YANMAR

M2215-04E140

# YANMAR®

# SERVICE MANUAL

## SAIL DRIVE UNIT

### SD40/SD40-4T
### SD50/SD50-4T

YANMAR CO.,LTD.

| History of Correction | | | | Document No. | M2215-04E140 |
|---|---|---|---|---|---|
| | | | | Page No. | 1 |
| Manual Name: | YANMAR SERVICE MANUAL FOR SAIL DRIVE UNIT SD40/SD40-4T & SD50/SD50-4T | | | | |
| UNIT Model: | SD40/SD40-4T, SD50/SD50-4T | | | | |
| No.of Correction | Date of Correction | Cause for Correction | Outline of Correction | Corrected Item Number | Corrected by: |
| - | Mar. 2005 | Added SD50/-4T | (1) Added SD50 series.<br>(2) Changed document number.<br>M9961-H13030<br>↓<br>M2215-04E140 | - | Quality Control Dept.<br>Marine factory |
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# CONTENTS

# FOR SAFETY

## 1. SAFETY LABELS

- Most accidents are caused by negligence of basic safety rules and precautions. For accident prevention, it is important to avoid such causes before development to accidents.
  Please read this manual carefully before starting repair or maintenance to fully understand safety precautions and appropriate inspection and maintenance procedures.
  Attempting at a repair or maintenance job without sufficient knowledge may cause an unexpected accident.

- It is impossible to cover every possible danger in repair or maintenance in the manual. Sufficient consideration for safety is required in addition to the matters marked ⚠ CAUTION . Especially for safety precautions in a repair or maintenance job not described in this manual, receive instructions from a knowledgeable leader.

- Safety marks used in this manual and their meanings are as follows:

⚠ **DANGER** — **DANGER**-indicates an imminent hazardous situation which, if not avoided, WILL result in death or serious injury.

⚠ **WARNING** — **WARNING**-indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.

⚠ **CAUTION** — **CAUTION**-indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

- **NOTICE** - indicates that if not observed, the product performance or quality may not be guaranteed.

## 2. Safety Precautions

### (1) SERVICE AREA

**⚠ WARNING**

• Sufficient Ventilation

Inhalation of exhaust fumes and dust particles may be hazardous to ones health. Running engines welding, sanding, painting, and polishing tasks should be only done in well ventilated areas.

**⚠ CAUTION**

• Safe / Adequate Work Area

The service area should be clean, spacious, level and free from holes in the floor, to prevent "slip" or "trip and fall" type accidents.

**⚠ CAUTION**

• Clean, orderly arranged place

No dust, mud, oil or parts should be left on the floor surface.
[Failure to Observe]
An unexpected accident may be caused.

**⚠ CAUTION**

• Bright, Safely Illuminated Area

The work area should be well lit or illuminated in a safe manner. For work in enclosed or dark areas, a "drop cord" should be utilized. The drop cord must have a wire cage to prevent bulb breakage and possible ignition of flammable substances.

**⚠ CAUTION**

• Safety Equipment

Fire extinguisher(s), first aid kit and eye wash / shower station should be close at hand (or easily accessible) in case of an emergency.

## (2) WORK - WEAR (GARMENTS)

**⚠ CAUTION**


### • Safe Work Clothing

Appropriate safety wear (gloves, special shoes/boots, eye/ear protection, head gear, harness', clothing, etc.) should be used/worn to match the task at hand. Avoid wearing jewelry, unbuttoned cuffs, ties or loose fitting clothes around moving machinery. A serious accident may occur if caught in moving/rotating machinery.

## (3) TOOLS

**⚠ WARNING**

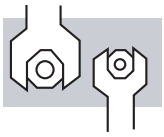
### • Appropriate Lifting / Holding

When lifting an engine, use only a lifting device (crane, jack, etc.) with sufficient lifting capacity. Do not overload the device. Use only a chain, cable, or lifting strap as an attaching device. Do not use rope, serious injury may result.

To hold or support an engine, secure the engine to a support stand, test bed or test cart designed to carry the weight of the engine. Do not overload this device, serious injury may result.

Never run an engine without being properly secured to an engine support stand, test bed or test cart, serious injury may result.

**⚠ WARNING**



### • Appropriate Tools

Always use tools that are designed for the task at hand. Incorrect usage of tools may result in damage to the engine and or serious personal injury.

## (4) GENUINE PARTS and MATERIALS

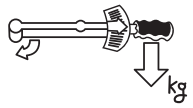
**⚠ CAUTION**


### • Genuine Parts

Always use genuine YANMAR parts or YANMAR recommended parts and goods. Damage to the engine, shortened engine life and or personal injury may result.

## (5) FASTENER TORQUE

**⚠ WARNING**

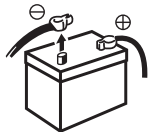



### • Torquing Fasteners

Always follow the torque values and procedures as designated in the service manual. Incorrect values, procedures and or tools may cause damage to the engine and or personal injury.

## (6) Electrical

**⚠ WARNING**



### • Short Circuits

Always disconnect the (-) Negative battery cable before working on the electrical system. An accidental "short circuit" may cause damage, fire and or personal injury. Remember to connect the (-) Negative battery cable (back onto the battery) LAST

**⚠ WARNING**

### • Charging Batteries

Charging wet celled batteries produces hydrogen gas. Hydrogen gas is extremely explosive. Keep sparks, open flame and any other form of ignition away. Explosion may occur causing severe personal injury.

**⚠ WARNING**

### • Battery Electrolyte

Batteries contain sulfuric acid. Do NOT allow it to come in contact with clothing, skin and or eyes, severe burns will result.

## (7) WASTE MANAGEMENT

**⚠ CAUTION**

Observe the following instructions with regard to hazardous waste disposal. Negligence of these will have a serious impact on environmental pollution concerns.

1) Waste fluids such as lube oil, fuel and coolant shall be carefully put into separate sealed containers and disposed of properly.
2) Do NOT dispose of waste materials irresponsibly by dumping them into the sewer, overland or into natural waterways.
3) Waste materials such as oil, fuel, coolant, solvents, filter elements and batteries, must be disposed of properly according to local ordinances. Consult the local authorities or reclamation facility.

## (8) FURTHER PRECAUTIONS

**⚠ WARNING**

### • Fueling / Refueling

Keep sparks, open flames or any other form of ignition (match, cigarette, etc.) away when fueling/refueling the unit. Fire and or an explosion may result.

**⚠ WARNING**

### • Hot Surfaces.

Do NOT touch the engine (or any of its components) during running or shortly after shutting it down. Scalding / serious burns may result. Allow the engine to cool down before attempting to approach the unit.

**⚠ WARNING**

### • Rotating Parts

Be careful around moving/rotating parts. Loose clothing, jewelry, ties or tools may become entangled causing damage to the engine and or severe personal injury.

**⚠ WARNING**

### • Preventing burns from scalding

1) Never open the filler cap shortly after shutting the engine down. Steam and hot water will spurt out and seriously burn you. Allow the engine to cool down before attempt to open the filler cap.
2) Securely tighten the filler cap after checking the cooling water. Steam can spurt out during engine running, if tightening loose.

**⚠ CAUTION**

### • Safety Label Check

Pay attention to the product safety label.
A safety label (caution plate) is affixed on the product for calling special attention to safety.
If it is missing or illegible, always affix a new one.

# 3. Precautions for Service Work

## (1) Precautions for Safety

Read the safety precautions given at the beginning of this manual carefully and always mind safety in work.

## (2) Preparation for Service Work

Preparation is necessary for accurate, efficient service work. Check the customer ledger file for the history of the engine.

- Preceding service date
- Period/operation hours after preceding service
- Problems and actions in preceding service
- Replacement parts expected to be required for service
- Recording form/check sheet required for service

## (3) Preparation before Disassembly

- Prepare general tools, special service tools, measuring instruments, oil, grease, non-reusable parts, and parts expected to be required for replacement.
- When disassembling complicated portions, put match-marks and other marks at places not adversely affecting the function for easy reassembly.

## (4) Precautions in Disassembly

- Each time a parts is removed, check the part installed state, deformation, damage, roughening, surface defect, etc.
- Arrange the removed parts orderly with clear distinction between those to be replaced and those to be used again.
- Parts to be used again shall be washed and cleaned sufficiently.
- Select especially clean locations and use clean tools for disassembly of hydraulic units such as the fuel injection pump.

## (5) Precautions for Inspection and Measurement

Inspect and measure parts to be used again as required to determine whether they are reusable or not.

## (6) Precautions for Reassembly

- Reassemble correct parts in correct order according to the specified standards (tightening torques, and adjustment standards). Apply oil important bolts and nuts before tightening when specified.
- Always use genuine parts for replacement.
- Always use new oil seals, O-rings, packing and cotter pins.
- Apply sealant to packing depending on the place where they are used. Apply of grease to sliding contact portions, and apply grease to oil seal lips.

## (7) Precautions for Adjustment and Check

Use measuring instruments for adjustment to the specified service standards.

# 1 General

## 1.1 Specifications

| Item | | Unit | Contents | | | | |
|---|---|---|---|---|---|---|---|
| Model | | | SD40-3, SD50-3 | | SD40-4, SD50-4 | | SD40-4T, SD50-4T |
| Clutch system | | | Cone clutch | | | | |
| Reduction gear system | | | Bevel gear | | | | |
| Direction of rotation | Input shaft | | Counter-clockwise viewed from stern | | | | |
| | Propeller shaft | | Counter-clockwise or clockwise viewed from stern | | | | |
| Reduction ratio | Ahead | | 2.32 | | | | |
| | Astern | | 2.32 | | | | |
| Lubrication system | | | Splash lubrication | | | | |
| Lub.oil capacity | | L | 2.2 (SD40 old type 1.8) | | | | |
| Dry mass | | kg | 39 | | | | 41 |
| Applicable eng. | Model | | 3JH3CE | 3JH4CE | 4JH3CE | 4JH4CE | 4JH3-TCE |
| | Output (DIN6270B) | kW (PS) | 29.4(40)/3800 | 29.4(40)/3000 | 41.2(56)/3800 | 40.5(55)/3000 | 55.2(75)/3800 |
| Allowable torque | | N•m (kgf•m) | 129(13.1) | | | | 140(14.3) |
| Allowable speed at Input shaft | | $min^{-1}$ (rpm) | 4000 | | | | |
| Lube oil | | | API service grade GL4 or higher,SAE80W-90 or 90(High performance gear lube, as shown on the right, is also acceptable.) | | | | Quicksilver high performance gear lube. |
| Max. propeller dia. | | mm (inch) | 457(18) | | | | |
| Mounting size | | | SAE #5 | | | | SAE #4 |
| Sealing method for bottom of ship | | | Double | | | | |
| Engine installation direction | | | 180° Acceptable | | | | |

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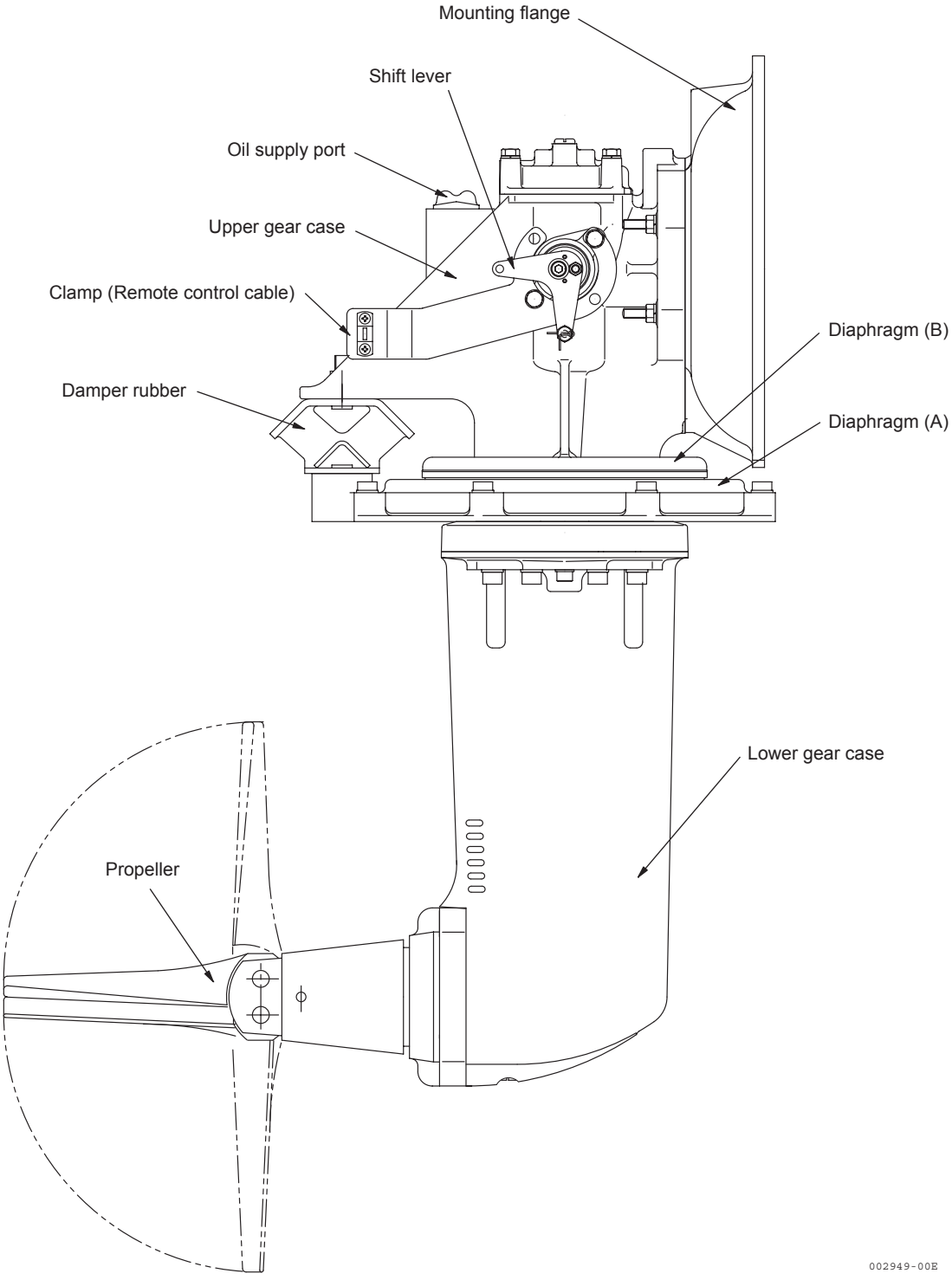
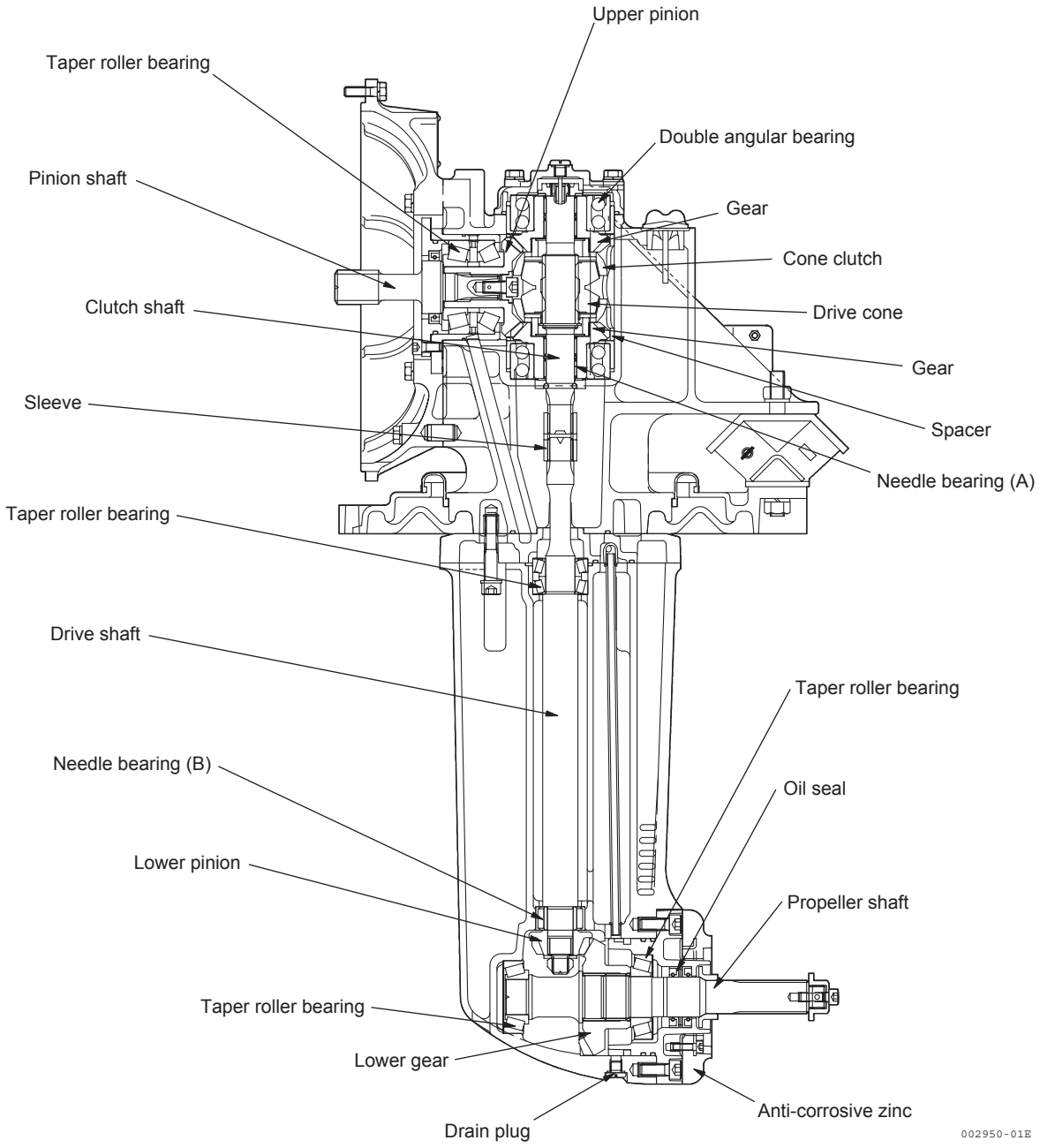
## 1.2 Exterior view



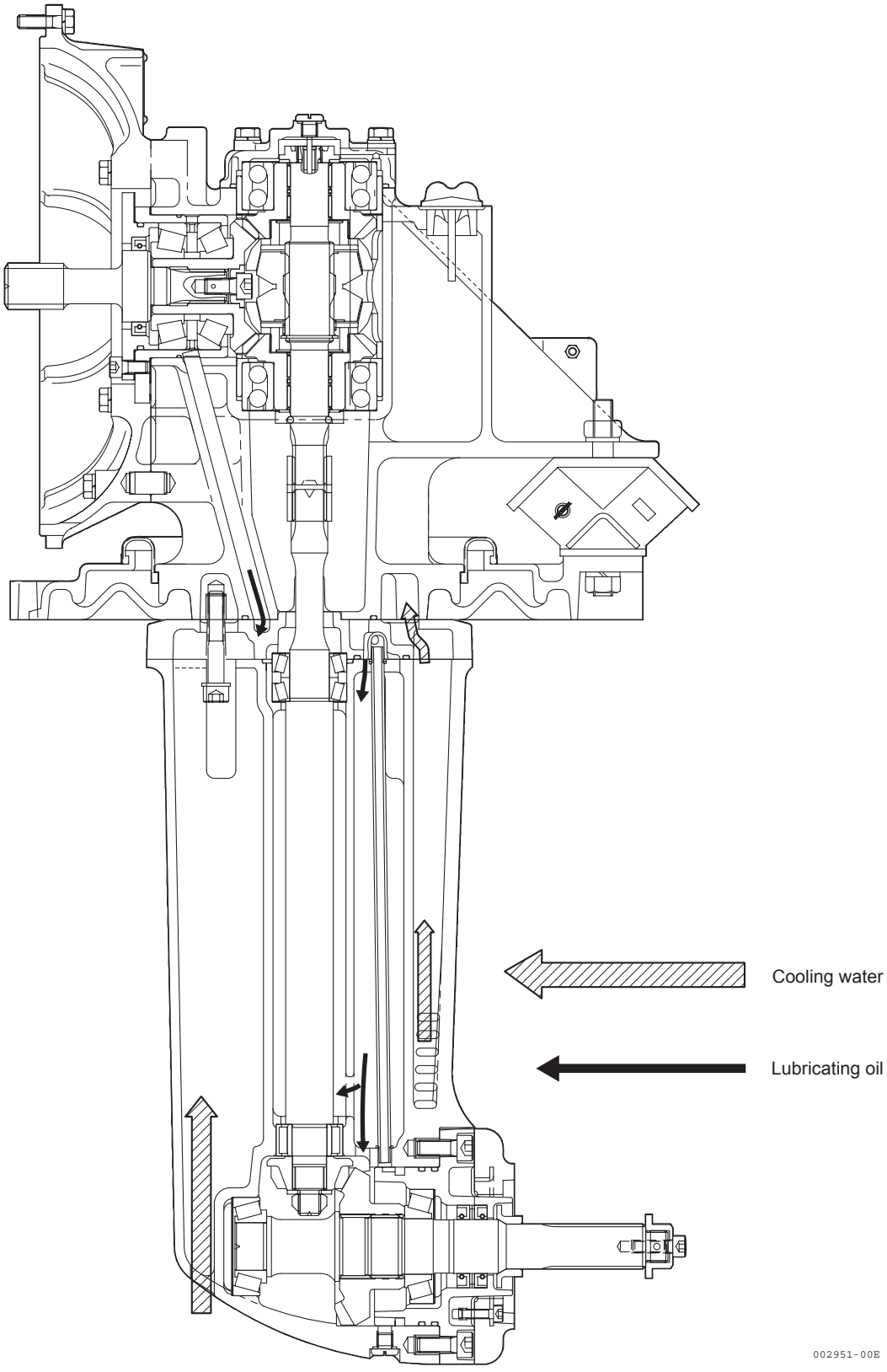
## 1.3 Sectional view



## 1.4 Criteria for replacing parts

| | | Criteria for replacement | |
|---|---|---|---|
| | | Standard value | Standard service life |
| Bearing | Needle bearing (A) (K24 x 28 x 17) | Evidence of needle flaking or loss | Every 1500 hours |
| | Needle bearing (B) | | |
| Anti-corrosive zinc | | Weight : ≦400 g (with plug) | A half year or less than 1/2 of its original size |
| Oil seals | | 1) Lip hardening or hair cracks<br>2) Disassembly | Every 1000 hours or 2 years |
| O-ring | | Disassembly | |
| Diaphragms (A) & (B) | | Hair cracks | 2 years |
| Steel band | | Disassembly | |

## 1.5 Route of cooling water and lubricating oil



## 1.6 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

See 1.2 specifications.

(3) Lube oil viscosity

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

| SD40, SD50 | | | |
|---|---|---|---|
| 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 GP 90 | GL-5 | 90 |
| SD40-4T, SD50-4T | | | |
| Quicksilver® | High performance gear lube | | |

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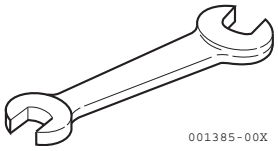
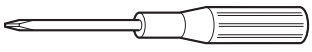
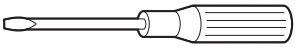
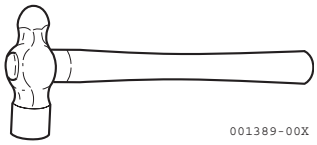
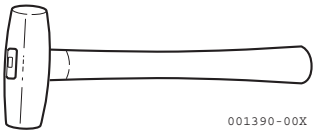
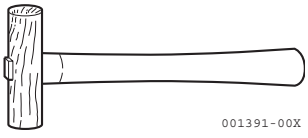
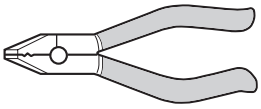
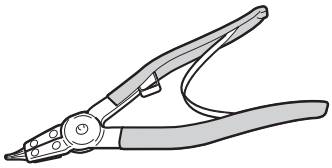
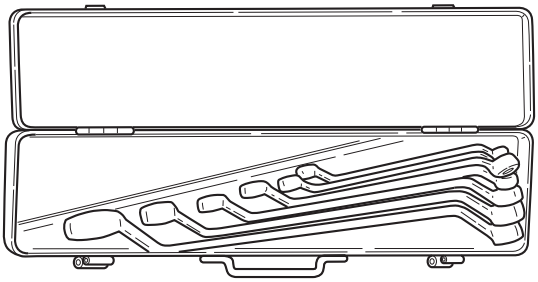
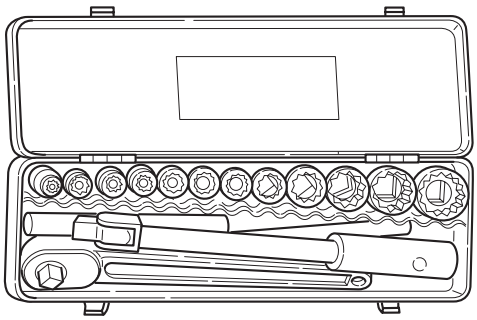
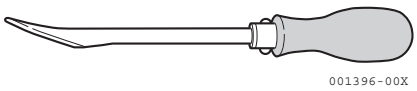
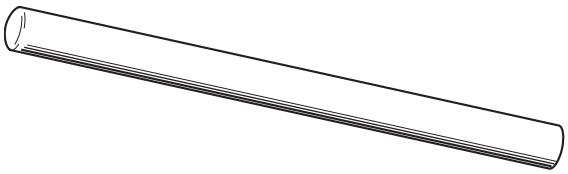
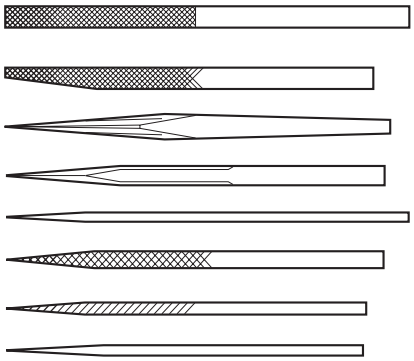
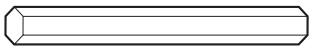
## 1.7 Disassembly and reassembly

The following tools are necessary when disassembling and reassembling the sail drive unit.
These tools must be used according to disassembly process and location.

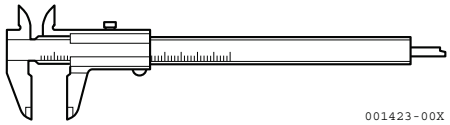
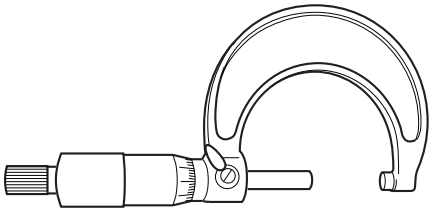
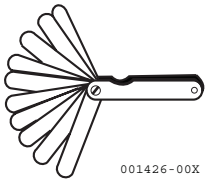
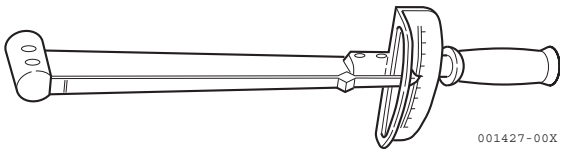
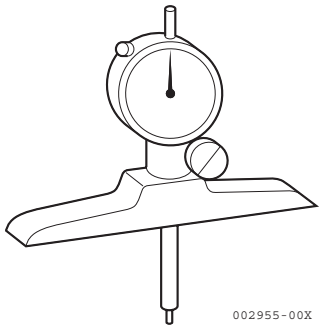
**General hand tools**

| Name | Illustration | Remarks |
|---|---|---|
| Spanner |  001385-00X | 10 x 13<br>12 x 14<br>17 x 19<br>21 x 23<br>21 x 24 |
| Screwdriver for +<br>(Cross recessed head) screws |  002952-00X | |
| Screwdriver for −<br>(Philips head) screws |  002953-00X | |
| Steel hammer |  001389-00X | |
| Copper hammer |  001390-00X | |
| Mallet |  001391-00X | |

| Name | Illustration | Remarks |
|---|---|---|
| Nipper |  001392-00X | |
| Plier |  001393-00X | |
| Starting plier |  003262-00X | |
| Offset wrench |  001394-00X | 1set |
| Box spanner |  001395-00X | 1set |

| Name | Illustration | Remarks |
|---|---|---|
| Scraper |  001396-00X | |
| Lead rod |  001397-00X | |
| File |  001398-00X | 1set |
| Rod spanner for hexagon socket head screws (L-type) |  001399-00X | 5 mm<br>6 mm<br>8 mm |
| Rod spanner for hexagon socket head screws (Straight type) |  002954-00X | 5 mm<br>6 mm<br>8 mm |

**Measuring instruments**

| Name | Illustration | Accuracy & range | Ref. |
|---|---|---|---|
| Vernier calipers |  001423-00X | 1/20 mm, 0-150 mm | |
| Micrometer |  001424-00X | 1/100 mm, 0-25 mm, 25-50 mm, 100-125 mm | |
| Thickness gauge |  001426-00X | 0.05-2 mm | |
| Torque wrench |  001427-00X | 0-147 N-m (0-15 kgf-m) | |
| Dial depth gauge |  002955-00X | 1/100 mm, 0-150 mm | 8.1.2 |