



SAIL-DRIVE

MODEL: SD20, SD50/SD50-4T

OPERATION MANUAL

EN

Applicable Engine Model:

1GM10C, 2YM15, 3YM20, 3YM30, 3JH4E, 4JH4E 4JH3-TCE

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Introduction

This Installation and Operation Manual describes Sail-Drive Models SD20, SD50, SD50-4T.

For engine handling and operation, refer to the respective operation manuals for Engine Models 1GM10C, 2YM15, 3YM20, 3YM30, 3JH4E, 4JH4E and 4JH3-TCE. However, instructions for the marine gear box are not necessary as they are included.

Engines and sail-drive combinations are available as follows:

Engine model	Sail-drive model
1GM10C	SD20
2YM15	
3YM20, 3YM30	
3JH4E	SD50
4JH4E	
4JH3-TCE	SD50-4T

1. For Your Safety

1. For Your Safety

1.1 Safety Precautions For Inspection

⚠ DANGER

Battery

Never smoke or permit sparks near the battery, because it may emit explosive hydrogen gas. Place the battery in a well-ventilated place.



⚠ DANGER

Fuel

Use only diesel fuel. Never use other fuels, including gasoline, kerosene, etc., because they could cause a fire. The wrong fuel could also cause the fuel injection pump and injector to fail due to lack of proper lubrication. Be sure to check that you have selected the correct diesel fuel before filling the fuel tank.



Do not use starting fluids or sprays. Their use may cause explosion, serious injury and engine damage.

⚠ WARNING

Fire Prevention

Be sure to stop the engine and confirm that there are no open flames in the vicinity before fueling. If you do spill fuel, wipe such spillage carefully and dispose of the wiping materials properly. Wash your hands thoroughly with soap and water.



Never place oil or other flammable material in the engine room.

Install a fire extinguisher near the engine room, and familiarize yourself with its use.

⚠ WARNING

Exhaust Gas

Exhaust gas contains poisonous carbon monoxide and should not be inhaled.



Be sure to install ventilation ports or ventilators in the engine room and ensure good ventilation during engine operation.

⚠ WARNING

Moving Parts

Do not touch or let your clothing get caught in the moving parts of the engine, such as the front drive shaft, V-belt or propeller shaft, during engine operation. You will be injured.



Never operate the engine without covers on the moving parts.

EN

1. For Your Safety

⚠ CAUTION



Burns

The whole engine is hot during operation and immediately after shut-down. The exhaust manifold, exhaust pipe and high pressure fuel lines are very hot. Never touch these parts with your body or clothing.

⚠ WARNING



Alcohol

Never operate the engine while you are under the influence of alcohol. Never operate the engine when you are ill or not feeling well.

⚠ DANGER



Battery Fluid

Battery fluid is dilute sulphuric acid. It can blind you if it gets in your eyes, or burn your skin. Keep the fluid away from your body.

If you touch it, wash it off immediately with a large quantity of fresh water and call your doctor for treatment.

⚠ WARNING



Fire by Electric Short-Circuits

Always turn off the battery switch before inspecting the electrical system.

Failure to do so could cause short-circuiting and fires.

⚠ WARNING



Stop the engine before you service it.

Turn the battery switch off. If you must inspect while the engine is in operation, never touch moving parts. Keep your body and clothing well clear of all moving parts.

⚠ CAUTION



Scalds

When extracting oil from the engine while it is still hot, don't let the oil splash on you.

Wait until the temperature has dropped before extracting cooling water from the engine. Don't let it splash on you.

1. For Your Safety

⚠ DANGER

Forbidden Modifications.

Never release the limiting devices such as the engine speed limit, fuel injection limit, etc.

Modification will impair the safety and performance of the product and shorten product life.

Also note that any troubles arising from modification are not covered by our warranty.

⚠ DANGER

Precautions for Treating Waste.

Never dispose of waste oil or other fluid in a field, sewer, river, or the sea.

Treat waste matters safely observing regulations or laws.

Ask a waste recovery company to collect it.

2. Specifications

2. Specifications

Model		SD20	SD50	SD50-4T
Reduction gear system		Constant mesh gear with dog clutch use	Cone clutch	
Direction of rotation	Input shaft	Counter-clockwise viewed from stern		
	Propeller shaft	Counter-clockwise viewed from stern	Counter-clockwise or clockwise viewed from stern	
Reduction ratio	Ahead	2.64	2.32	
	Astern	2.64	2.32	
Propeller speed (min-1)		1364	1293	1638
Lubrication system		Oil bath type		
Lubrication oil capacity	Standard unit	2.2 L	2.2 L	
	Long-reach unit	2.5 L	2.35 L (Extension 58), 2.45 L (Extension 100)	
Dry weight		30 Kg	39 kg	41 kg
Remote-control device	Control head	Single control lever		
	Cable	"MORSE" 33C (equivalent)		
Applicable engine model (Fuel stop power at crankshaft)		1GM10C (6.7kW/3600 min-1) 2YM15 (10.3kW/3600 min-1) 3YM20 (16.2kW/3600 min-1) 3YM30 (22.1kW/3600 min-1)	3JH4E (29.4 kW/3000 min-1) 4JH4E (40.5 kW/3000 min-1)	4JH3-TCE (55.2kW/3800min-1)

Note: A propeller with rubber bushing must be used in all SD series sail-drives.

3. Selecting Lubricating Oil

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3.1 Choice of lube oil

The choice 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:

3.2 Kind of lube oil

Engine series	GM, YM				JH3, JH4		
Engine model	1GM10C	2YM15	3YM20	3YM30	3JH4E	4JH4E	4JH3-TCE
Sail-drive model	SD20				SD50	SD50	SD50-4T
Lubrication oil for the sail-drive	API CC or greater and SAE 10W30	API GL4 or GL5 and SAE 80W90 or 90			API GL4 or GL5 and SAE 80W90 or 90 or Quicksilver High Performance Gear Lube		Quicksilver High Performance Gear Lube

Use only oil of quality "GL-4" or "GL-5" in the API service, and SAE No. 90 or 80W90.

(Except model SD20 x 1GM10C and SD50/-4T)

For SD20 (except if coupled with the 1GM10C) and SD50/-4T

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

(Applicable model: SD20 x 1GM10C)

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-59	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

Use "Quicksilver High Performance Gear Lube" for the SD50/-4T.

This lube oil is available through all Mer-Cruiser, Mercury, Mariner and Force outlets in their Quicksilver accessories program.

3. Selecting Lubricating Oil

This High Performance Gear Lube is available in the following sizes:

Volume	Part number	Package
300 ml	92-802851Q1	case of 24 tubes
1 L	92-802854Q1	case of 12 plastic bottles
10 L	92-802856Q1	case of 2 cans
60.5 L	92-802857Q1	single drum
208 L	92-802858Q1	single drum

3.3 Lube oil viscosity

The viscosity of the lube oil greatly influences Sail-Drive performance

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

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

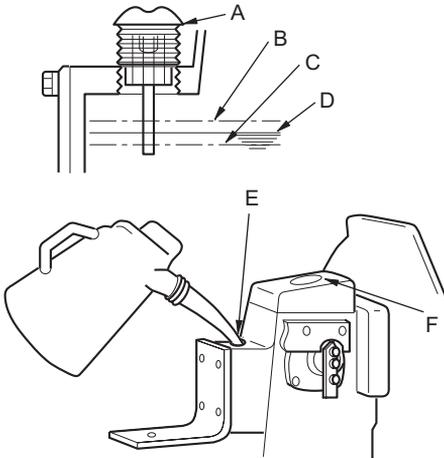
4.1 Filling with lubricating oil

4.1.1 SD20 and SD50/-4T

- (1) Remove the dipstick (yellow cap) and supply approved lube oil.
- (2) Check the amount of lube oil by inserting the dipstick as far as possible. Do not screw the dipstick in. (see the illustration below). The oil level should reach the upper mark on the dipstick.

⚠ CAUTION

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



SD20

- A Dipstick
- B Upper limit
- C Lower limit

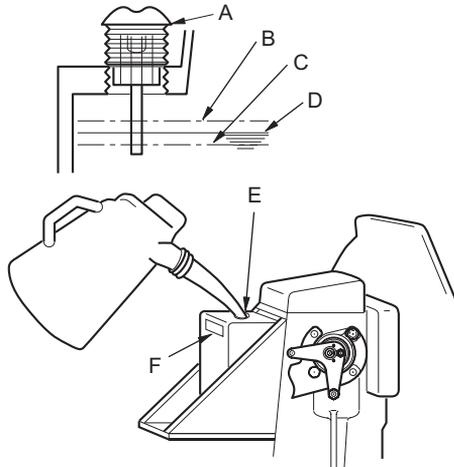
Sail-Drive Model:SD20 & SD50/-4T

Lube oil capacity:

Sail-drive model	SD20	SD50/-4T
Standard unit	2.2 L	2.2 L
Long-reach unit	2.5 L	2.35 L (Extension 58) 2.45 L (Extension 100)

⚠ 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 oil capacity nameplate.



SD50/SD50-4T

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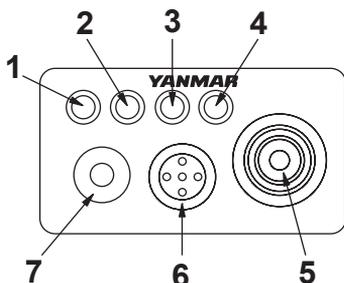
- D Oil level
- E Oil supply port
- F Oil capacity nameplate

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

4.2 Check of instrument panel alarm system:

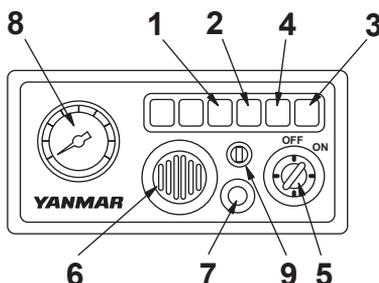
Turn on the battery switch. Then the key in the "ON" position and check the lamps on the panel (with the engine off).

(A-type)



- | | |
|----------------------------|------------------|
| 1 Rubber seal (Sail-Drive) | 4 LO press |
| 2 CW temp | 5 Key switch |
| 3 Charge | 6 Warning Buzzer |

(B-Type)



- | |
|----------------|
| 7 Push button |
| 8 Tachometer |
| 9 Check switch |

(1) Lube oil warning lamp should be lit.

(2) 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.

(3) Charging warning lamp should be lit.

(4) Rubber seal lamp should be out.

(5) The warning buzzer should sound.

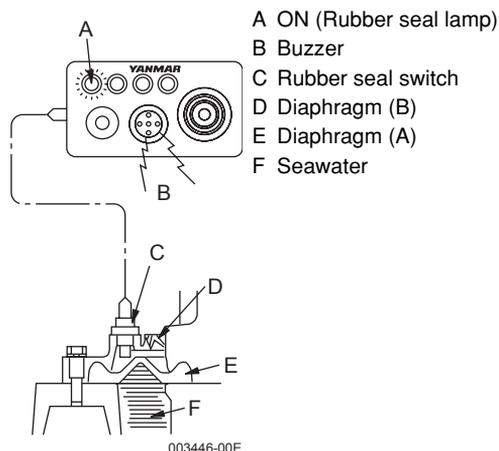
⚠ WARNING

The rubber seal alarm lamp warns of seawater entering the boat. The water-tight structure of the Sail-Drive is the dual type. Even if the rubber diaphragm (A) is damaged and seawater 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, under sail, quickly return to the nearest port for repairs.

⚠ CAUTION

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



- A ON (Rubber seal lamp)
- B Buzzer
- C Rubber seal switch
- D Diaphragm (B)
- E Diaphragm (A)
- F Seawater

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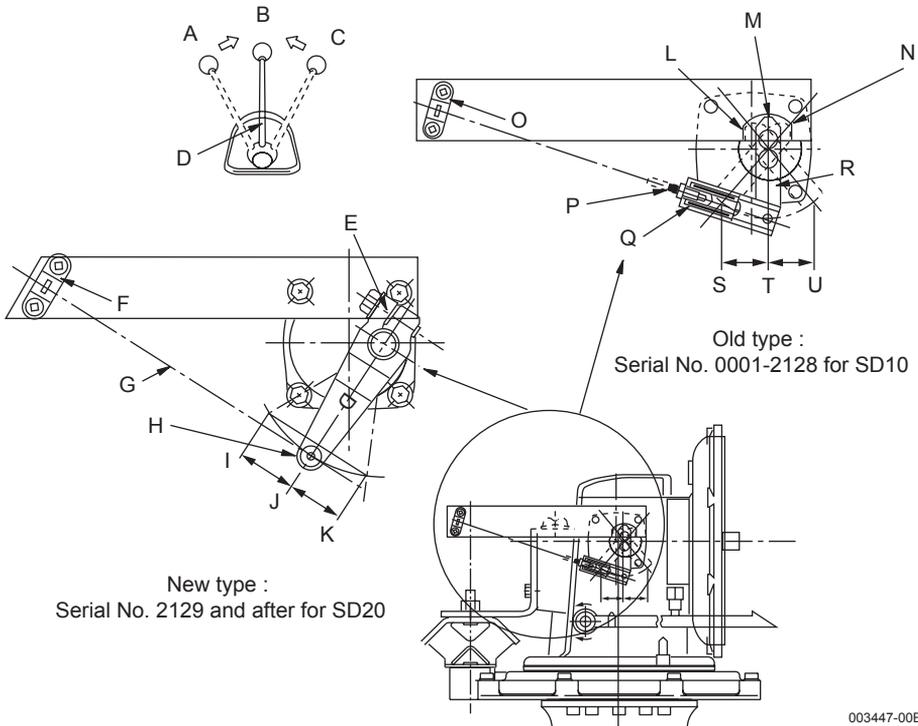
4. Starting the New Sail-Drive for the First Time

4.3 Remote-Control Device Check

4.3.0.1 SD20

While cranking the engine slowly, shift the control handle of the remote-control head (single lever control) rapidly 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 SD20 uses a dog clutch, the clutch is not engaged unless the operation lever is moved to the stopper position.



New type :
Serial No. 2129 and after for SD20

Old type :
Serial No. 0001-2128 for SD10

New type: Serial No. 2129 and after for SD20

- A Control handle
- B Astern
- C Neutral
- D Ahead
- E Operation lever
- F Cable clamp
- G Remote control cable
- H Pivot
- I Astern
- J Neutral
- K Ahead

Old type: Serial No. 0001-2128 for SD10

- L Ahead stopper
- M Neutral position
- N Astern stopper
- O Cable clamp
- P Remote control cable
- Q Spring joint
- R Operation lever
- S Astern
- T Neutral
- U Ahead

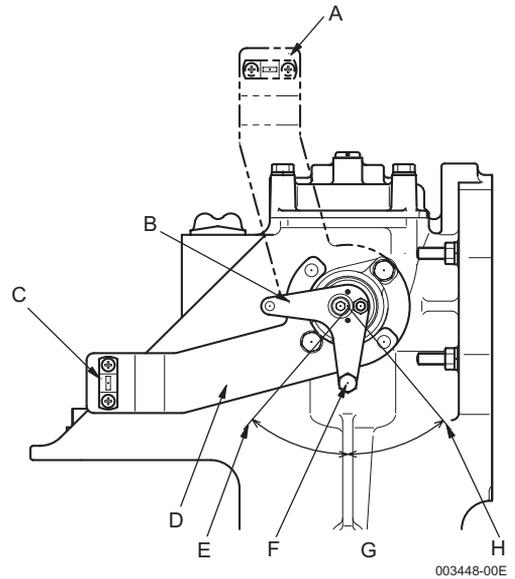
4. Starting the New Sail-Drive for the First Time

4.3.0.2 SD50 & SD50-4T

After starting the engine, check the shift action by using the control head to shift the Ahead and Astern positions. The Ahead/Astern clutch is a mechanical clutch called a cone clutch. Although a grinding noise is made when this type of clutch is engaged, it has no effect on the operation of the engine.

⚠ CAUTION

Because of the rubbing produced at the frictional face of the cone clutch, gripping action is lessened with use and periodic inspection and maintenance is necessary.

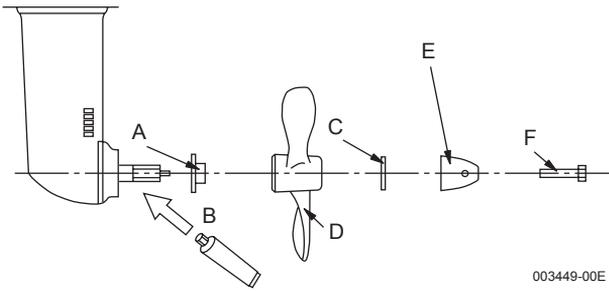


- A When attaching the cable mounting plate at a 90° angle handle
- B Operation lever
- C Cable clamp
- D Remote control cable
- E Propeller shaft clockwise
- F Pivot
- G Neutral
- H Propeller shaft counter-clockwise

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

4.4 Fitting for Fixed Propeller (2-blade)



- A Spacer
- B Grease
- C Washer
- D Propeller
- E Nut Tightening torque 60-70 Nm (M16, SD20)
80-100 Nm (M20, SD50/-4T)
- F Bolt M8x75mm
Tightening torque 11-15 Nm

003449-00E

Locking Procedure for Fixed Propeller Nut (Optional). When tightening the nut at 60-70 Nm torque for the SD20, and 80-100 Nm torque for the SD50/-4T, move the shift lever to ahead and hold the crankshaft V-pulley clamp nut with a wrench to stop the rotation.

CAUTION

Rubber bushing (Folding propeller)

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

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4.5 Recommended Propeller Size (Max.)

Engine model	Sail-Drive Model	Folding type Dia. mm (inch)	2-blade, fixed type- Dia. mm (inch)
1GM10C	SD20	355 (14)	380 (15)
2YM15		368 (14.5)	380 (15)
3YM20		380 (15)	405 (16)
3YM30		405 (16)	420 (16.5)
3JH4E	SD50	457 (18)	457 (18)
4JH4E		457 (18)	457 (18)
4JH3-TCE	SD50-4T	457 (18)	457 (18)

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).

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

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 actu-

al navigation, there is 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.

5. Method of Operation

5. Method of Operation

5.1 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: For other items, refer to the engine operation manual.

Note: When sailing, set the remote control lever in neutral.

Old type:

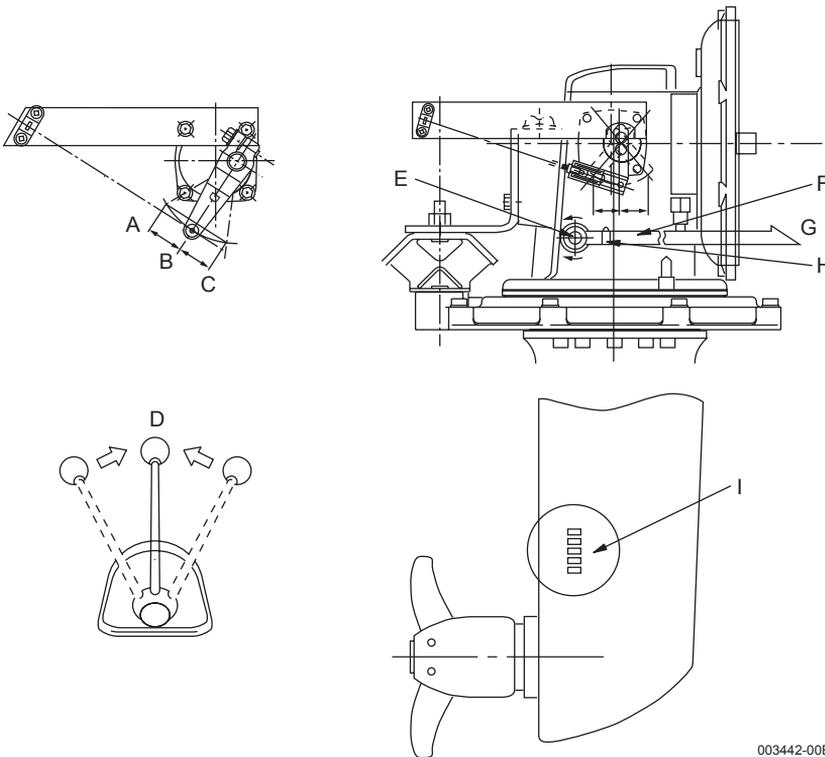
Serial No.0001-2128 for Model SD20

New type:

Serial No.2129 and after for Model SD20

5.1.1 SD20

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A Atern
B Neutral
C Ahead

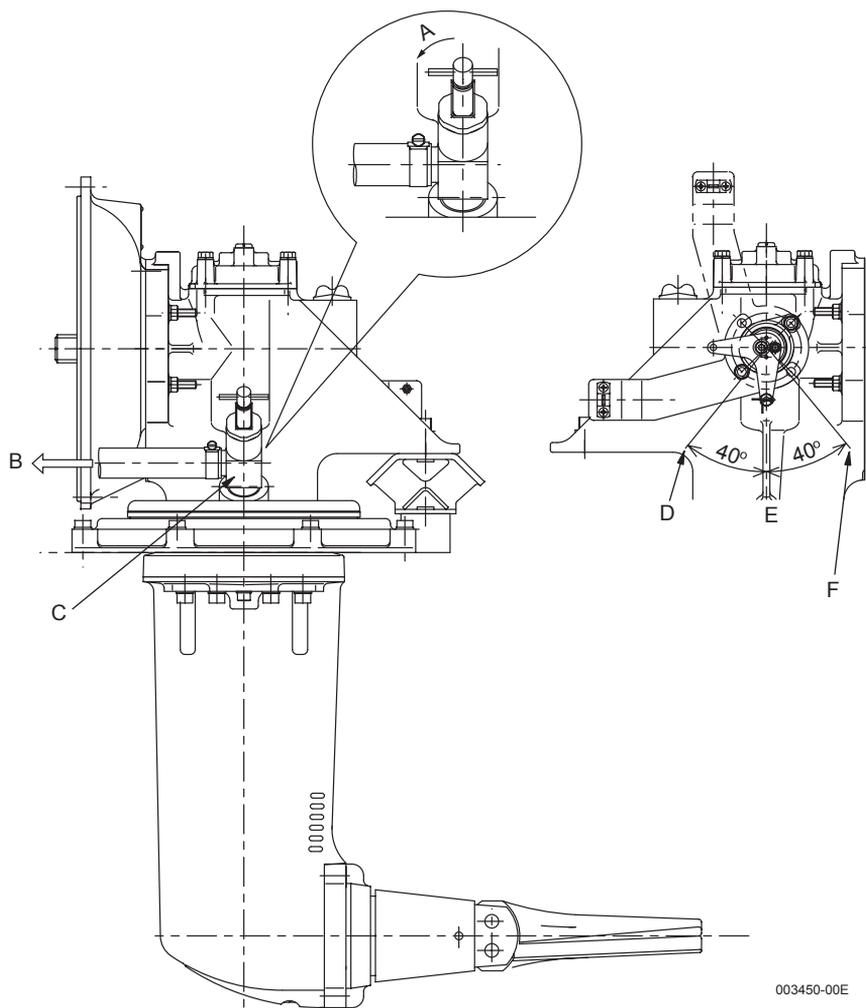
D Neutral
E Cock, C.W.
F C.W. hose

G To C.W. pump
H Hose clamp
I Seawater inlet

003442-00E

5. Method of Operation

5.1.2 SD50/SD50-4T



A Open
B To C.W. pump

C Cock C.W.
D Propeller shaft Clockwise

E Neutral
F Propeller shaft Counter-clockwise

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6. Periodic Inspections and Maintenance

6. Periodic Inspections and Maintenance

	Every day	50 hrs. or after 1 month	Every 100 hrs.	Every 250 hrs.	Every 1 year	Every 2 years
Lubricating Oil						
(1) Check oil level: fill	Before operation	First	SD20	SD50/-4T		
(2) Change lube oil	○	○	○	○		
Cooling Water						
(1) Open/close cooling water cock	Before/after operation ○				○	
(2) Clean cooling water suction hole	After operation					
(3) Drain cooling water	○					
Remote Control System					Replace if the thickness is less than 10 mm.	Serial No. 2129 and after for SD20
(1) Inspect remote control device		First			○	
(2) Inspect and replace clutch shifter		○	○			
Anti-Corrosive Zinc			Replace if wear is more than 50%			
(1) Inspect and replace anti-corrosive zinc			○			
Lower Case					○	
(1) Repair case coating						
Boat Bottom Water- tightness						Inspect and replace, if there is cracking, or at least every 6 years
(1) Inspect and replace rubber diaphragm seal ring						○
(2) Inspect seal sensor					○	
Flexible mount					Replace if clearance is less than 1 mm.	
(1) Inspect and replace mounting height.					○	
					 <p>003451-00E A: Clearance</p>	

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6. Periodic Inspections and Maintenance

6.1 Lubricating oil system

6.1.1 SD20

- (1) Check the oil level before every operation.
- (2) 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 manner:

- (1) Put the boat hull on a block.

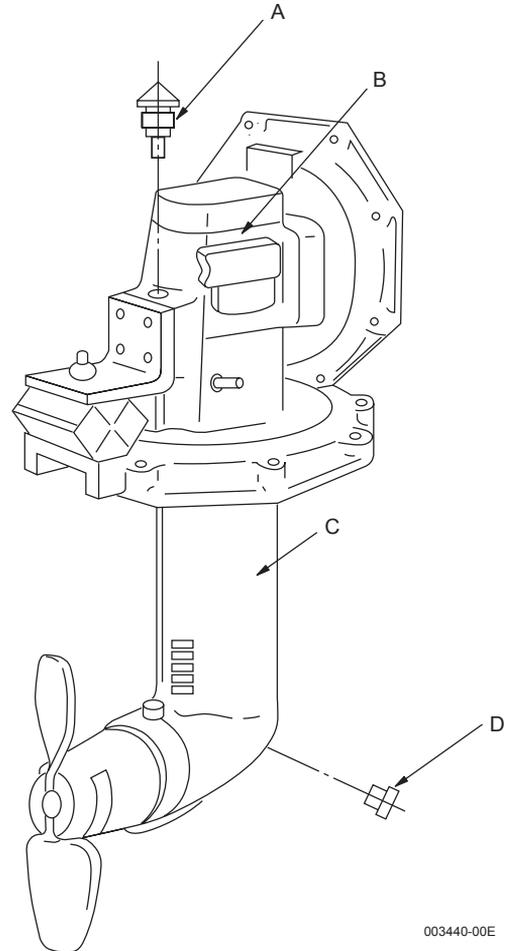
Drain the oil by removing the lower gear case drain plug, and the upper gear case oil dipstick.

⚠ 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.

SD20



- A Dipstick
- B Upper gear case
- C Lower gear case
- D Lube oil drain plug

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6. Periodic Inspections and Maintenance

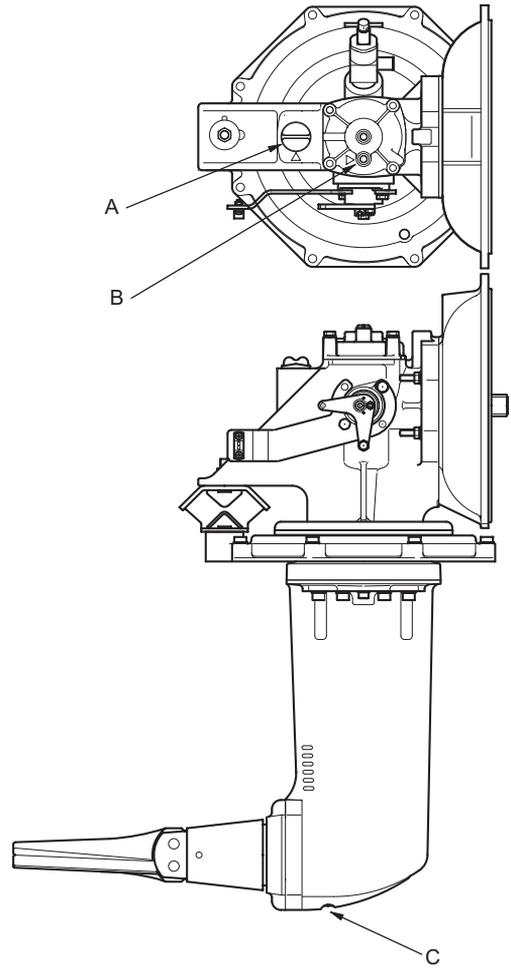
6.1.2 SD50/-4T

- (1) Check the oil level before every operation.
- (2) Change the oil after the first 50 hours of operation or after long storage, and every 250 hours of operation thereafter. Lube oil should be changed while the engine is still warm.

⚠ 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.

SD50/SD50-4T



003441-00E

A Dipstick B Plug C Drain plug

6. Periodic Inspections and Maintenance

6.2 Procedure for filling and removing oil in the Sail-Drive; SD50/-4T

When the boat is (6.2.1) in the water and (6.2.2) out of the water

Used equipment:

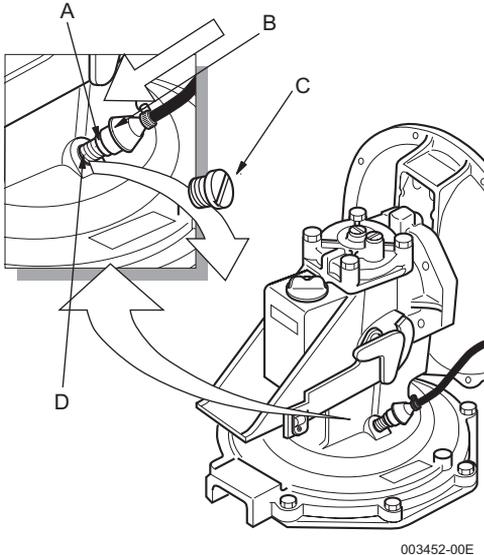
Description	Part code	Quantity	Remarks
Bottle of Quicksilver High Performance Gear Lube from MerCruiser	MerCruiser Part code 92-850743A1	2	Each bottle contains 0.946 liter of oil. Mandatory for SD50/-4T. For other models see page 8.
Market pump from MerCruiser on bottle	MerCruiser Part code 91-85729A1	1	
Adapter joint	196311-92960	1 (2)	Thread std. M10 x 1.5 max. length 12 mm.
O-ring for adapter	24311-000100	1 (2)	
Stiff rubber hoses		2	Inner diameter \varnothing 14-16 mm + hose clips (If Yanmar part is used, part code is 196440-92970)
Compressor set	-	1	
Hand pump	28210-000080	1	Option parts

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6. Periodic Inspections and Maintenance

6.2.1 When the boat is in the water

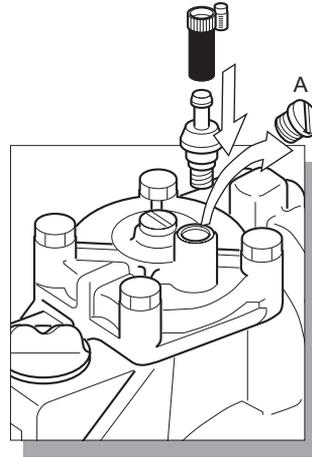
6.2.1.1 Preparing the sail-drive:



- A O-ring
- B Adapter joint
- C Oil changing plug
- D Tread M10 x 1.5

- (1) Take out the oil changing plug located under the shift lever.
- (2) Screw in the adapter joint (196311-92960) with the O-ring (24311-000100). When using own adapter joint, max. length of thread is 12 mm.
- (3) Attach a stiff rubber hose with inner diameter $\varnothing 14\sim 16$ mm with hose clips to the adapter joint at the oil changing position. Hose must be long enough to drain to bucket or pump. (If Yanmar original rubber hose is used, part code is 196440-92970)

6.2.1.2 Removing oil (total quantity 2.2 liter)



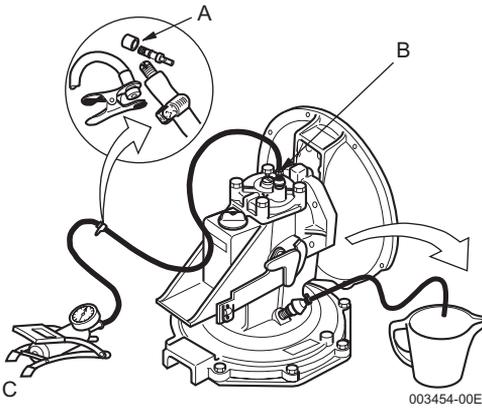
- A Plug

6.2.1.3 Fastest way: Blowing out by using Air pressure

First follow steps (1), (2), (3) on page 22

- (1) Take out the plug from the upper case cover.
- (2) Screw in a second adapter joint (P/N 196311-92960) with an O-ring (P/N 24311-000100) at the oil inlet position. Screw in the oil plug at the dipstick position.
- (3) Connect the air pressure hose with hose clips.
- (4) Option 1: Using Compressed air from main system or 12 V portable compressor.
 1. Connect hose at top adapter joint to compressed air and within 10 to 15 minutes almost all oil will be blown out.

6. Periodic Inspections and Maintenance



- A One-way valve
- B Adapter joint screwed in cover
- C Simple foot pump

Use Compressed Air (0.5~1 Bar) from main system, 12 V portable compressor or from portable hand pump or foot pump.

Option 2: Using Compressed air with help from a portable hand pump or foot pump

- (1) Install a one-way (non return) valve in the pressure line (connected to the top cover). This is done to maintain the pressure during use of the pump.
- (2) Connect the hand pump or foot pump with the pressure line to the adapter joint on the top as shown above.

- (3) With the system now connected, pump out the oil until empty. The first 0.9 liter will take approx. 3 minutes. The second part takes more time as mostly air will be pumped out; this will take approx. 12 minutes.

6.2.1.4 Using Yanmar Pump

First follow steps (1), (2), (3) on page 22 and step (1) on page 22

Connect the hand pump with hoses as shown above, and start pumping.

Be aware that oil has to flow down through narrow parts and then up again.

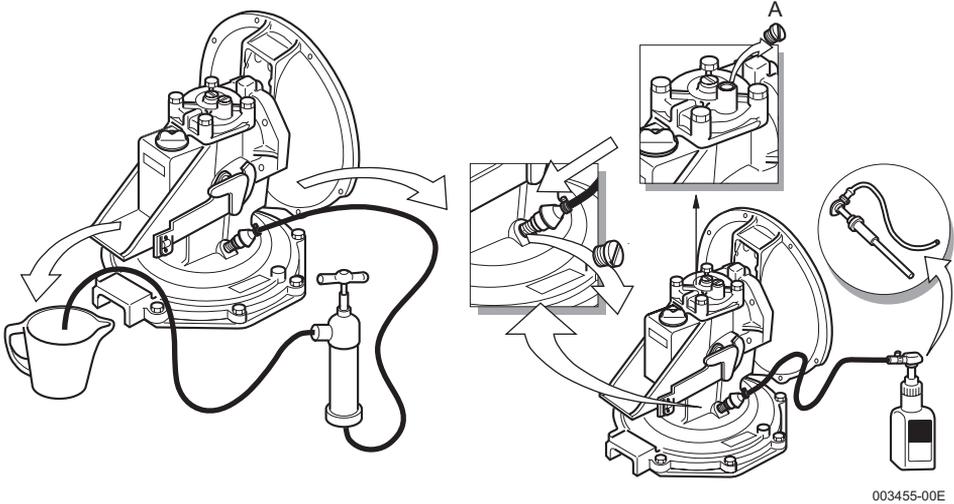
Therefore, during this procedure, at first suction pressure will be high and pumping will be hard. A few minutes waiting in between will help. After taking out about 0.9 liter of oil, mostly you will pump out air, but continuous pumping is necessary.

Though approx. 100-200 ml of old oil will remain in the drive unit, in this case, it is no problem to fill-up with the new oil for maintenance.

The hand pump (p/ #:28210-000080) and rubber hose (p/ #:196440-92970) are available from Yanmar, and are optional parts for SD50/-4T. Or any type of hand pump or rubber hose (Inner diameter \varnothing 14-16 mm) available from the hardware shop, are usable.

EN

6. Periodic Inspections and Maintenance



A Plug

EN 6.2.1.5 Filling oil (total quantity 2.2 liter)

The following methods of filling with lube oil are in addition to the way mentioned in page 10.

6.2.1.6 Fastest way: By using MerCruiser pump or simple market pump

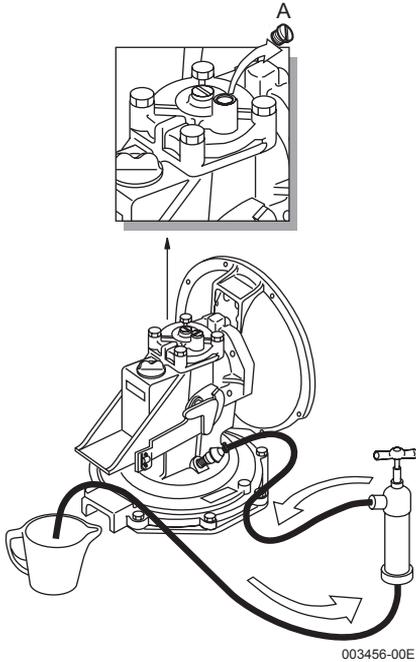
First follow steps (1) and (2) on page 22

- (1) Use a MerCruiser pump with Part number 91-85729A1 like the one shown above or use a similar pump available on the market.
- (2) Screw the pump on a new bottle of Quicksilver High Performance Gear Lube Part number 92-850743A1 (0.946 liter) from MerCruiser.
- (3) Connect the hose with a hose clip to the adapter joint below the shift lever.
- (4) Take out the plug from the upper case cover.
- (5) Fill the oil by pushing the upper part of the pump. After bottle is empty, change the bottle while the pump and hose remains connected with the adapter joint.
- (6) After filling, first screw in and tighten the plug at the top cover. Then remove the oil bottle, pump, hose and adapter joint and screw in the oil plug (don't forget the gasket).

6. Periodic Inspections and Maintenance

6.2.1.7 By using Yanmar Hand Pump

First follow steps (3) and (4) on page 24.



A Plug

- (1) Connect the hoses as shown above at the top adapter joint to the hand pump by using the rubber hose.

- (2) Take out the plug from the upper case cover.
- (3) Fill in the oil moved by the hand pump. Be aware that oil has to flow down through narrow parts and then up again. Therefore, during this procedure, at first suction pressure will be high and pumping will be hard. A few minutes waiting in between will help. The hand pump (p/#: 28210-000080) and rubber hose (p/#: 196440-92970) are available from Yanmar, and are optional parts for SD50/-4T. Or any type of hand pump or rubber hose (Inner diameter \varnothing 14-16 mm) available from the hardware shop, are usable.
- (4) After filling, first screw in and tighten the plug at the top cover. Then remove the hand pump, hose and adapter joint and screw in the oil plug (don't forget the gasket).

6.2.1.8 By not using pump

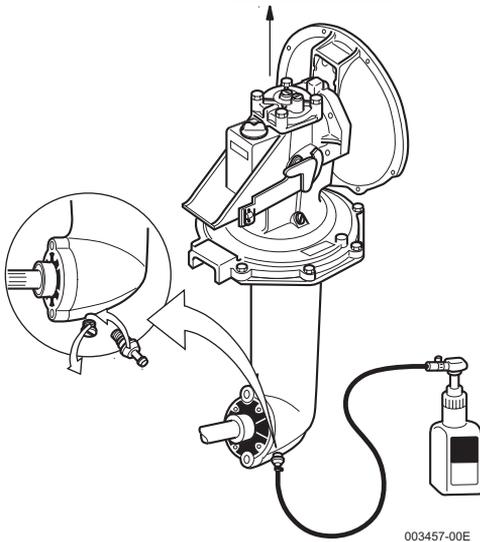
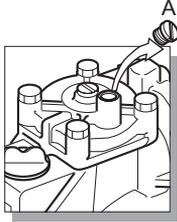
For the oil filling procedure by not using pump, see the explanation on chapter 4., page 10.

EN

6. Periodic Inspections and Maintenance

6.2.2 When the boat is out of the water

6.2.2.1 Preparing the sail-drive:



A Plug

- (1) Remove the bottom drain plug
- (2) Screw in the adapter joint (P/N 196311- 92960) with the O-ring (P/N 24311- 000100).

When using own adapter joint, max. length of thread is 12 mm.

- (3) Attach a stiff rubber hose with inner diameter $\varnothing 14\sim 16$ mm with hose clips to the adapter joint at the oil drain position. The hose must be long enough to drain to bucket.

- (4) Take out the dipstick and oil inlet plug from the upper case cover.

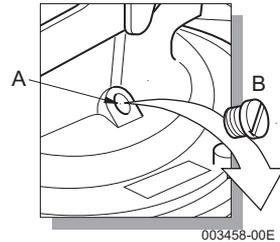
6.2.2.2 Removing oil (total quantity 2.2 liter)

6.2.2.3 By draining

First follow steps (1), (2), (3), (4) on page 26.

Oil drain is possible from this point but will take much time.

- (1) After approx. 0.6 liter has been drained, remove the oil changing plug. If you remove sooner, oil may spill out of this position (because max. oil level is higher than this position).



A Tread M10 x 1.5

B Oil changing plug

6.2.2.4 Fastest way: Blowing out by using Air pressure

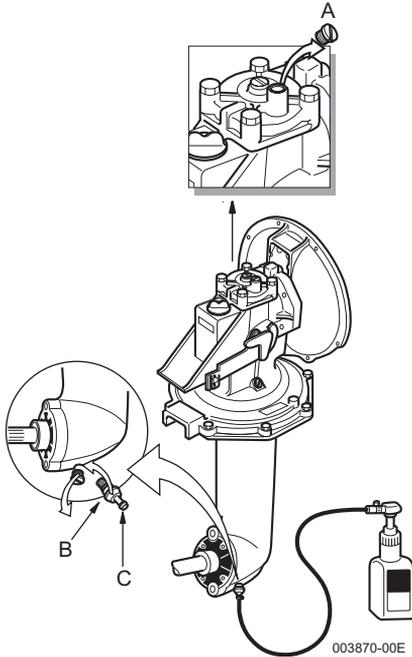
First follow steps (1), (2), (3) on page 22, then follow the procedures on page 22. Be aware that oil is divided in two channels connected by the lower gear and lower drain port.

6. Periodic Inspections and Maintenance

6.2.2.5 Filling oil (total quantity 2.2 liter)

6.2.2.6 By using MerCruiser pump or simple market pump

First follow steps (1), (2), (4) on page 26.



- A Plug
- B O-ring
- C Adapter joint

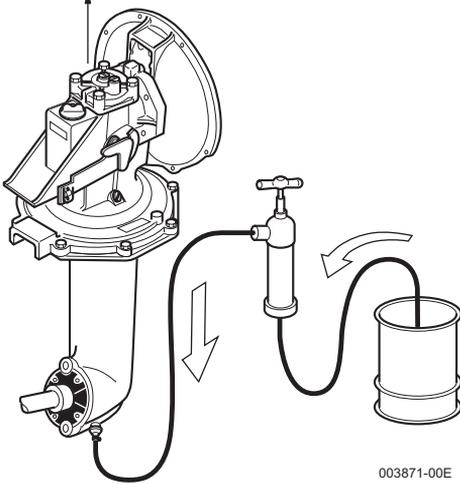
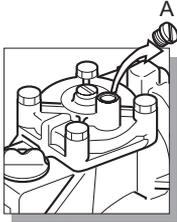
- (1) Use a MerCruiser pump with Part number 91-85729A1 like the one shown on p. 24, 6.2.1.4, or use a similar pump available on the market.
- (2) Screw the pump on a new bottle of Quicksilver High Performance Gear Lube Part number 92-850743A1 (0.946 liter) from MerCruiser.
- (3) Remove the oil changing plug below the shift lever.
- (4) Connect the hose with a hose clip to the adapter joint at the drain position.
- (5) Take out the plug from the upper case cover.
- (6) Fill the oil by pushing the upper part of the pump. After the first bottle is empty, screw in the oil changing plug (don't forget the gasket).
- (7) Change the bottle while the pump and hose remain connected with the adapter joint.
- (8) After filling, first screw in and tighten the plug at the top cover. Then remove the oil bottle, pump, hose and adapter joint and screw in the oil drain plug (don't forget the gasket).

EN

6. Periodic Inspections and Maintenance

6.2.2.7 By using Yanmar hand pump

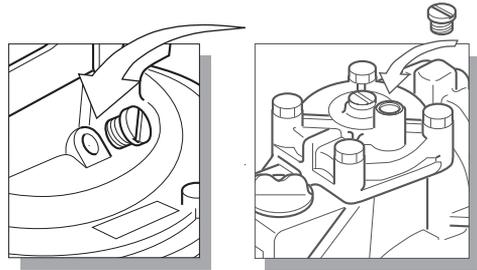
First follow steps (1), (2), (3), (4) on page 26.



A Plug

- (1) Connect the hose from the bottom and a suction hose to Yanmar pump with hose clip like shown above.
- (2) Take out the plug from the upper case cover.
- (3) Fill oil by pumping it into drive. Be aware that oil has to flow up through narrow parts. Therefore,

pumping will be hard. A few minutes waiting in between will help. After pumping in about 1 liter of oil, screw in the oil changing plug (do not forget to insert the gasket). Please be aware that the drain hose can easily slip out of the bucket and cause oil spilling. The hand pump (p/#: 28210-000080) and rubber hose (p/#:196440-92970) are available from Yanmar, and are optional parts for SD50/-4T. Or any type of hand pump or rubber hose (Inner diameter \varnothing 14-16 mm) available from the hardware shop, are usable.



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- (4) After filling, first screw in and tighten the plug at the top cover. Then remove the pump, hose and adapter joint and screw in the oil drain plug (do not forget to insert the gasket).

6.2.2.8 By not using pump

For the oil filling procedure by not using pump, see the explanation on chapter 4., page 10.

6. Periodic Inspections and Maintenance

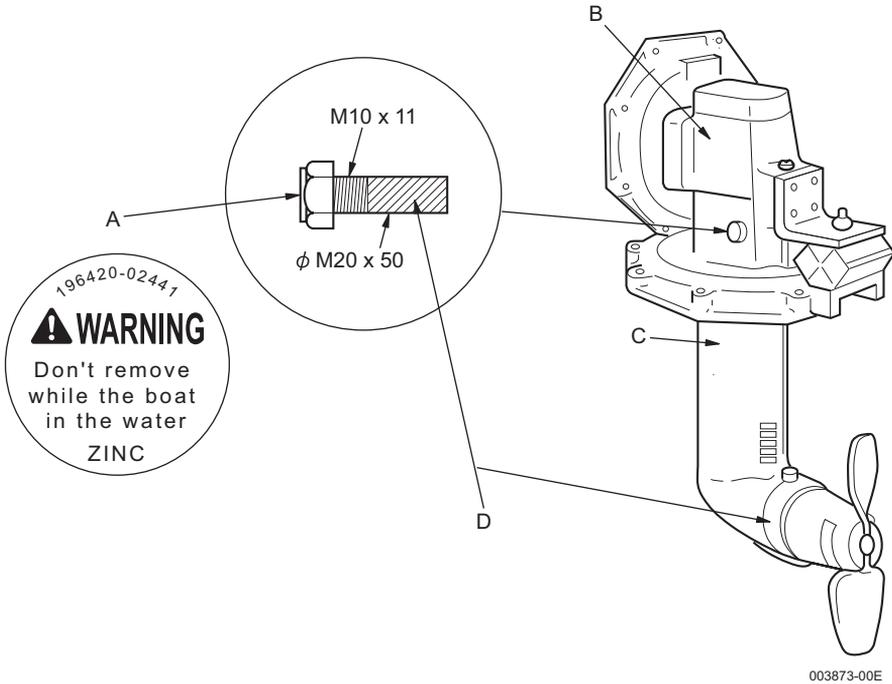
6.3 Anticorrosive zinc

6.3.1 SD20 and SD50/ SD50-4T

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 half of the original volume (size).

SD20



A Safety label
B Anticorrosive zinc

C Upper gear case
D Lower gear case

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 (including Anticorrosive Zinc) while the boat is in the water.

6.4 Rubber diaphragms (A) and (B) (SD20 and SD50/-4T)

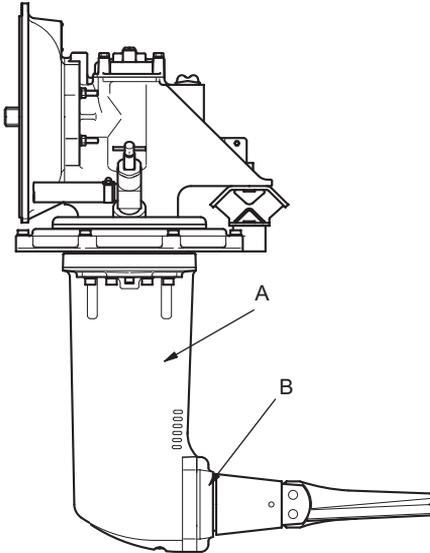
The rubber diaphragms (A) and (B) of the Sail-Drive are important parts for the hull and crew safety. Since rubber degener-

ates during use, be sure to replace them at

6. Periodic Inspections and Maintenance

least every six years (see the table: Periodic Inspections and Maintenance on page 18.) (Boat hull must be lifted onto a block.) To replace, consult your Yanmar dealer.

SD50/-4T



003874-00E

- A Lower gear case
- B Upper gear case

6.5 When the boat hull is raised onto a block, inspect the following:

(1) Remove deposit from the lower gear case.

Remove seaweed, seashells, 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.

(2) Repairing damaged membrane

The membrane of the lower gear case which is always in seawater may be damaged when hitting floating objects

in the sea, or when having deposit removed from it. Do not use paint containing copper derivatives.

(3) Inspecting anticorrosive zinc

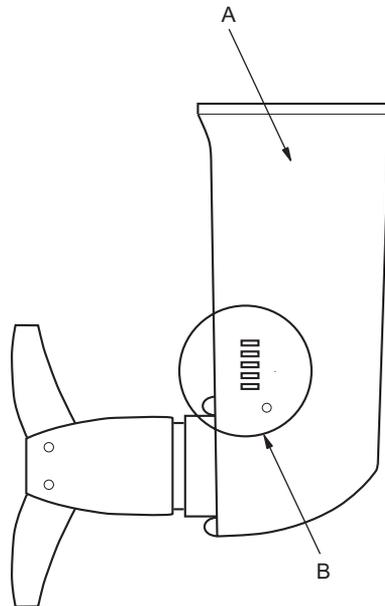
Since anticorrosive zinc can not be inspected except when the boat hull is raised onto a block, be sure not to forget to inspect it.

(4) 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 seawater-proof grease to the pins blade gear and propeller shaft.

(5) 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)



003875-00E

- A Lower gear case
- B Seawater inlet

7. Electrical Wiring Diagrams

7. Electrical Wiring Diagrams

See Appendix B. at the back of this manual.

Color coding	
R	Red
B	Black
W	White
Y	Yellow
L	Blue
O	Orange
L/B	Blue/Black
W/L	White/Blue
Y/W	Yellow/White
W/R	White/Red
L/R	Blue/Red
W/B	White/Black
R/B	Red/Black

A-type Instrument Panel	
Applicable Engine Model: 1GM10C	
4	Battery Recommended capacity GM,12V-70AH 1GM,12V-100AH (Mini.)
5	Battery switch
6	FUSE
7	Starter motor
8	Alternator
9	Not used
10	C.W. temp. switch
11	L.O. pressure switch
12	Spare connector
13	Extension cable 3 m. (Standard)
14	The total length extension cable must be less than 6 m.
15	Rubber seal switch (Sail-drive)
16	Amplifier
17	Earth
18	Sail-drive extension cable 0.3 m.
19	Not used (Except 1GMC)
20	Key switch
21	Push button switch
22	Charge lamp
23	C.W. temp. lamp
24	L.O. pressure lamp
25	Rubber seal lamp (Sail-drive)
26	Buzzer

Note: $1 + 2 + 3 < 2,5 \text{ m} - 20 \text{ mm}^2$

(Cross sectional area)

$1 + 2 + 3 < 5 \text{ m} - 40 \text{ mm}^2$

(Cross sectional area)

B-type Instrument Panel

Applicable Engine Model:

3YM30, 3YM20 and 2YM15

(See A-5)

3JH4E, 4JH4E (See A-6)

B-type Instrument Panel	
Applicable Engine Model: 1GM10C	
4	Battery Recommended capacity GM,12V-70AH 1GM,12V-100AH (Mini.)
5	Battery switch
6	FUSE
7	Starter motor
8	Alternator
9	Not used
10	C.W. temp. switch
11	L.O. pressure switch
12	Tachometer sender
13	Extension cable 3 m. (Standard)
14	The total length extension cable must be less than 6 m.
15	Rubber seal switch (Sail-drive)
16	Amplifier
17	Earth
18	Sail-drive extension cable 0.3 m.
19	Not used (Except 1GMC)
20	Light switch
21	Key switch
22	Push button switch
23	Charge lamp
24	C.W. temp. lamp
25	L.O. pressure lamp
26	Rubber seal lamp (Sail-drive)
27	Buzzer
28	Tachometer

Note: $1 + 2 + 3 < 2,5 \text{ m} - 20 \text{ mm}^2$

(Cross sectional area)

$1 + 2 + 3 < 5 \text{ m} - 40 \text{ mm}^2$

(Cross sectional area)

C-type Instrument Panel

Applicable Engine Model:

3JH4E, 4JH4E (See A-7)

7. Electrical Wiring Diagrams

B x B-type Instrument Panel	
Applicable Engine Model: 4JH3-TCE	
1	Procured by customer
2	Battery
3	Battery switch
4	Relay
5	Eng. stop solenoid
6	Air heater
7	Starter relay
8	Starter
9	C.W. Temp. switch
10	Eng. oil pressure switch
11	Alternator
12	Earth bolt
13	C.W. Temp. sender
14	Tacho sensor
15	Sail-drive
16	Amplifier
17	Wire harness for 2 panel
18	Option
19	Wire harness
20	Starter switch
21	Stop switch
22	Fuse
23	Buzzer stop illumination
24	Buzzer
25	Tachometer with hour meter
26	Charge
27	Eng. oil pressure
28	C.W. Temp.
29	Sail-drive
30	Exhaust
31	Fuel emplacement
32	Instrument panel no. 2 station; Option

C x B-type Instrument Panel	
Applicable Engine Model: 4JH3-TCE	
1	Procured by customer
2	Battery
3	Battery switch
4	Relay
5	Eng. stop solenoid
6	Air heater
7	Starter relay
8	Starter
9	C.W. Temp. switch
10	Eng. oil pressure switch
11	Alternator
12	Earth bolt
13	C.W. Temp. sender
14	Tacho sensor
15	Sail-drive
16	Eng. oil pressure sender
17	Wire harness for 2 panel
18	Option
19	Wire harness
20	Starter switch
21	Stop switch
22	Fuse
23	Buzzer stop illumination
24	Buzzer
25	Tachometer with hour meter
26	C.W. Temp. meter
27	Eng. oil pressure meter
28	Charge
29	Eng. oil pressure
30	C.W. Temp.
31	Sail-drive
32	Exhaust
33	Fuel filter
34	Fuel emplacement
35	Instrument panel no. 2 station; Option

- MANUFACTURER'S DECLARATION FOR MACHINERY PARTS ACCORDING TO 94/25/EEC(ANNEX-15) & 89/336/EEC
- MANUFACTURER: YANMAR CO., LTD.
1-32, Chayamachi, Kita-ku, Osaka, Japan
- DESCRIPTION OF THE MACHINERY PARTS
- CATEGORY: Diesel engine
 1. MAKE: YANMAR
 2. THIS MACHINERY PART MUST NOT BE PUT INTO SERVICE UNTIL THE MACHINERY INTO WHICH IT IS TO BE INCORPORATED HAS BEEN DECLARED IN CONFORMITY WITH THE PROVISIONS OF THE DIRECTIVE.
- IMPORTER IN THE EU: YANMAR MARINE INTERNATIONAL B.V.
Brugplein 11
1332 BS Almere-de Vaart, The Netherlands



Nagahama, Japan, Sept. 21, 1997
Place and date issued

Y. Sugita
Manager
Quality Assurance Dept.
Power System Operation Div.