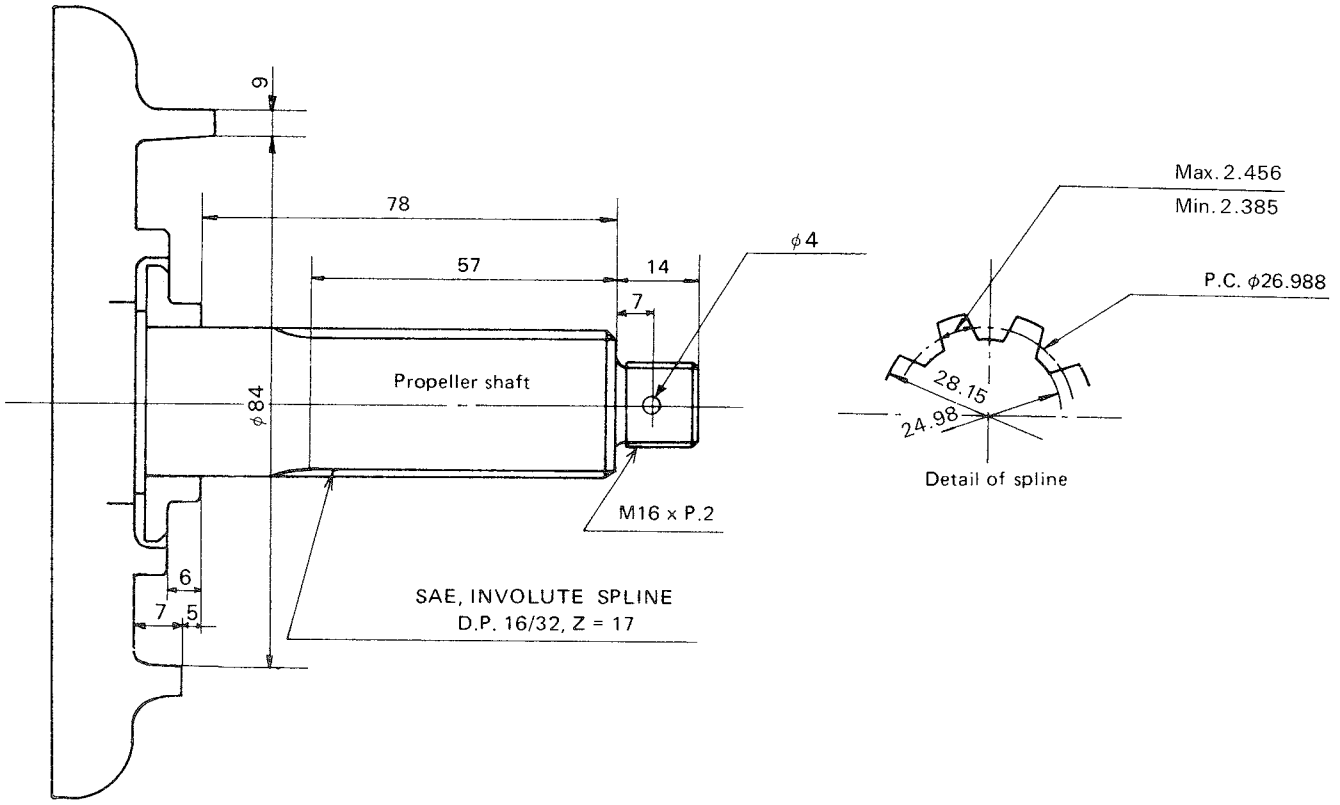


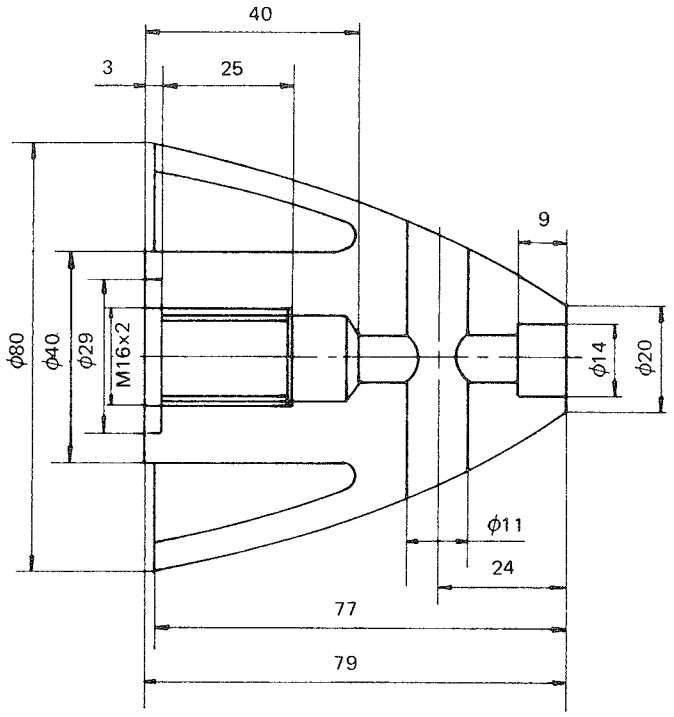
3. Specifications

Model		SD20	SD31
Reductinon gear system		Constant mesh gear with dog clutch	
Direction of rotation	Input shaft	Counter-clockwise viewed from stern	
	Propeller shaft	Counter-clockwise viewed from stern	
Reduction ratio	Ahead	2.64	2.31
	Astern	2.64	2.31
Propeller speed r.p.m. (at cont. rating)		1,289	1,558
Lubrication system		Oil bath type	
Lubrication oil capacity	Standard unit	2.2ℓ	
	Long-reach unit	2.5ℓ	
Dry weight		30kg	33kg
Remote-control device	Control head	Single control lever, Travel 70mm (2¾")	
	Cable	"MORSE" 33C (equivalent)	
Applicable engine model		1GM10C (9HP/3600 r.p.m.)	3JH2CE (38HP/3600 rpm)
		2GM20C (18HP/3600 r.p.m.)	3JH2-TCE (47HP/3600 rpm)
			3JH3CE (40HP/3800 rpm)
		3GM30C (27HP/3600 r.p.m.)	4JH2CE (50HP/3600 rpm)
			4JH3CE (52HP/3800 rpm)

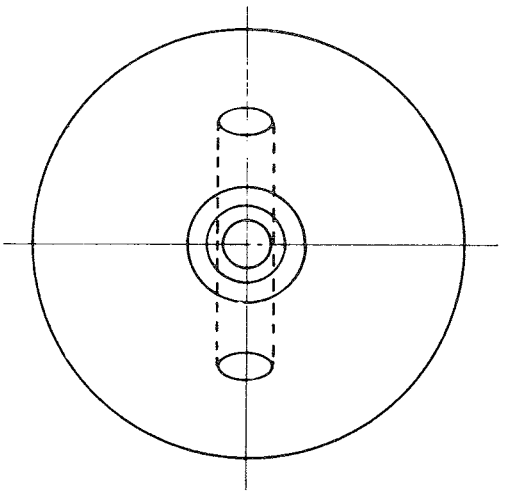
4. Parts Dimensions

4-1 Propeller Shaft & Nut



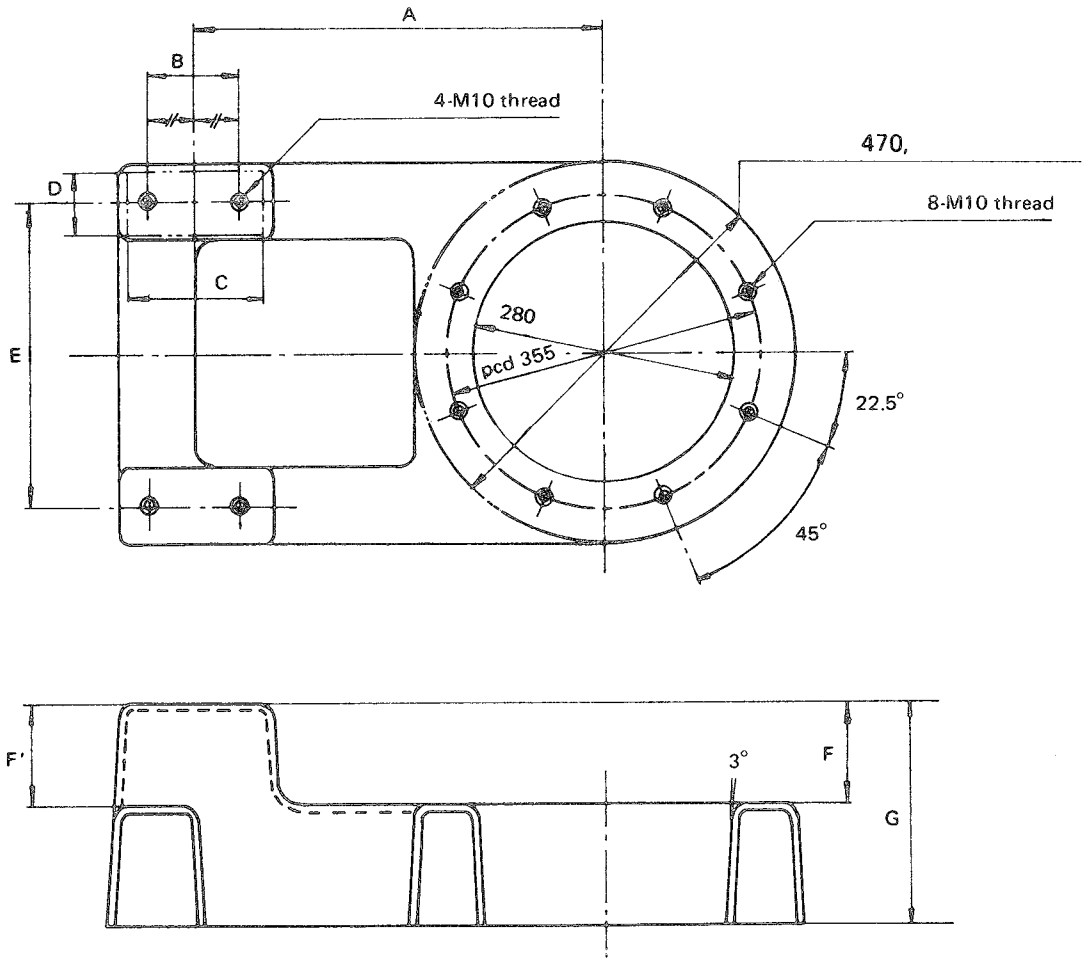


Nut for fixed propeller (Optional)



Unit : mm

4-2 Engine Bed



mm

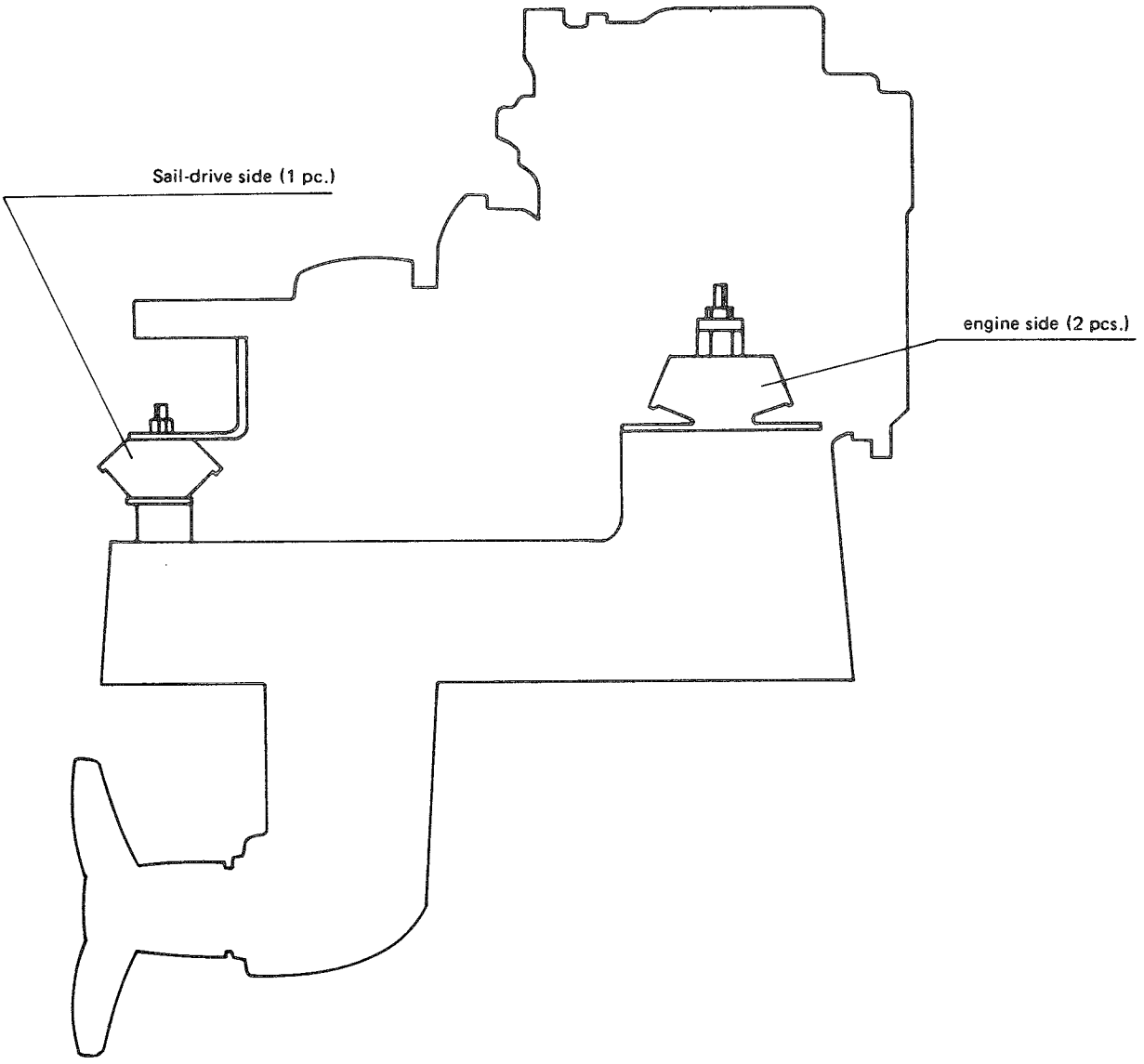
	A	B	C	D	E	F	F'	G
1GM10C	371.5±0.5	128	160	50	370	110	110	255
2GM20C	371.5±0.5	174	206	50	370	110	110	255
3GM30C	468.5±0.5	174	206	50	370	110	110	255
3JH2CE	574.5±0.5	174	206	50	420	115	115	260
3JH2-TCE	574.5±0.5	174	206	50	420	115	115	260
4JH2CE	684.5±0.5	174	206	50	490	120	120	265

[Note] Local supply parts.

Parts name	Q'ty/Unit	Remarks
Bolts, M10 x 30mm	4	Flex. mount/Eng. bed
Bolts M10 x 45mm	8	Seal flange
Spring washer, 10	12	
Plane washer, 10	12	

5. Flexible Mounting

Model	Engine side (2 pcs.) Mount, I.D. mark	Sail-drive side (1 pc.) Mount, I.D. mark
1GM10C x SD20	50	130
2GM20C x SD20	75	150
3GM30C x SD20	100	230
3JH2CE x SD31	200	230
3JH2-TCE x SD31	200	230
3JH3CE x SD31	200	230
4JH2CE x SD31	250	230
4JH3CE x SD31	250	230



6. Installation

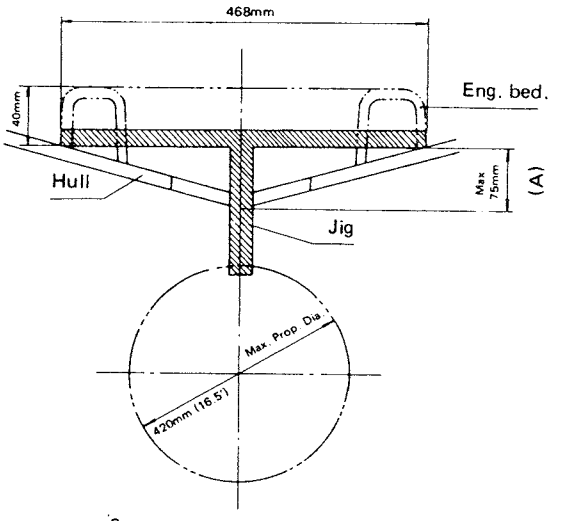
The Yanmar Sail-Drive is delivered separately from the eninge. When installing the unit, be sure to check that accessories and parts necessary for engine installation are correct. Parts and accessories included in the same packing as the Sail-Drive are as follows:

Sail-Drive (SD20 & 31) Part List

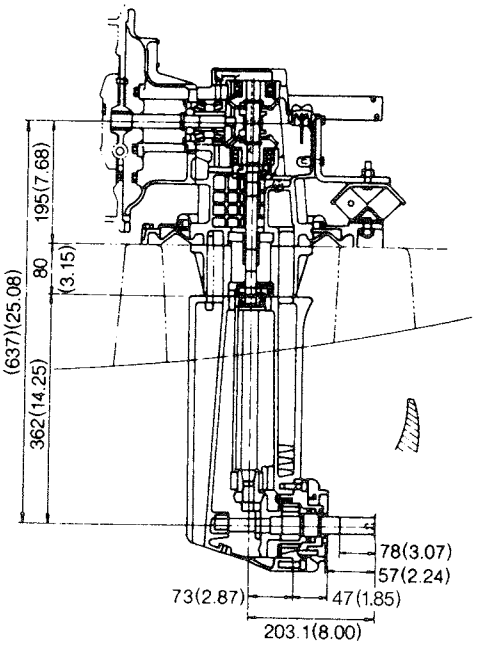
Parts Name	Q'ty/Unit	Remarks
Amplifier & wire harness	1	Rubber seal switch
Rubber protection	1	Drive unit & hull
Bolts with washer M8 x 30	8	Mounting flange (SD20)
Bolts with washer M8 x 25	8	Mounting flange (SD31)
Mark sheet	1	Mounting bed installation
Hexagonal spanner, 6	1	Tool
Hexagonal spanner, 8	1	Tool

Fitting for Engine Bed

Make an engine bed that fits the bottom of the boat. (A) dimension in the drawing below should be no greater than 75mm, as a larger dimension will result in the propeller being raised and it may foul the hull. To determine the proper engine bed size use the jig as illustrated below.

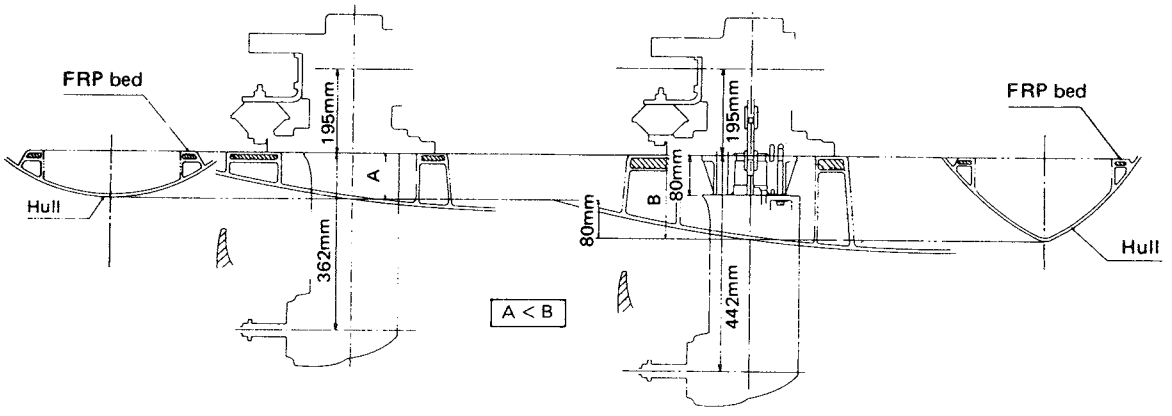


Long-reach Unit



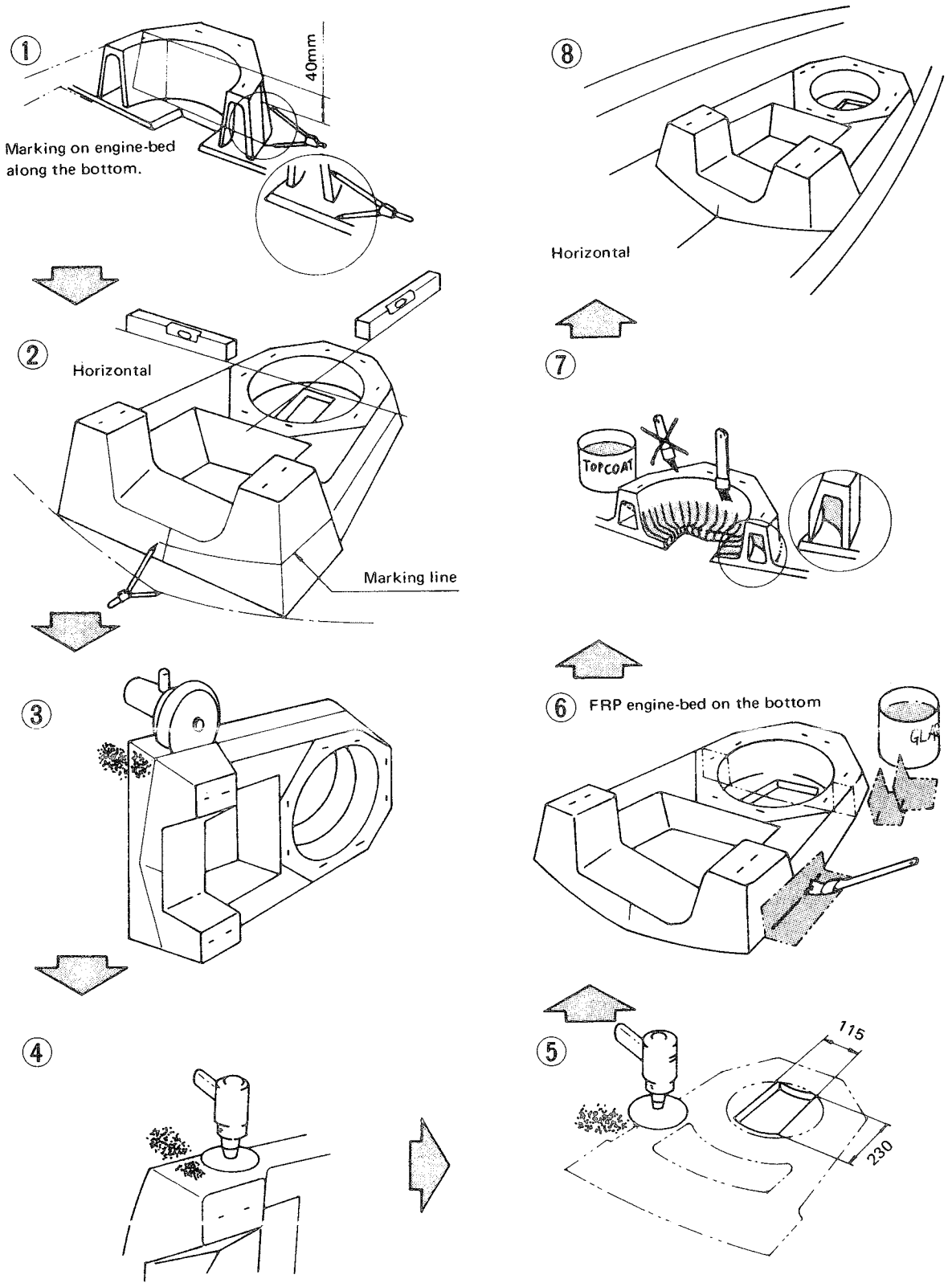
Long-reach Unit (Extension 80' Kit) Optional Parts

For installation in hulls with a high engine bed the SD20 & 31 includes extended shaft models with an 80mm longer reach than the standard units.



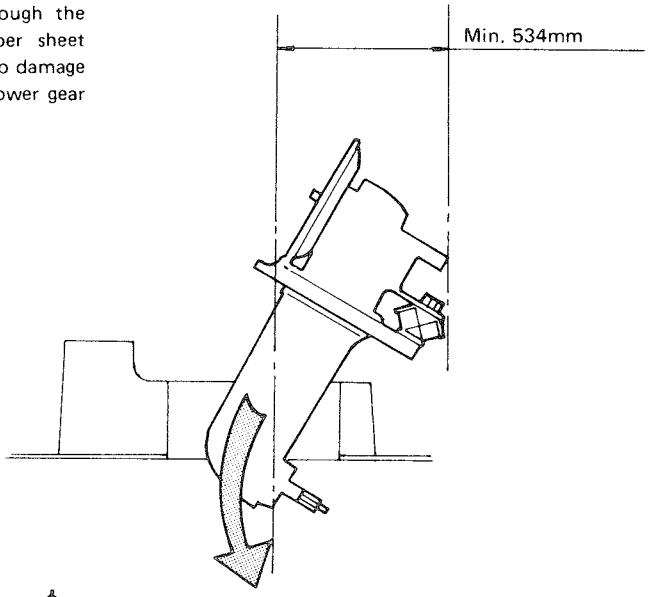
STANDARD UNIT **LONG-REACH UNIT**

6-1 Installation Procedures

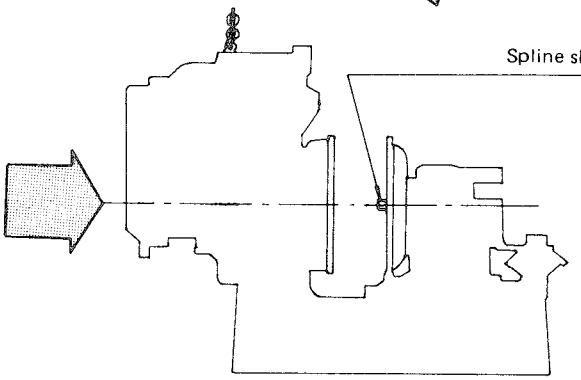


⑨

When making the sail-drive pass through the hull bottom, attach cloths or rubber sheet around the bottom hole in order not to damage the lower gear case. Otherwise, the lower gear case coating may be damaged.

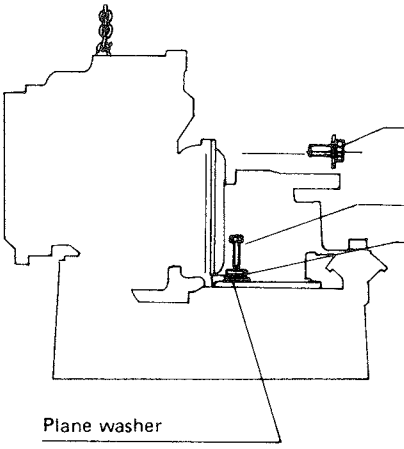


⑩



For the sail-drive, be sure to use the folding propeller which is provided with the rubber bushing. If a propeller without rubber bushing is used, the shaft, bearing, and gears of the sail-drive may be damaged.

⑪

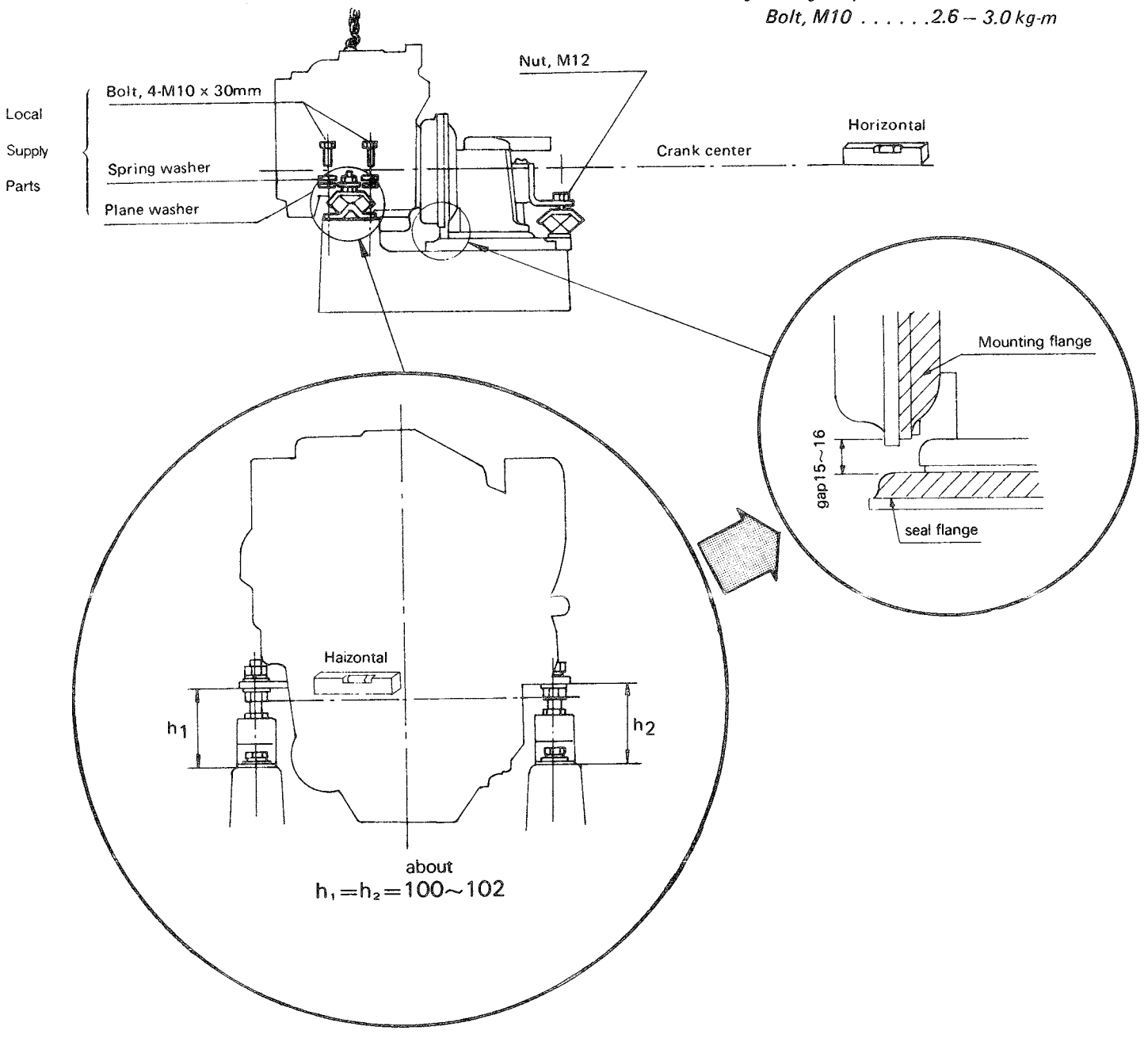


[Note]
Tightening torque:
Bolt, M8 . . . . . 1.1 – 1.5 kg-m
Bolt, M10 . . . . . 2.6 – 3.0 kg-m

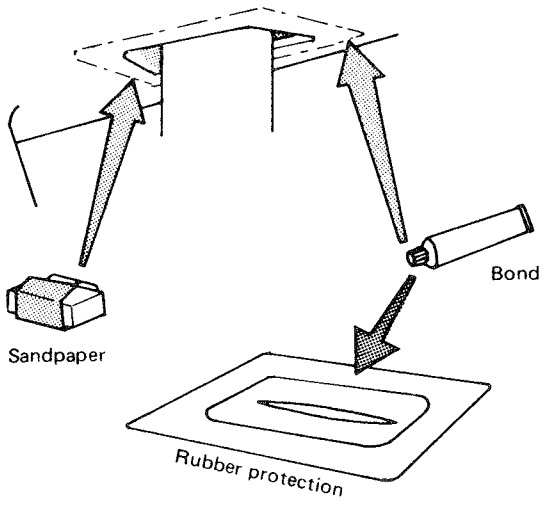
⑫ Adjust, mounting position.

Adjust the jack nuts of the vibration-proof rubber mounts (2 pcs.) at the engine side to obtain horizontality for the rear, forward, left and right directions.

[Note]
Tightening torque
Bolt, M10 . . . . . .2.6 – 3.0 kg-m



⑬



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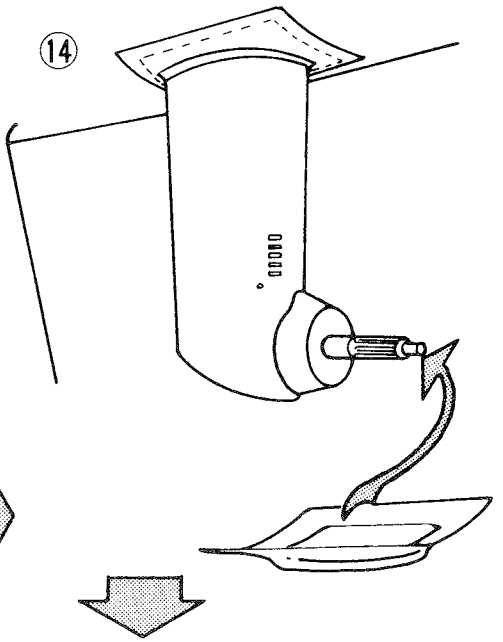
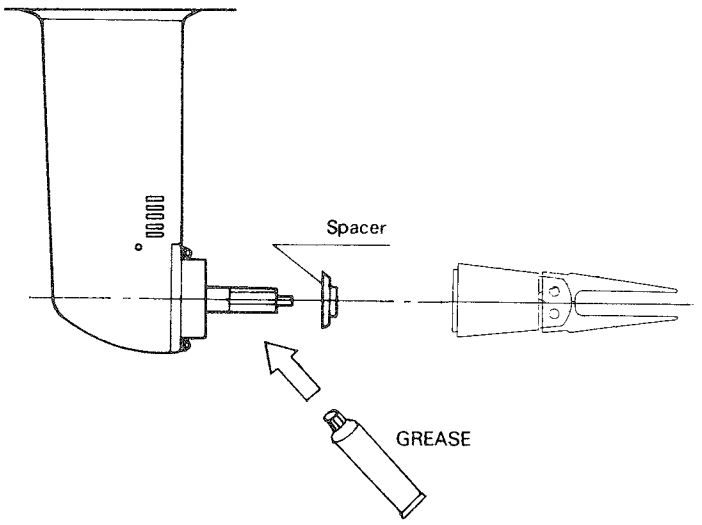


⑮ Fitting for Folding Propeller.



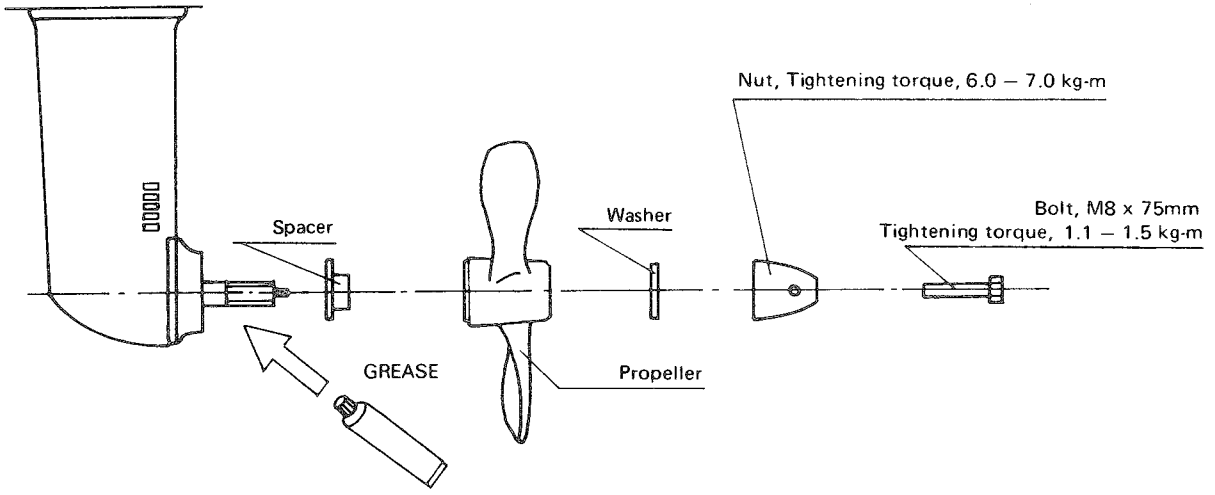
Caution for Installing "ALCO" Folding Propeller.
Refer to the "ALCO" Folding Propeller Installing Manual.

⚠ CAUTION

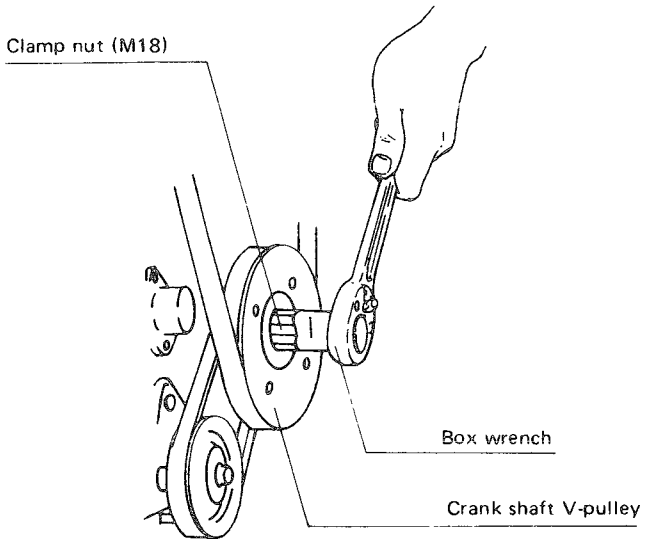
Rubber bushing (Folding propeller)

For the sail-drive, be sure to use the folding propeller which is provided with the rubber bushing. Do not use the propeller without the rubber bushing. If a propeller without rubber bushing is used, the shaft, bearing, and gears of the sail-drive are surely damaged.

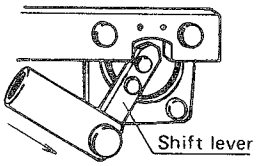
Fitting for Fixed Propeller. (2-blade)



Locking Procedure for Fixed Propeller Nut (Optional)
When tightening the nut at 6.0 ~ 7.0 kg-m. torque, move the shift lever to ahead and hole the crankshaft V-pulley clamp nut with wrench to stop the rotation.

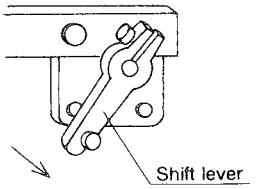


Old type : Serial No.0001~ 2128 for Model SD20



Ahead position

New type : Serial No. 2129 and after for Model SD20
Serial No. 0107 and after for Model SD30



⚠ CAUTION

Rubber bushing (Folding propeller)

For the sail-drive, be sure to use the folding propeller which is provided with the rubber bushing. Do not use the propeller without the rubber bushing. If a propeller without rubber bushing is used, the shaft, bearing, and gears of the sail-drive are surely damaged.

Recommended Propeller Size (Max.)

Model	Folding type Dia. x Pitch, mm (inch)	2-blede, fixed type Dia. x Pitch, mm (inch)
1GM10C	355 x 200 (14 x 8)	355 x 275 (14 x 10.75)
2GM20C	380 x 255 (15 x 10)	405 x 300 (16 x 11.75)
3GM30C	405 x 305 (16 x 12)	420 x 335 (16.5 x 13.25)
3JH2CE	405 x 305 (16 x 12)	420 x 335 (16.5 x 13.25)
3JH2-TCE	420 x 340 (16.5 x 13.5)	420 x 370 (16.5 x 14.5)
3JH3CE	405 x 305 (16 x12)	420 x 335 (16.5 x 13.25)
4JH2CE	420 x 340 (16.5 x 13.5)	420 x 370 (16.5 x 14.5)
4JH3CE	420 x 340 (16.5 x 13.5)	420 x 370 (16.5 x 14.5)

⚠ CAUTION

Precautions on matching of the propeller

(1) Be sure to confirm a matching of the propeller in a sea trial.

(2) Execute a propeller matching on the basis of the propeller shaft rated output (continuous rating at propeller shaft). 95% of the engine rated output (continuous rating at crankshaft) becomes the propeller shaft rated output (continuous rating at propeller shaft).
Note: The propeller shaft output becomes 95% of the engine rated output (continuous rating at crankshaft) in consideration of mechanical efficiency 95% of the Sail-drive.

(3) In the case of propeller calculation, further add 5% at minimum as the sea margin to the aforementioned matching point. That is, 95% of the propeller shaft rated output (Continuous rating at propeller shaft) becomes the best propeller matching.
Note about sea margin: In actual navigation, there are an increase in resistance due to the waves, wind and fouling of the hull and moreover a drop in the efficiency due to fouling of the propeller. Consequently, in the case of propeller calculation, it is necessary to allow the engine output to have some margin. For that reason, it is necessary to add the sea margin of 5% at minimum.

6-2 Cooling Water Hose Piping

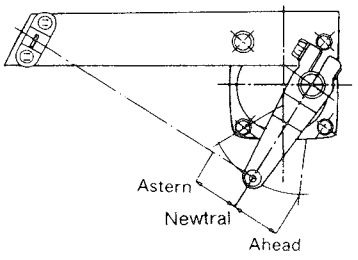
Attach the end of the cooling water hose to the cooling water cock on the upper case side of the Sail-Drive and clamp it with a hose clamp. Attach the other end of the hose to the cooling water pump on the engine side and clamp it with hose clamp. Cooling water hoses and hose clamps are included in the engine packing as the engine; the length of the cooling water hose is shown below (A).
Cut the hose to the proper length for installation.

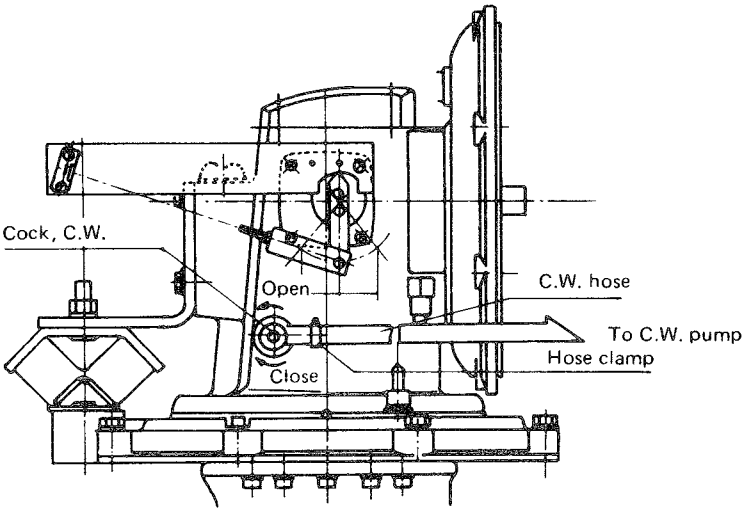
⚠ CAUTION

Do not make the hose too long, and avoid bending the piping.

Old type : Serial No.0001～ 2128 for Model SD20

New type : Serial No. 2129 and after for Model SD20
Serial No. 0107 and after for Model SD30





Detail of Sea Water Hose Connection

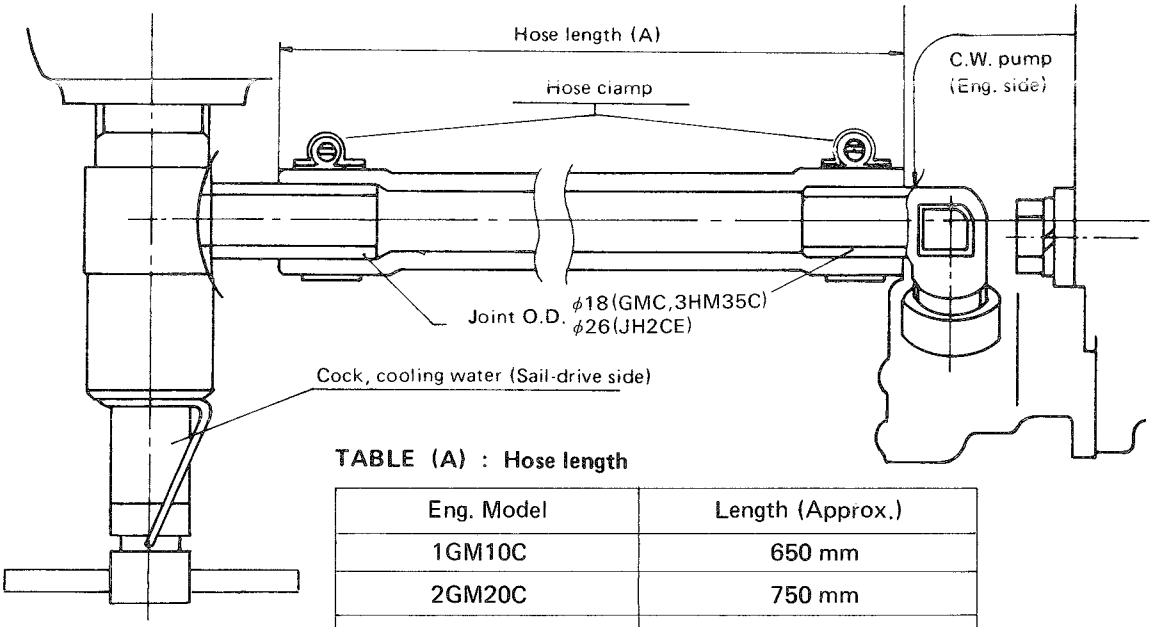


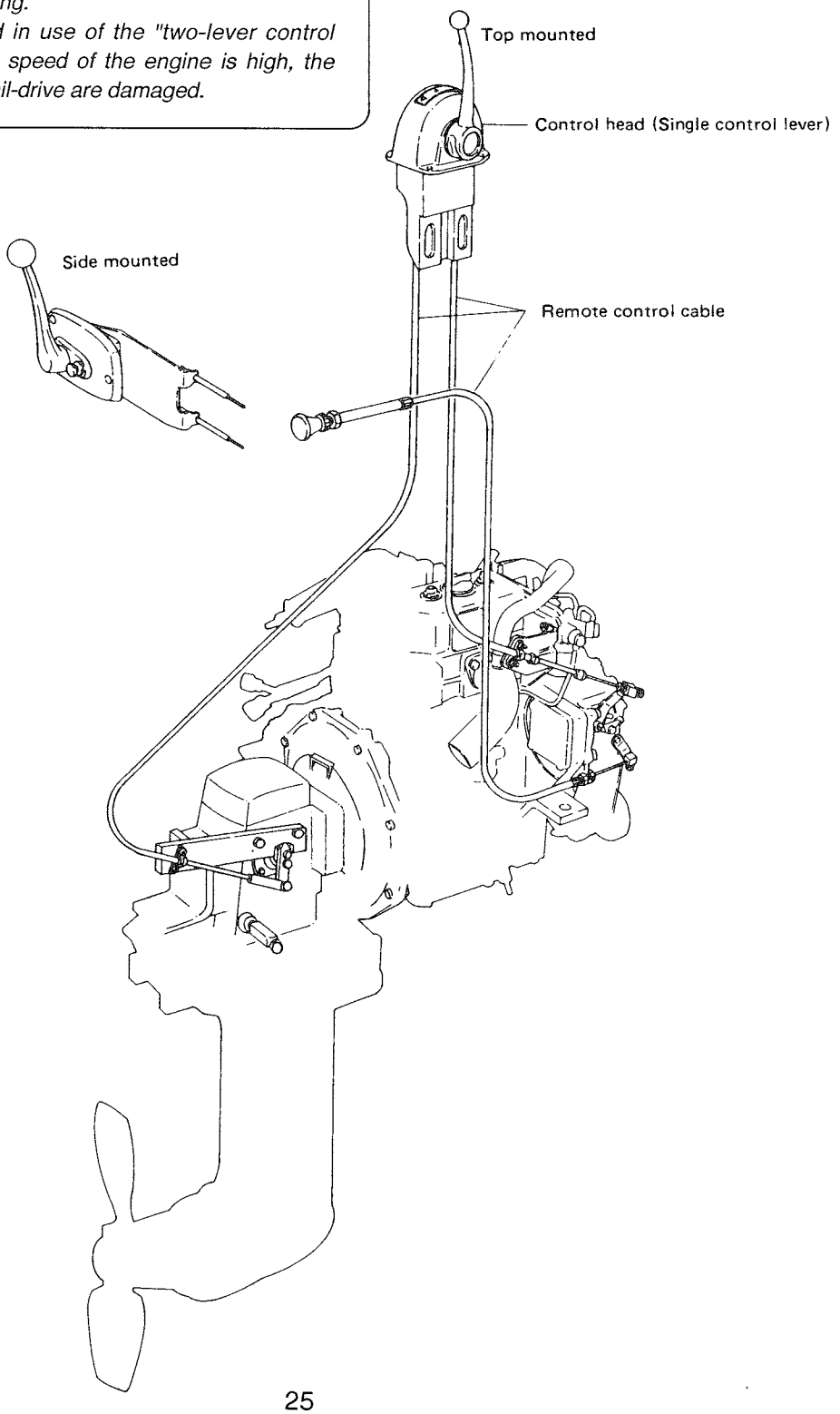
TABLE (A) : Hose length

Eng. Model	Length (Approx.)
1GM10C	650 mm
2GM20C	750 mm
3GM30C	850 mm
3JH2CE	1300 mm
3JH2-TCE	1300 mm
3JH3CE	1300 mm
4JH2CE	1300 mm
4JH3CE	1300 mm

6-3 Remote Control System

⚠ CAUTION

Use of the "two-lever control head" is prohibited. Be sure to use the "single-lever control head" to prevent a high-speed engagement from occurring.
If the clutch is engaged in use of the "two-lever control head" when the rotating speed of the engine is high, the shaft and gears of the Sail-drive are damaged.



6-3-1 Connecting the remote control cable

Connect the cable (Morse 33C or equivalent) with a spring joint or pivot. Crank the engine slowly, and while shifting the control lever of the control head through Neutral – Astern – Ahead – Neutral, confirm the followings:

(1) Are the lever engagements to astern and ahead smooth ?

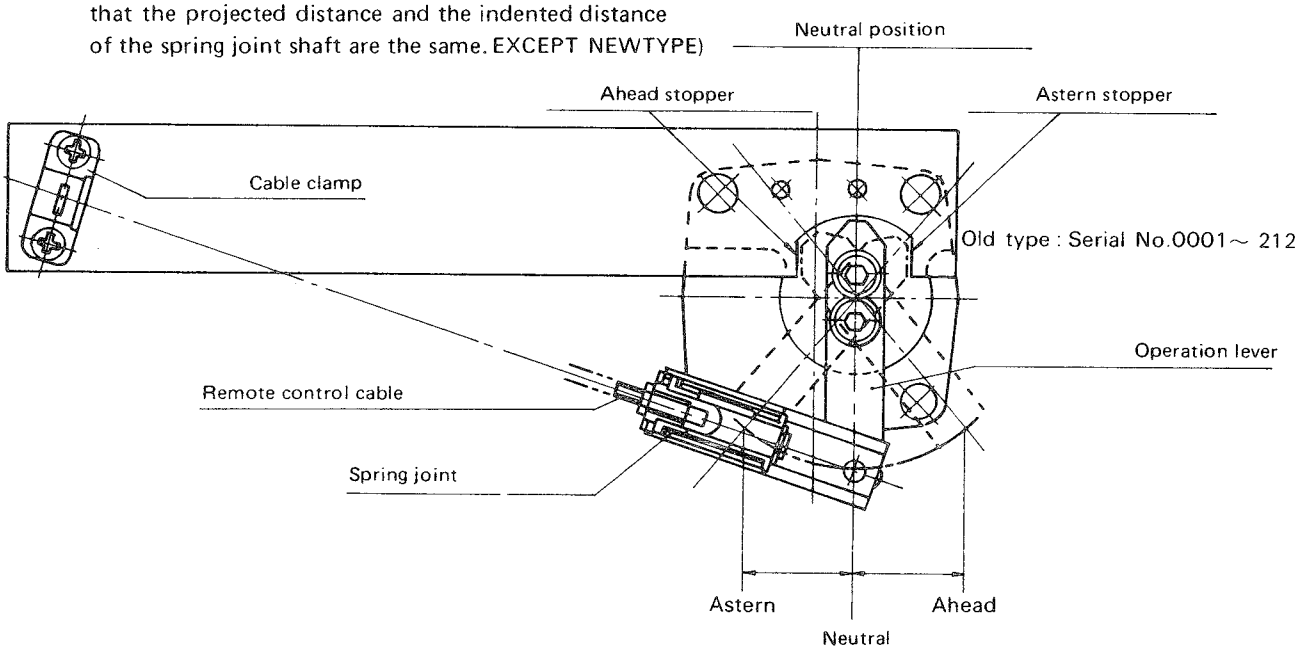
(2) Does the stopper work at both astern and ahead ?

(3) When the stopper is working, does the shaft of the spring position project, or is it indented at the astern position ?
(The spring joint absorbs shocks on astern and ahead engagements; adjust the cable connection so that the projected distance and the indented distance of the spring joint shaft are the same. EXCEPT NEWTYPE)

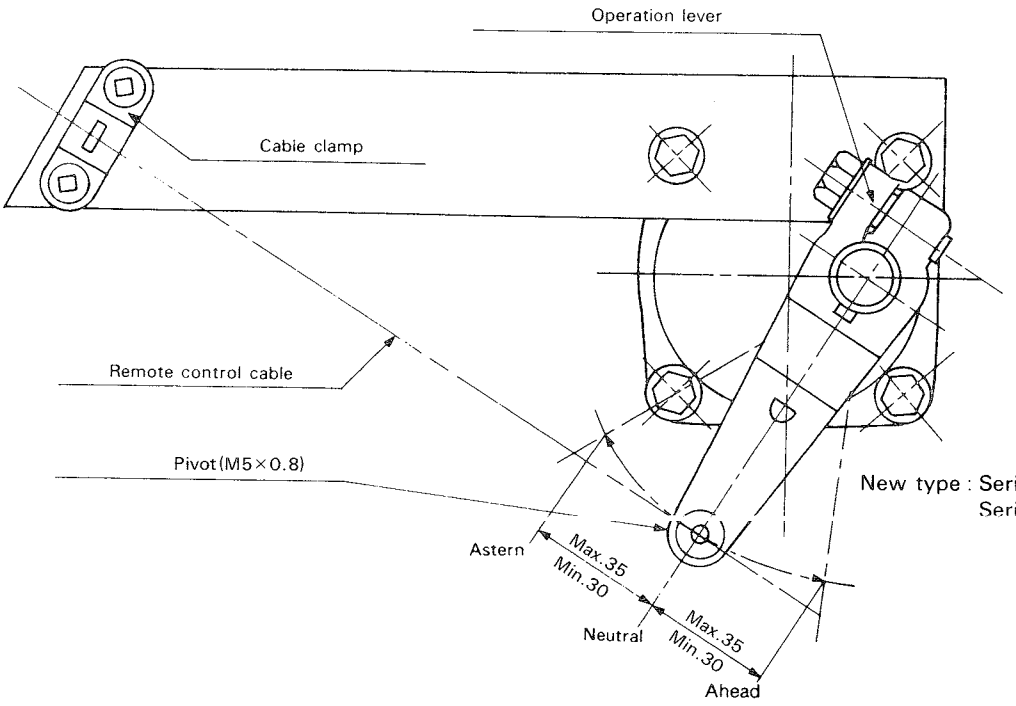
⚠ CAUTION

1 For the control head, use single control lever 70mm (2¾") travel wire.

2 When the cable is not connected correctly, additional strength is required to engage and disengage the operation lever, and insufficient engagement of the lever or malfunctioning of the stopper may occur.



Old type : Serial No.0001~ 2128 for Model SD20

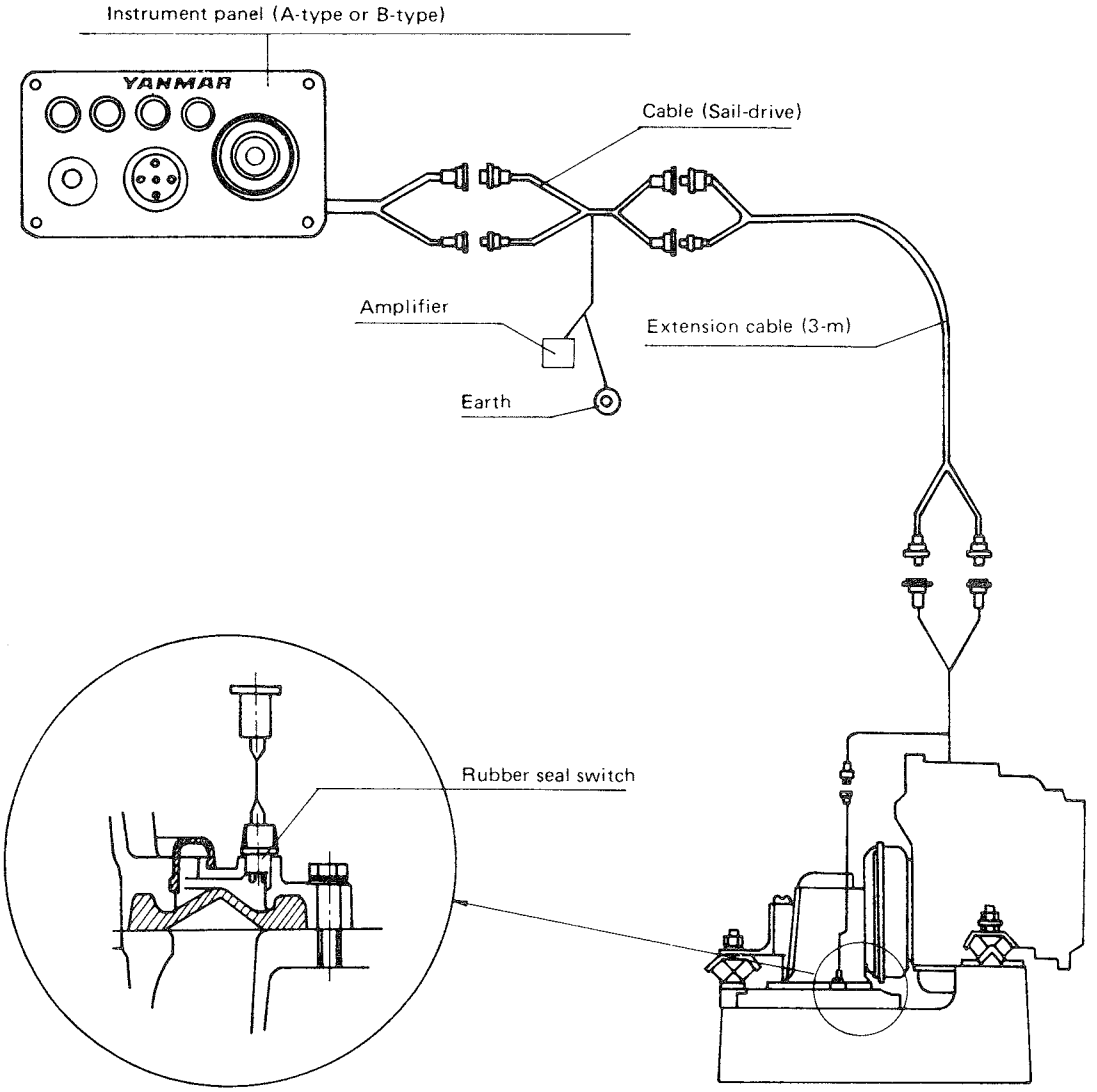


New type : Serial No.2129 and after for Model SD20
Serial No.0001 and after for Model SD31

6-4 Electrical Wiring

(1) For the Sail-Drive rubber seal switch, connect the black, white and red wires on the engine side.

(2) Connect the amplifier coupler between the wire-harness coupler and extension cable coupler on the engine side.



YANMAR "SAIL-DRIVE"

Model: SD20 & 31

OPERATION MANUAL

Applicable Engine Model: 1GM10C, 2GM20C, 3GM30C, 3JH2CE, 3JH2-TCE, 4JH2CE

1. Selecting Lubricating Oil

(1) Choice of lube oil

The selection of lube oil is very important to a Sail-drive. If an unsuitable oil is used, or oil change is neglected, it may result in damage, and a shorter Sail-drive life. When selecting the lube oil, it must be one of the following.

(2) Kind of lube oil

Use only oil of quality "GL4" or "GL-5" in the API service, and SAE No.90 or 80W90. (Except Model: SD20x1GM10C)

Use only oil of quality "cc" in the API service, and SAE No. 10W30.

(Applicable Model: SD20x1GM10C)

(3) Lube oil viscosity

The viscosity of the lube oil greatly influences Sail-drive performance.

Supplier	Brand Name	API Service	SAE No.
SHELL	Shell Spilax oil EP 90	GL-4	90
SHELL	Shell Spilax oil HD 90	GL-5	90
CALTEX	Multipurpose thuban EP	GL-4 – GL-5	90
MOBIL	Mobilub HD 80W-90	GL-5	80W-90
ESSO	Esso gear oil GP 90	GL-4	90
ESSO	Esso gear oil GX 90	GL-5	90

2. Starting the New Sail-Drive for the First Time

(1) Filling with lubricating oil

a) Remove the lube oil supply port (yellow cap) and supply approved lube oil.

b) Check the amount of lube oil by inserting the dip-stick as far as possible. The oil level should reach the upper mark on the dipstick.

c) Volume of lube oil reaching the upper mark on the dipstick.

⚠ CAUTION

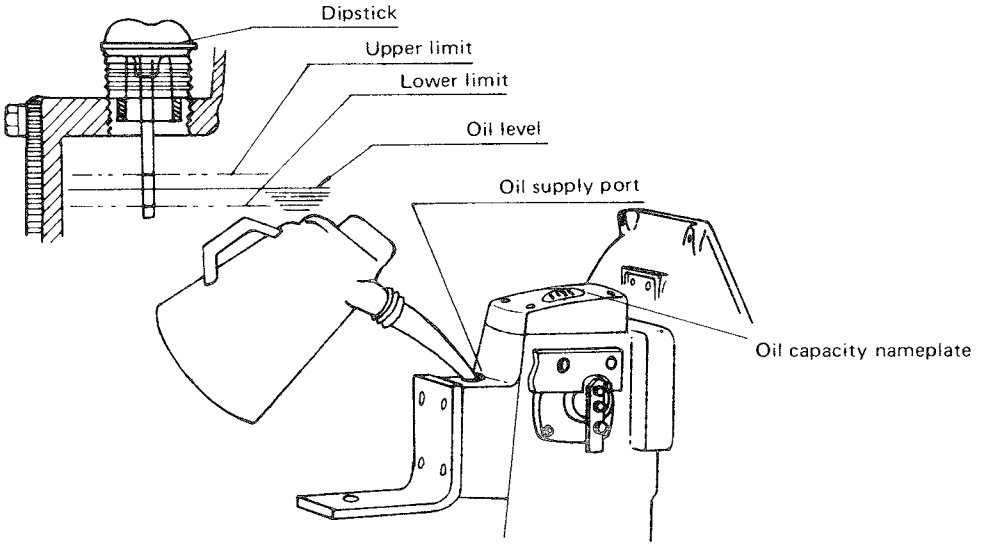
The lube oil capacity of the standard unit is different from that of the long reach unit. Confirm the capacity by means of the lube oil capacity nameplate of the respective top covers.

⚠ CAUTION

Since it takes about 10 minutes to fill up the Sail-drive with lube oil owing to its construction, check againt the supplied oil quantity by using the dipstick 15 minutes after completion of supply the specified quantity of oil.

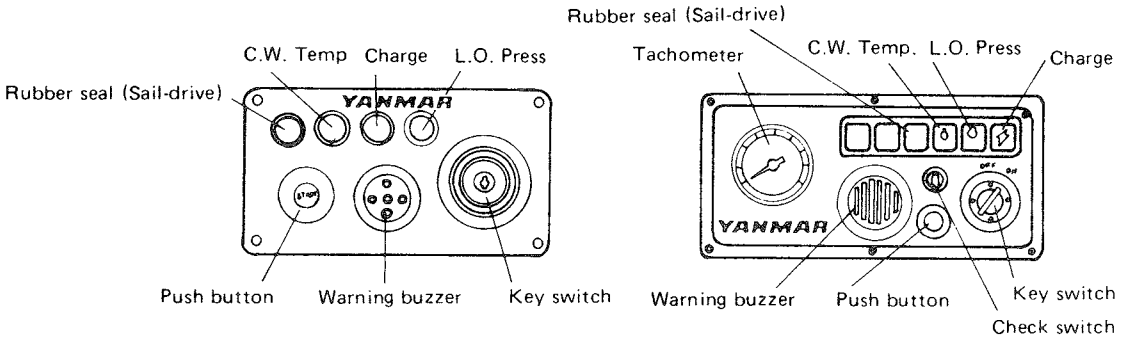
Sail-Drive Model: SD20 & 31. . . . . Lube. oil capacity:

Standard unit	2.2ℓ
Long-reach unit	2.5ℓ



(2) Check of instrument panel alarm system:

Turn on the battery switch. Then the key in the "ON" position and check the lamps on the panel (with the engine off).



[A-type] [B-type]

a) Lube oil warning lamp should be lit.

b) Cooling water temperature warning lamp should be out. (for small type panel; A-type only)
For the large type panel (B-type), raise the CHECK switch "ON" to see if the cooling water temperature warning lamp lights.

c) Charging warning lamp should be lit.

d) Rubber seal lamp should be out.

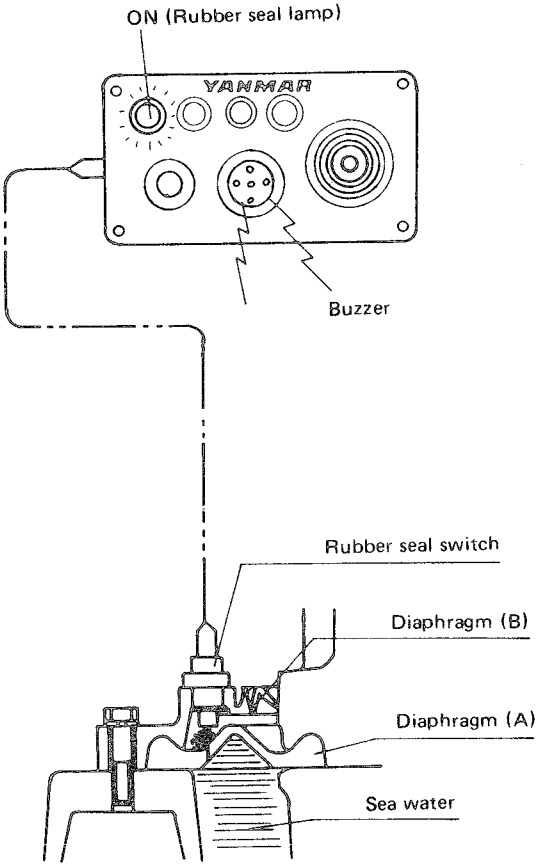
e) The warning buzzer should sound.

⚠ CAUTION

All the above alarm signs will continue until you push the starting button or turn the key off.

⚠ WARNING

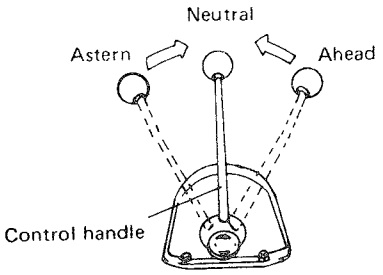
The rubber seal alarm lamp warns of sea water entering the boat. The watertight structure of the Sail-Drive is the dual type. Even if the rubber diaphragm (A) is damaged and sea water enters, the rubber diaphragm (B) prevents it from entering the inboard. The rubber seal switch between the rubber diaphragms (A) and (B) works the warning buzzer and lights the rubber seal lamp on the instrument panel. If this happens, stop the engine and quickly return to the nearest port under sail for repairs.

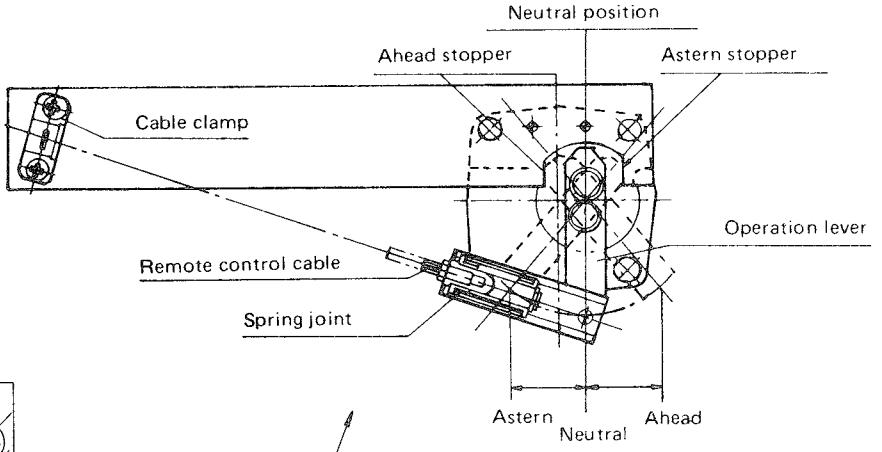


(3) Remote-Control Device Check

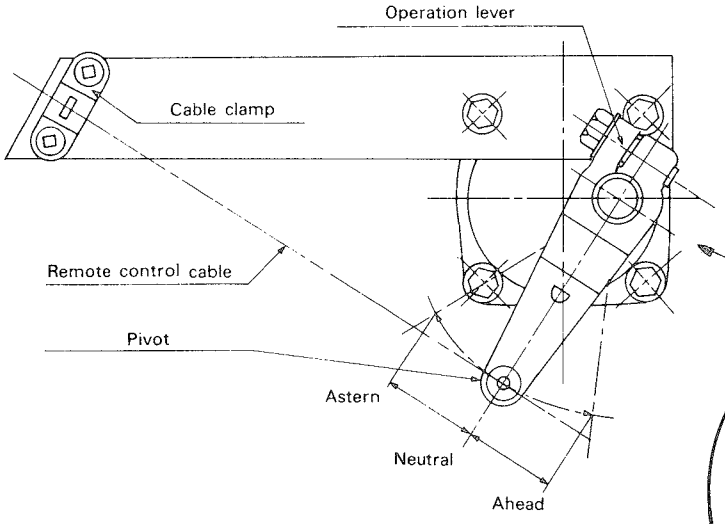
While cranking the engine slowly, shift rapidly the control handle of the remote-control head (single lever control) through Neutral - Ahead - Neutral - Astern. If a shift operation is done slowly, the tip of the clutch dog is worn away by being hammered, and consequently the clutch fails to engage. Confirm that the operation lever of the Sail-Drive moves smoothly to Ahead, Astern and Stopper.

Because the Sail-Drive uses a dog clutch, the clutch does not engage and makes the operation lever unusable until the stopper position is reached if the engine is not rotated. In this case, be sure to crank the engine in the following manner.

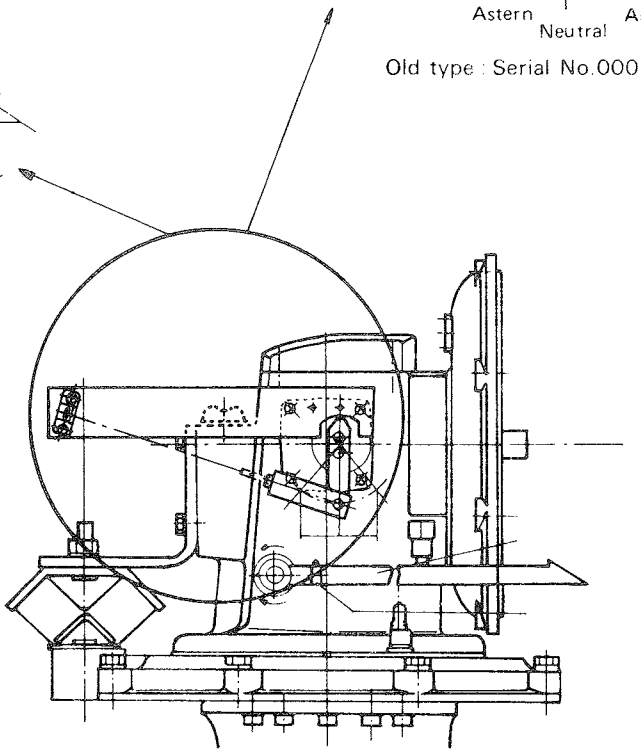




Old type : Serial No.0001~2128 for SD20



New type : Serial No.2129and after for SD20
Serial No.0001and after for SD31



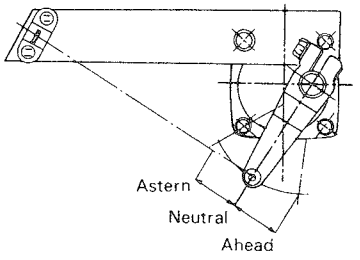
3. Method of Operation (Engine Cooling Water)

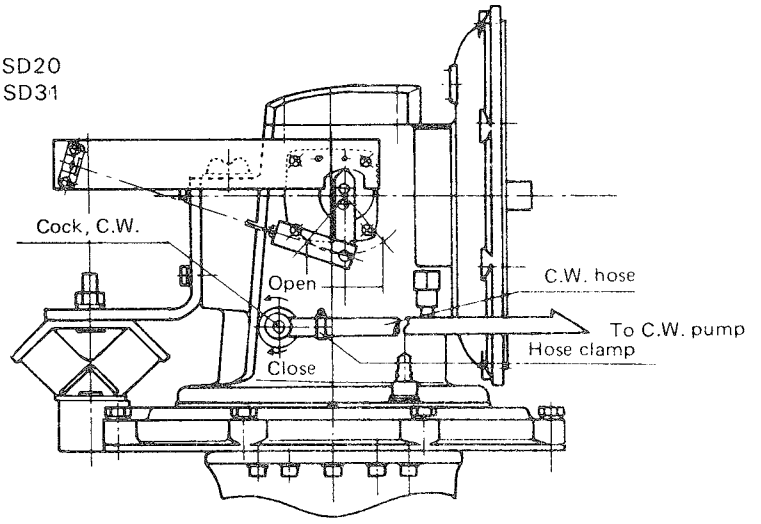
Opening or closing the cooling water system of the Sail-Drive Set Engine is done by the cooling water cock fixed on the upper case of the Sail-Drive. Be sure to open the cock and confirm that the C.W. has suction by cranking the engine before starting the boat. The cooling water passes through the Sail-Drive case, cools the engine by the cooling water pump, and is then discharged.

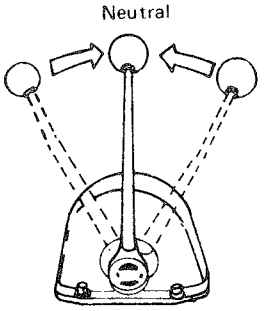
[Note 1] For other items, refer to the operation manual
[Note 2] When sailing, set the remote control lever in neutral.

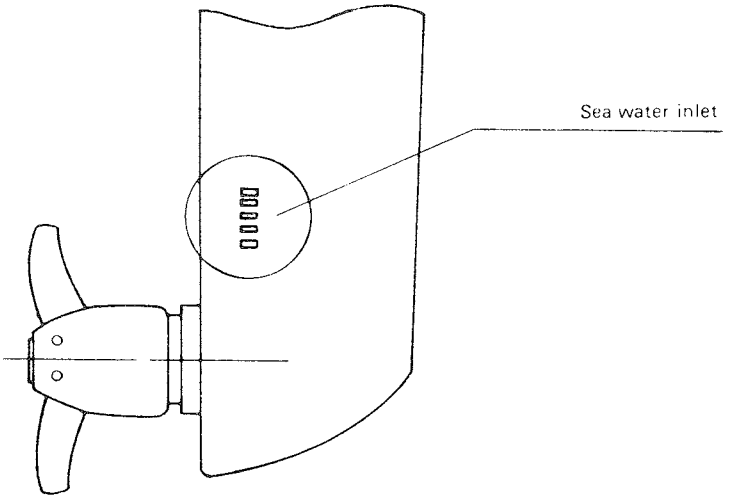
Old type : Serial No.0001～2128 for Model SD20

New type : Serial No. 2129 and after for Model SD20
Serial No. 0001 and after for Model SD31



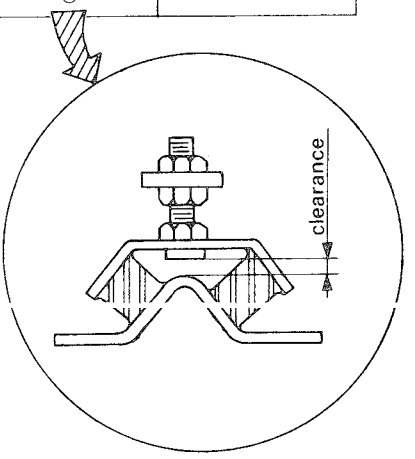






4. Periodical Inspections and Maintenance

	Every-day	50 hrs. or after month	Every 100 hrs.	Every 1 year	Every 2 years
Lubricating Oil (1) Check oil level : fill	Before operation ○				
(2) Change lube. oil		First ○	○		
Cooling Water (1) Open/close cooling water cock	Before / after operation ○				
(2) Clean cooling water suction hole				○	
(3) Drain cooling water	After operation ○				
Remote Control System (1) Inspect remote control device		First ○	○	Replace if the thickness is less than 10 mm.	Serial No. 2129 and after for SD20, and No. 0001 and after for SD31.
(2) Inspect and replace clutch shifter				○	
Anti-Corrosive Zinc (1) Inspect and replace anti-corrosive zinc			Replace if wear is more than 50% ○		
Lower Case (1) Repair case coating				○	
Boat Bottom Water-tightness (1) Inspect and replace rubber diaphram seal ring				Inspect ○	Replace if any cracks ○
(2) Inspect seal sensor				○	
Flexible mount (1) Ihcpect and replace of mounting height.				Replace if clearance became nothing. or used 1,000Hrs. ○	



(1) Lubricating oil system

a) Check the oil level before every operation.

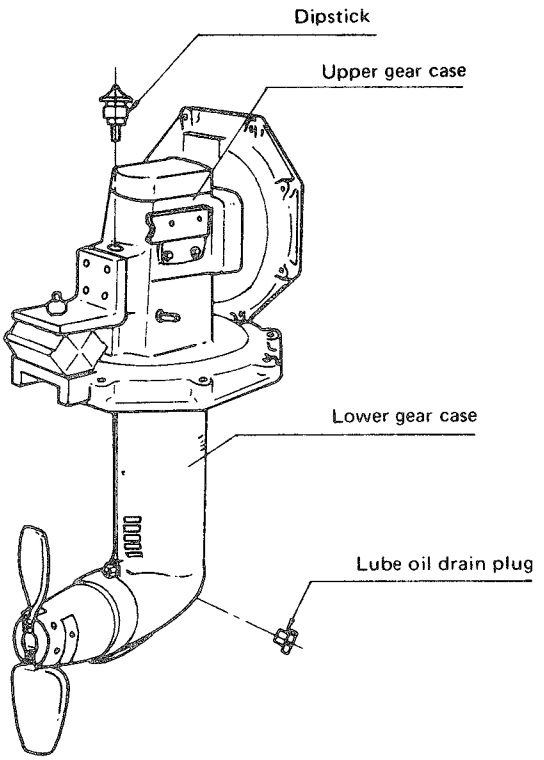
b) Change the oil after the first 50 hours of operation or after long storage, and every 100 hours of operation thereafter. Lube oil should be changed while the engine is still warm.

Change oil in the following way:

1. Put the boat hull on a block.
   Drain the oil by removing the lower gear case drain plug, and the upper gear case oil dipstick.

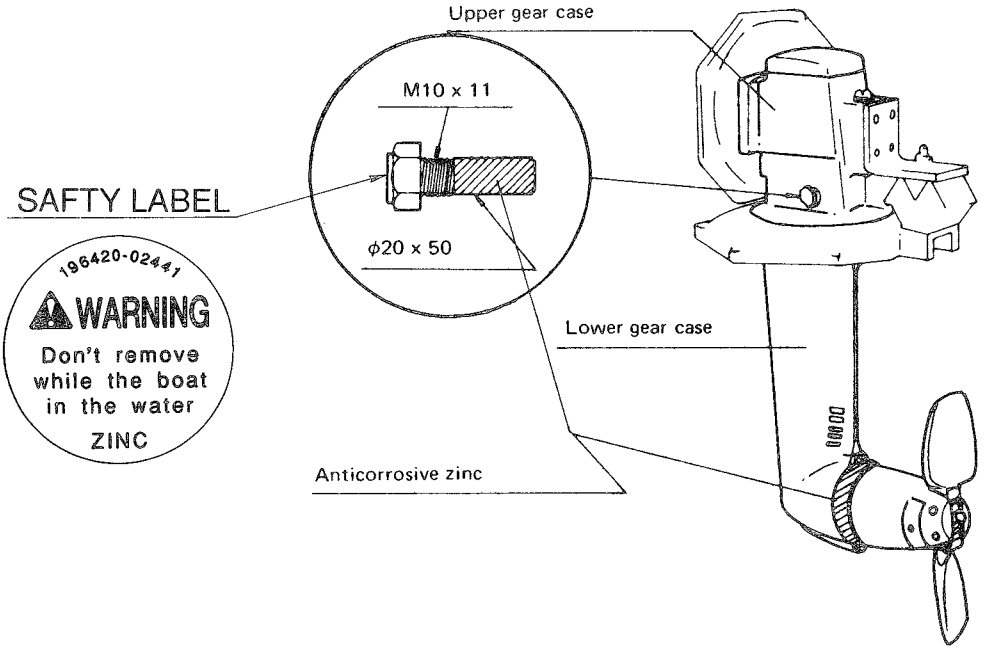
⚠ WARNING

Let the drive unit cool at least 5 minutes after operation before removing the oil drain plug. Hot oil could spurt out forcefully if the drain plug is removed from the drive unit immediately after operation.



(2) **Anticorrosive Zinc**

To prevent corrosion of the sail-drive body by sea (lake) water, replace the anticorrosive zinc at the earliest time of every 100 hours of operation, once every six months or when it becomes a half of the original volume (size).



Anticorrosive zinc is provided on the upper and lower gear case. To inspect and replace the anticorrosive zinc on the lower gear case, the boat hull must be put on a block.

⚠ WARNING

Do not remove the plug (include Anticorrosive Zinc) while the boat in the water.

(3) **Rubber diaphragms (A) and (B)**

The rubber diaphragms (A) and (B) of the Sail-Drive are important parts for the hull and crew safety. Since rubber degenerates during use, be sure to replace them every two years. (Boat hull must be lifted onto a block) To replace consult your Yanmar dealer.

(4) When the boat hull is raised onto a block, inspect the following:

a) Remove deposit from the lower gear case

Remove sea weed, sea shells, and marine growth from the lower gear case. Be sure to remove deposit completely around the cooling water intake since the engine may overheat if the intake amount is insufficient.

b) Repairing damaged membrane

The membrane of the lower gear case which is always in sea water may be damaged when hitting floating objects in the sea, or when having deposit removed from it. Do not use paint containing copper-derivatives.

c) Inspecting anticorrosive zinc

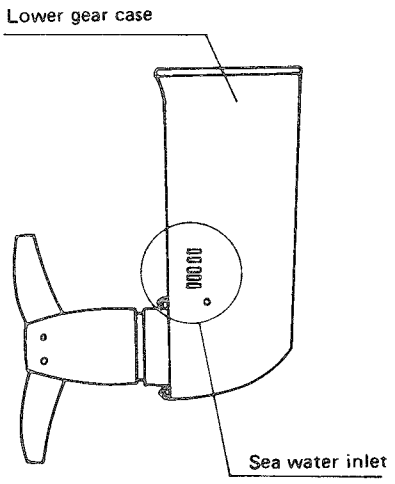
Since anticorrosive zinc can not be inspected except when the boat hull is raised onto a block, be sure not to forget to inspect it.

d) Inspecting the folding propeller

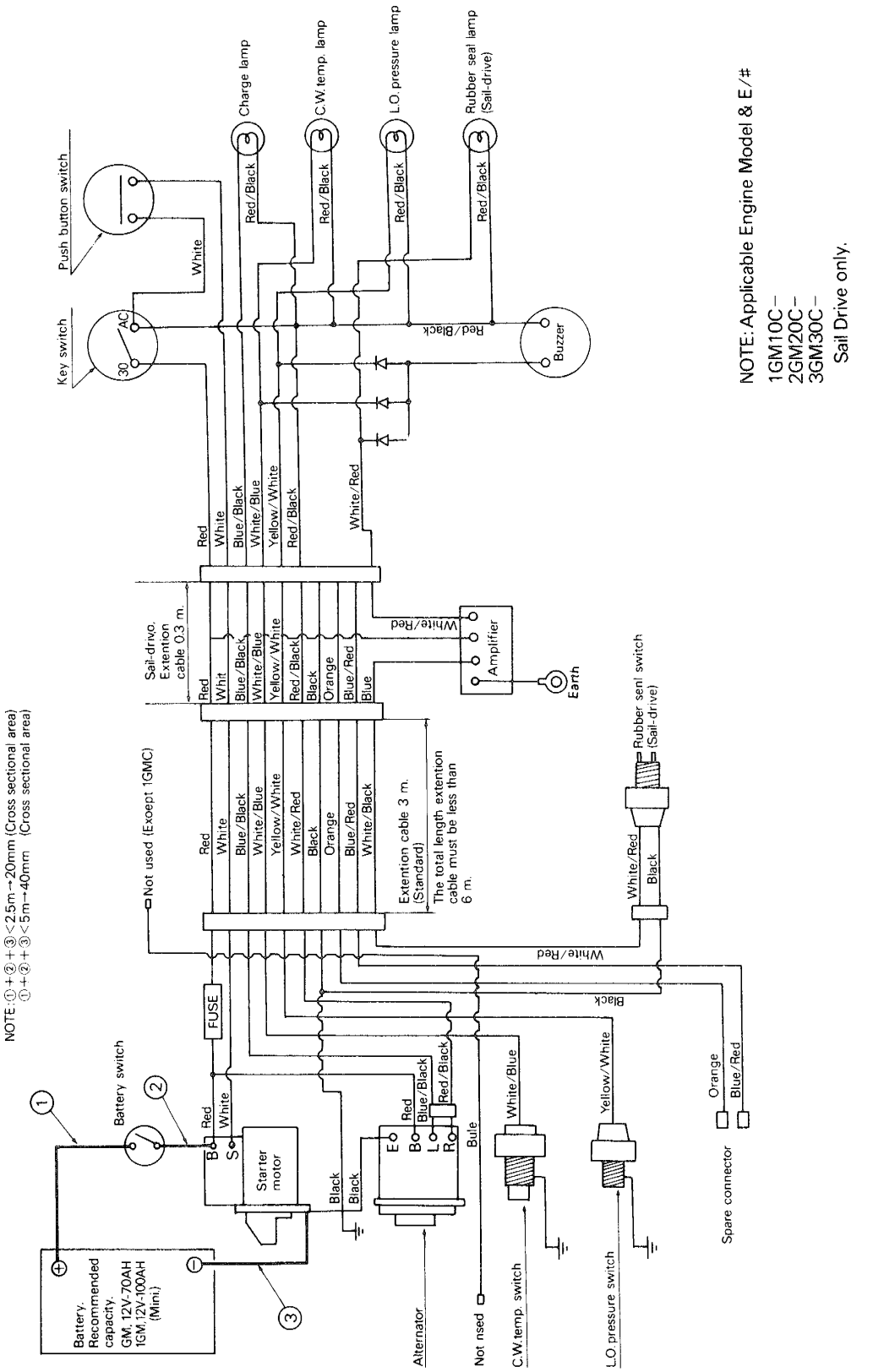
Inspect whether or not the blade of the folding propeller opens smoothly. Also inspect for wear on the blade-fixing pins. Replace them when wear is excessive. Apply sea water-proof grease to the pins blade gear and propeller shaft.

e) Draining water

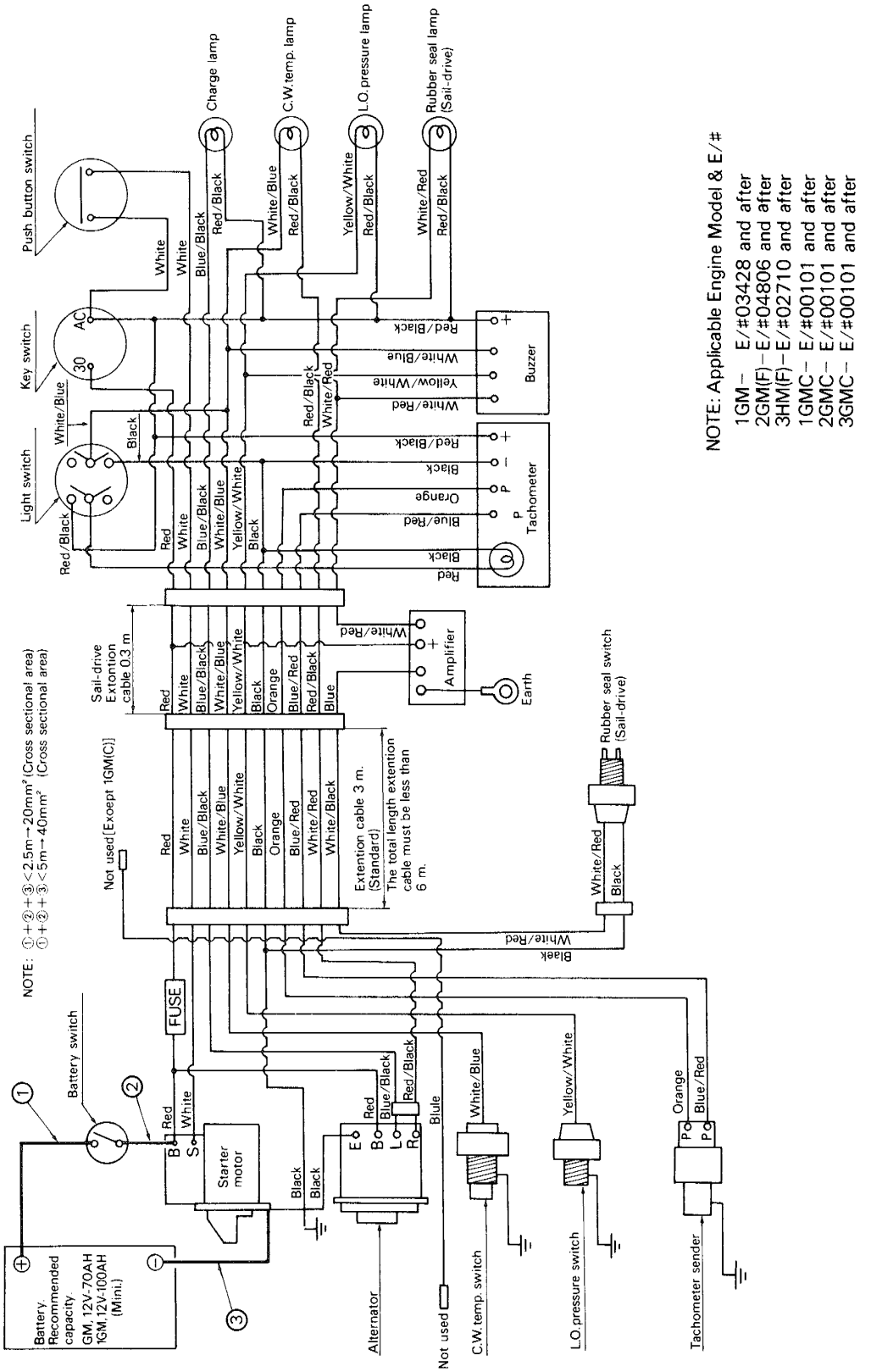
When the boat hull is on a block, drain the engine cooling water, and the water in the Sail-Drive case. (If this water is not drained freezing may cause cracks)



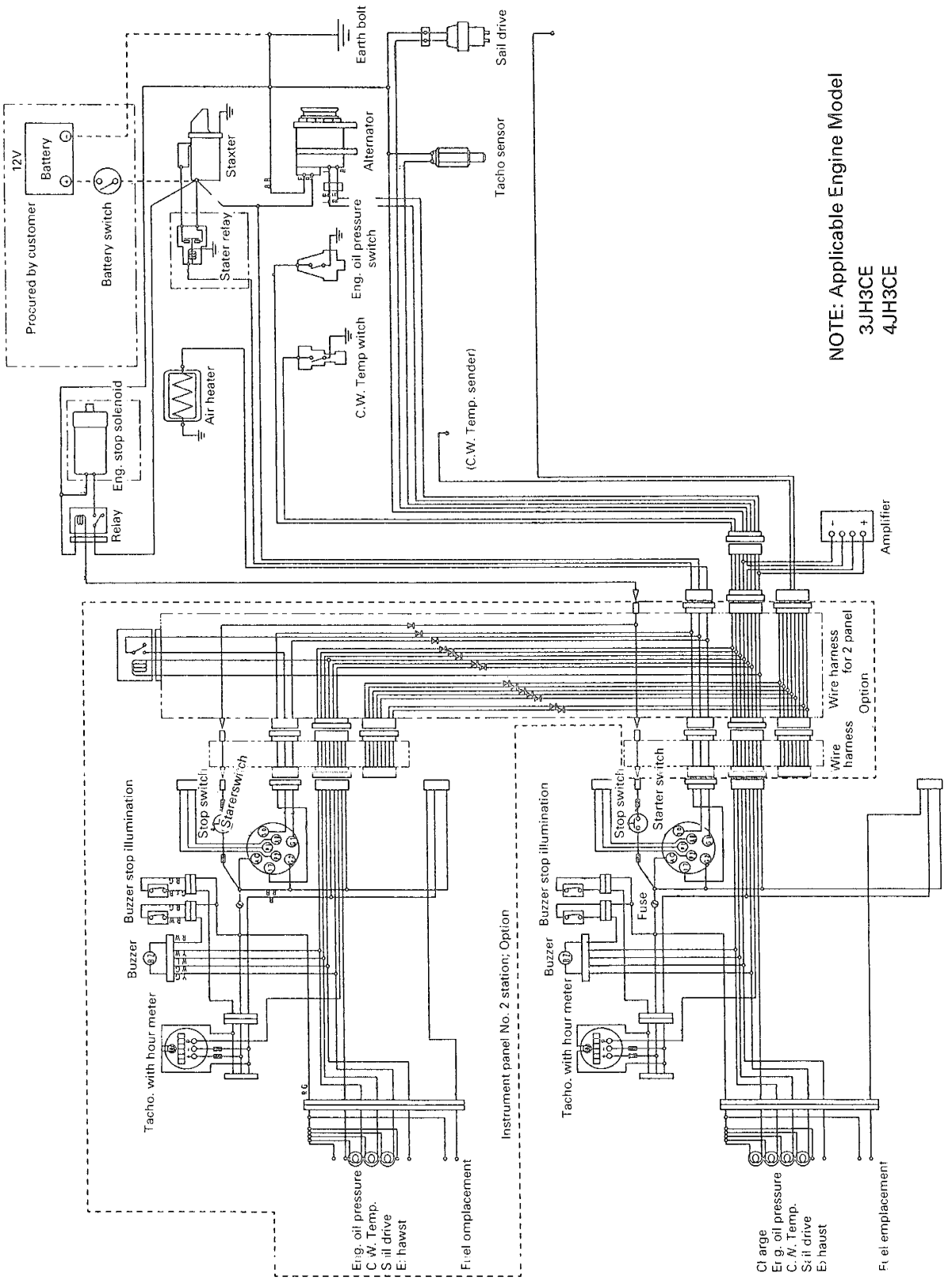
5. Electrical Wiring Diagram (A-type Instrument Panel)



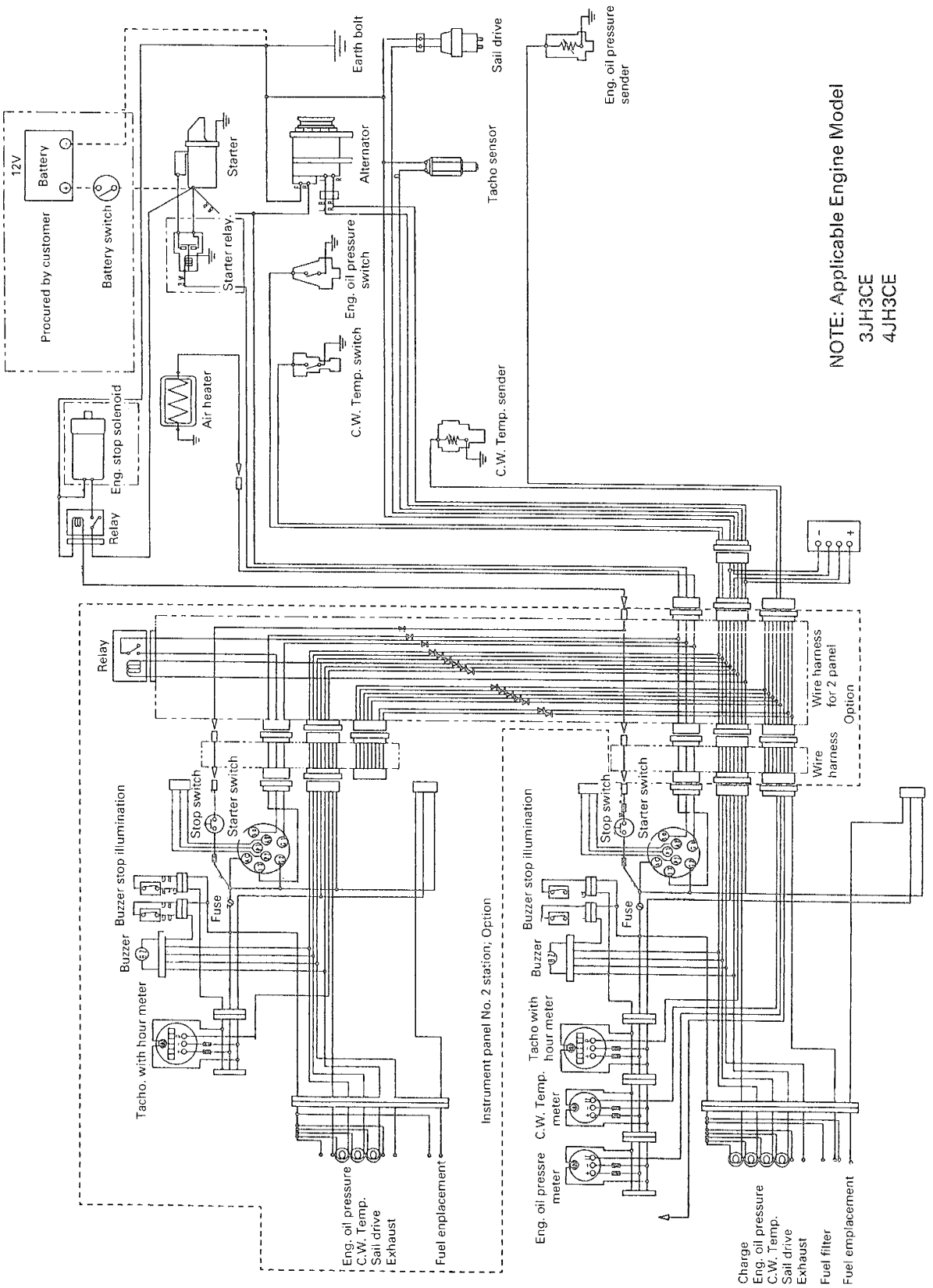
(B-type Instrument Panel)



(B×B type Instrument Panel)



(C×B type Instrument Panel)



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