

**YANMAR.**

M2215-04E140

---

**YANMAR®**

---

**SERVICE MANUAL**

---

**SAIL DRIVE UNIT**

---

**SD40/SD40-4T**

**SD50/SD50-4T**

---

**YANMAR CO.,LTD.**




# CONTENTS

1 General .....	1
1.1 Specifications .....	1
1.2 Exterior view .....	2
1.3 Sectional view .....	3
1.4 Criteria for replacing parts .....	4
1.5 Route of cooling water and lubricating oil .....	5
1.6 Lubricating oil .....	6
1.7 Disassembly and reassembly .....	7
1.8 Special tools .....	14
1.9 Notes on disassembly, inspection and reassembly .....	19
2 Disassembly .....	20
2.1 Disassembling the upper case .....	20
2.1.1 Removal of the unit .....	20
2.1.2 Disassembling the unit .....	27
2.2 Disassembling the lower case .....	32
2.2.1 Removal of unit .....	32
3 Reassembly .....	38
3.1 Reassembling the bearing for lower case .....	38
3.1.1 Needle bearing .....	38
3.1.2 Taper roller bearing outer race .....	38
3.2 Reassembling the bearings of shaft .....	39
3.2.1 Propeller shaft .....	39
3.2.2 Drive shaft .....	39
4 Shim adjustment (Gear backlash adjustment) .....	40
4.1 Location of adjustment shims .....	40
4.2 Measurement of the dimensions of the cases .....	41
4.2.1 Upper case .....	41
4.2.2 Lower case .....	41
4.3 Shim selection method for the clutch shaft .....	42
4.3.1 Measurement of the dimensions (L1, L2, L3) of the gear .....	42
4.3.2 Calculation of the shim thickness .....	43
4.4 Shim selection method for the pinion shaft .....	44
4.4.1 Measurement of the pinion dimensions .....	44
4.4.2 Calculation of the shim thickness .....	44
4.5 Shim selection method for the drive shaft .....	45
4.5.1 Measurement of the dimensions (M1) of the pinion .....	45
4.5.2 Calculation of the shim thickness .....	45

4.6 Shim selection method for the propeller shaft .....	46
4.6.1 Measurement of the dimensions (M3) of the gear .....	46
4.6.2 Calculation of the shim thickness .....	46
5 Adjustment of bearing assembly gap .....	47
5.1 Upper gear bearing .....	47
5.1.1 Measurement of the dimension (L6) of the bearing .....	47
5.1.2 Calculation of the shim thickness .....	47
5.2 Pinion shaft bearing .....	48
5.2.1 Measurement of the dimension (L4) of the bearing .....	48
5.2.2 Calculation of the shim thickness .....	48
5.3 Pinion drive shaft bearing .....	49
5.3.1 Measurement of the dimension (M2) of the bearing .....	49
5.3.2 Calculation of the shim thickness .....	49
5.4 Propeller shaft bearing .....	50
5.4.1 Measurement of the dimension (M4) of the bearing .....	50
5.4.2 Calculation of the shim thickness .....	50
6 Adjustment of the gear backlash .....	51
6.1 Upper gear .....	51
6.2 Lower gear .....	52
7 Adjustment of the gear dye pattern .....	53
7.1 Upper gear .....	53
7.2 Propeller shaft .....	54
8 Adjustment of the shift lever .....	55
8.1 Measurement of the dimensions (H, A) .....	55
8.1.1 Shift Lever bolt .....	55
8.1.2 Shifter pin position .....	55
8.2 Calculation of the shim thickness .....	56
8.3 Caution of reassembly .....	56
9 Tightening torque for nuts and bolts .....	57

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



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



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

- **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 one's 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.

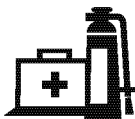
#### **CAUTION**



- **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)



### • 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

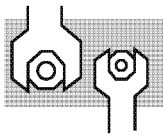


### • Appropriate Lifting / Holding

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.



### • 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

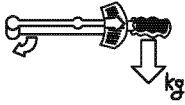


### • Genuine Parts

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

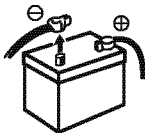


#### • Torquing Fasteners

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.

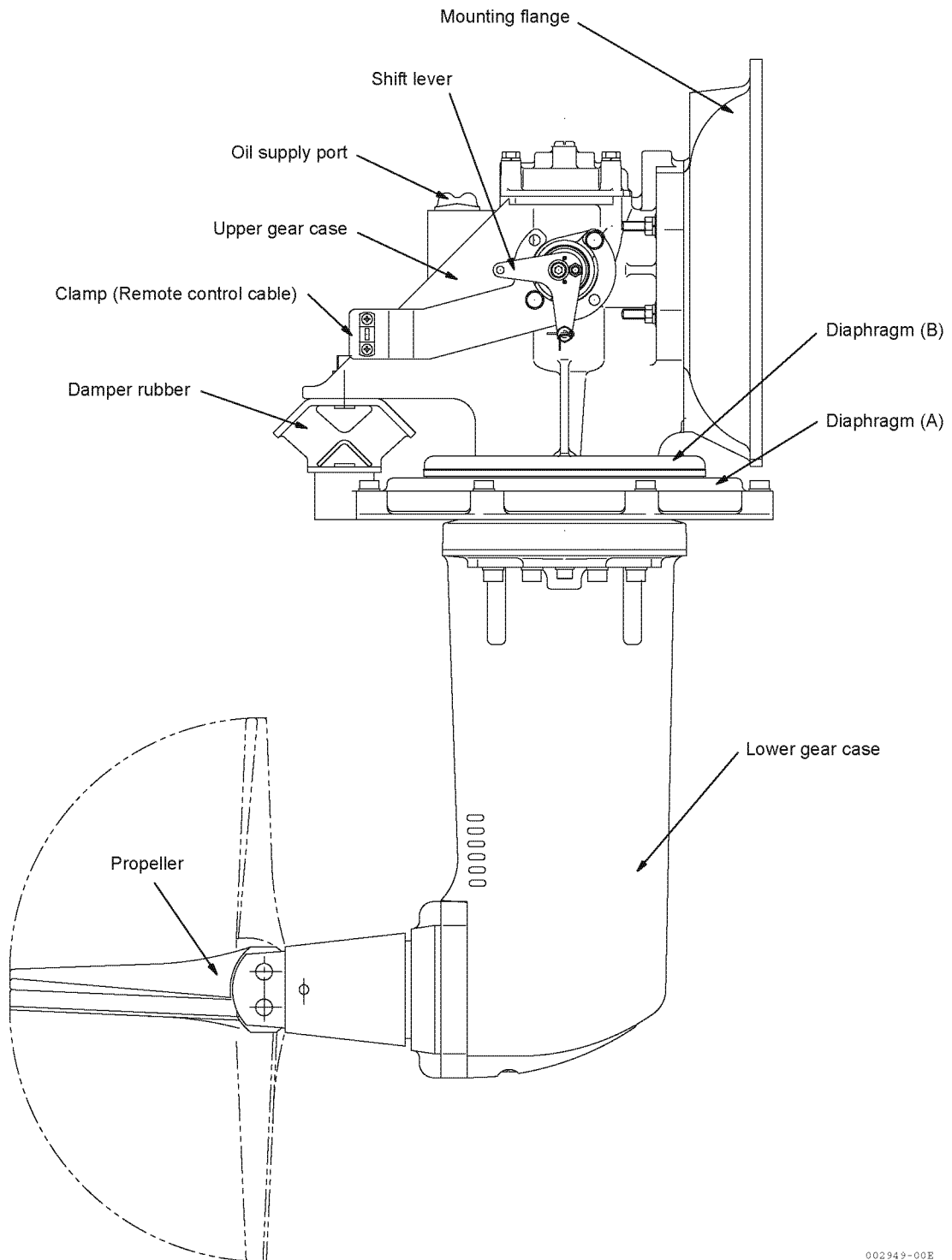
# 1 General

## 1.1 Specifications

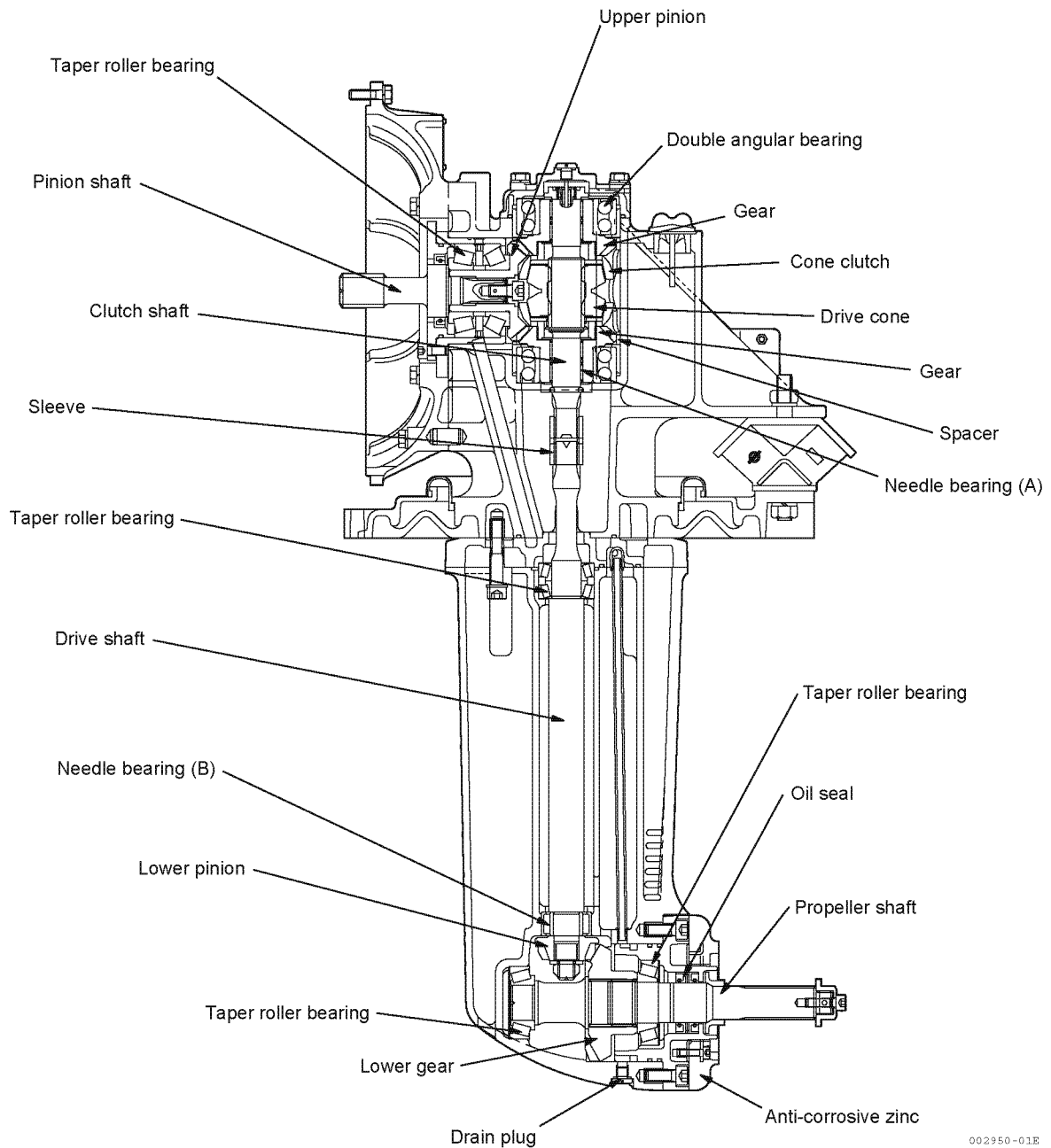
Item		Unit	Contents				
Model			SD40-3, SD50-3	SD40-4, SD50-4	SD40-4T, SD50-4T		
Clutch system			Cone clutch				
Reduction gear system			Bevel gear				
Direction of rotation	Input shaft		Counter-clockwise viewed from stern				
	Propeller shaft		Counter-clockwise or clockwise viewed from stern				
Reduction 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 <sup>-1</sup> (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				

Quicksilver® is registered trademark of Brunswick Corporation.

## 1.2 Exterior view



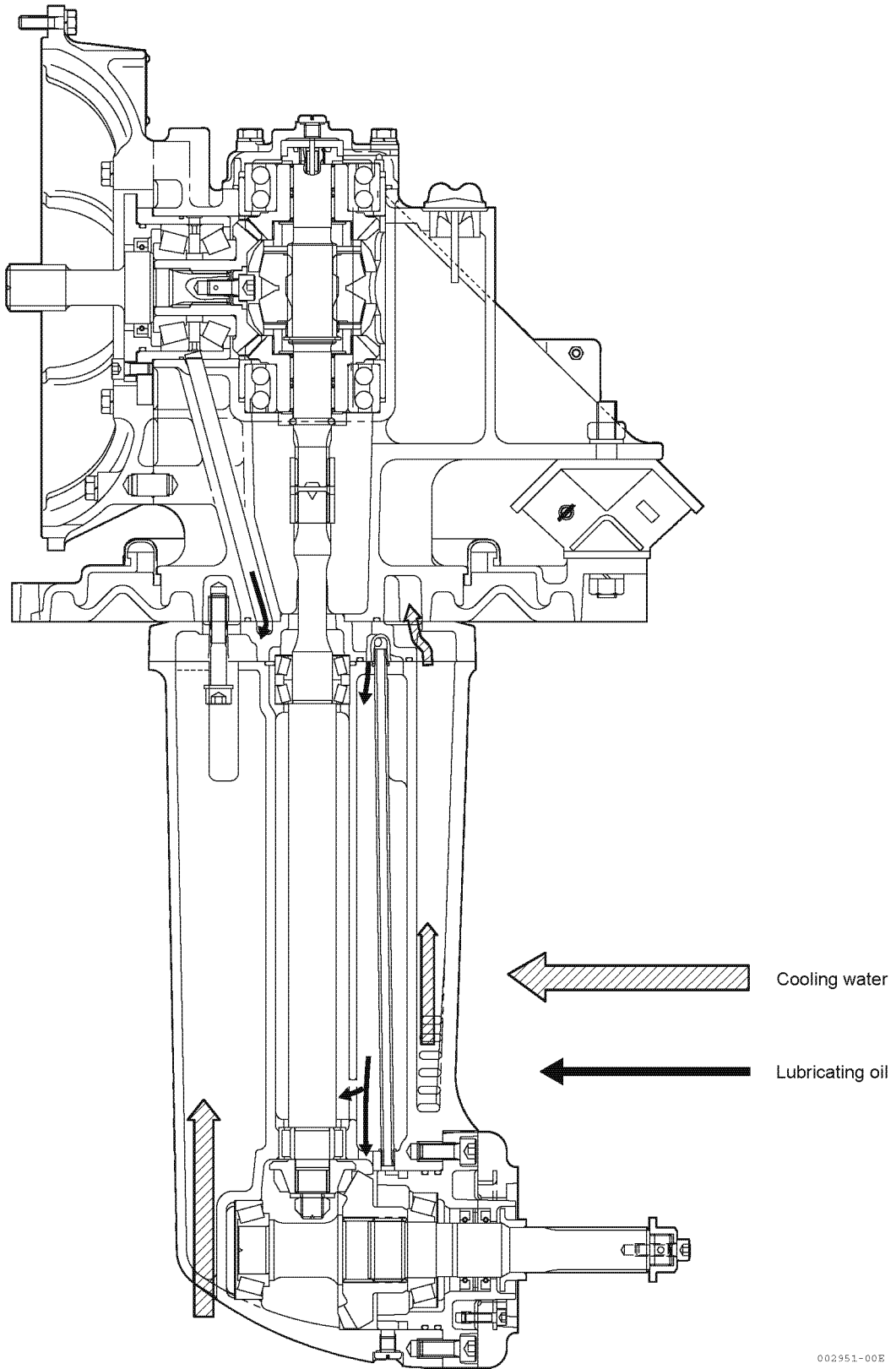
### 1.3 Sectional view



## 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 : $\leq 400$ g (with plug)	A half year or less than 1/2 of its original size
Oil seals		1) Lip hardening or hair cracks 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		

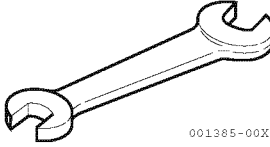
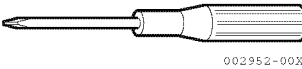
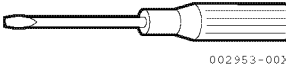


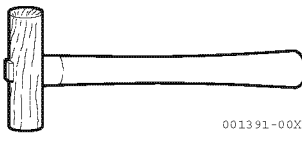
Quicksilver® is registered trademark of Brunswick Corporation.

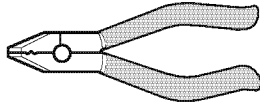

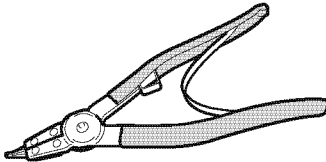
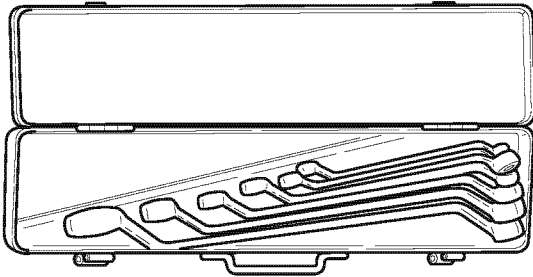
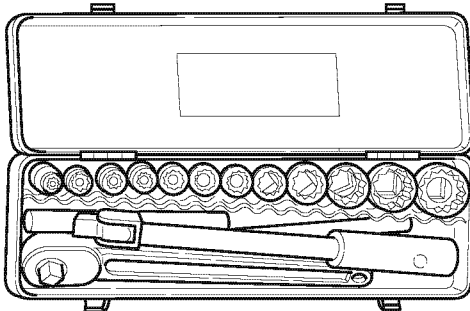



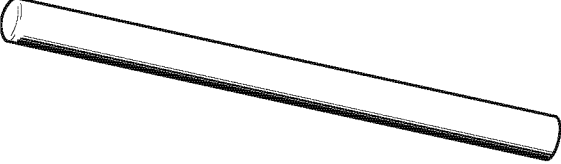
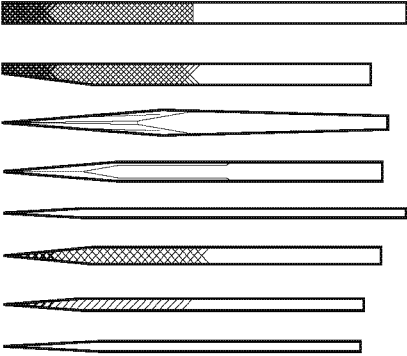


## 1.7 Disassembly and reassembly

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


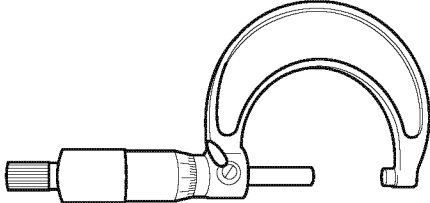
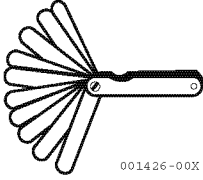
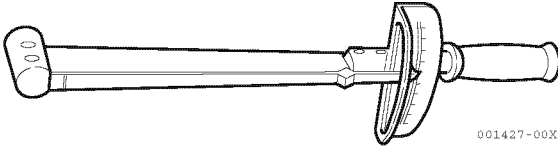
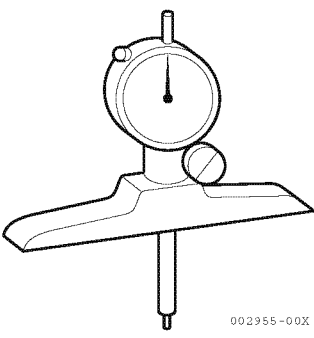
### General hand tools

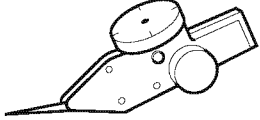
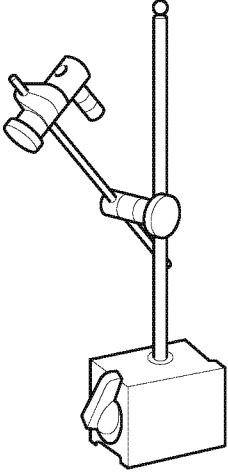
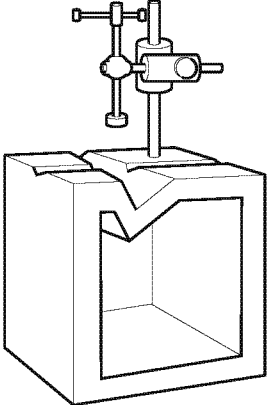
Name	Illustration	Remarks
Spanner		10 x 13 12 x 14 17 x 19 21 x 23 21 x 24
Screwdriver for + (Cross recessed head) screws		
Screwdriver for – (Philips head) screws		
Steel hammer		
Copper hammer		
Mallet		

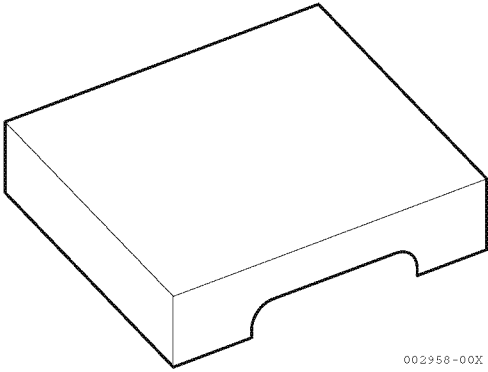
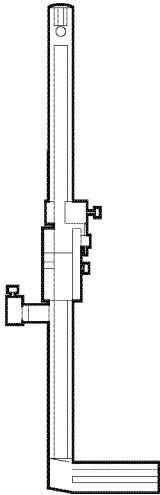
Name	Illustration	Remarks
Nipper	 <p style="text-align: center;">001392-00X</p>	
Plier	 <p style="text-align: center;">001393-00X</p>	
Starting plier	 <p style="text-align: center;">003262-00X</p>	
Offset wrench	 <p style="text-align: center;">001394-00X</p>	1set
Box spanner	 <p style="text-align: center;">001395-00X</p>	1set

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

Measuring instruments

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

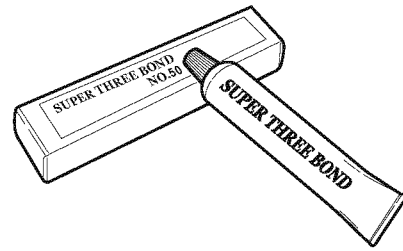
Name	Illustration	Accuracy & range	Ref.
Lever type dial test indicator	 <p>003042-00X</p>	1/100 mm, 0-0.8 mm	6.1
Magnetic base	 <p>002956-00X</p>		
Clamp type box block	 <p>002957-00X</p>	100 mm (K-type)	

Name	Illustration	Accuracy & range	Ref.
Surface plate	 <p style="text-align: right; margin-right: 20px;">002958-00X</p>		
Height gauge	 <p style="text-align: center;">002959-00X</p>	500 mm	

**Others**

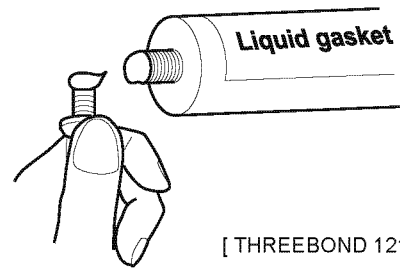
**Supplementary packing agent**

The surface to be coated must be thoroughly cleaned with thinner or benzene and completely dry. Moreover, coating must be thin and uniform.



002960-00X

**Liquid gasket**



[ THREEBOND 1215 ]

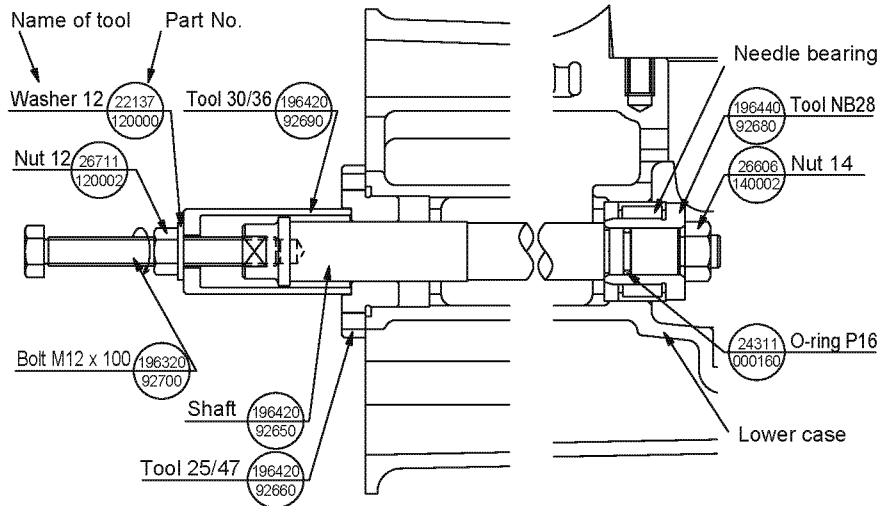
002961-00E

## 1.8 Special tools

### Reassembly tools

(1) For needle bearing

Use when reassembling the needle bearing to the lower case.

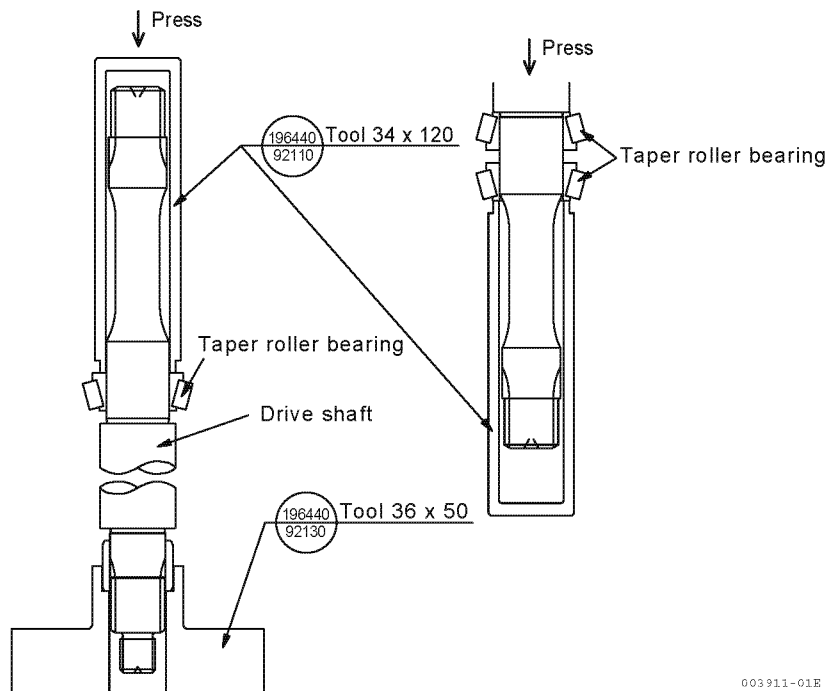


003910-00E

(2) For taper roller bearing at drive shaft

Use when reassembling the taper roller bearing at the drive shaft.

Press it as striking it with a hammer strongly.



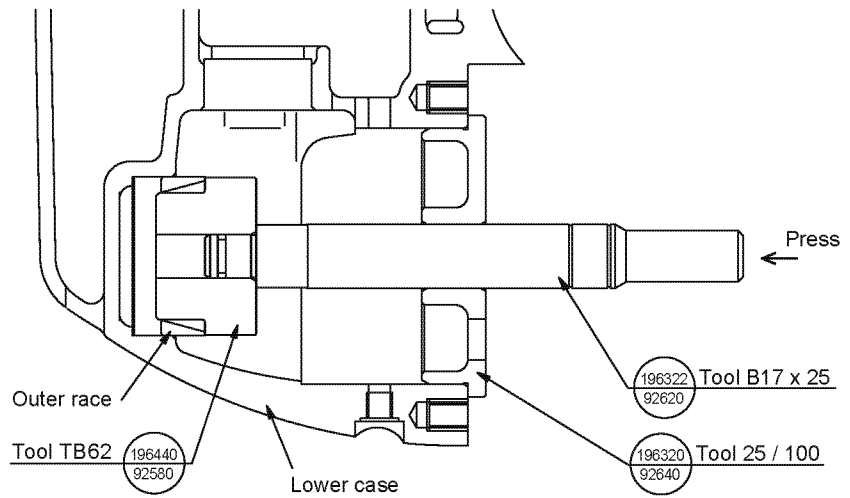
003911-01E



(3) For outer race of taper roller bearing at propeller shaft

Use when reassembling the outer race of the taper roller bearing to the lower case.

Press it as striking it with a hammer strongly.

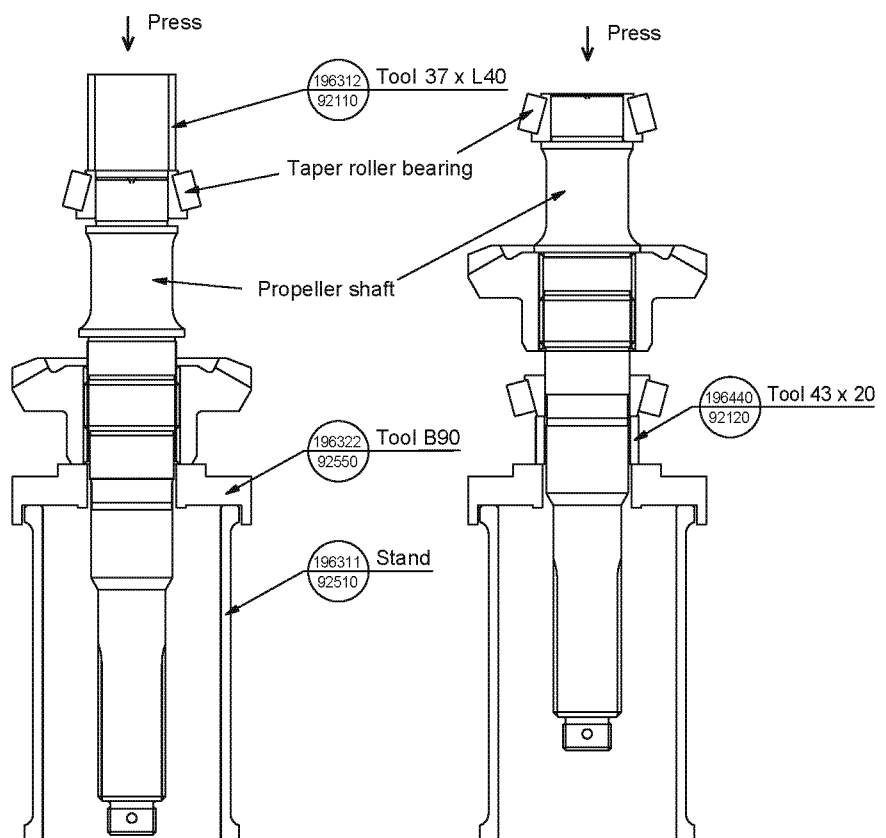


003912-00E

(4) For taper roller bearing at propeller shaft

Use when reassembling the taper roller bearing at the propeller shaft.

Press it as striking it with a hammer strongly.

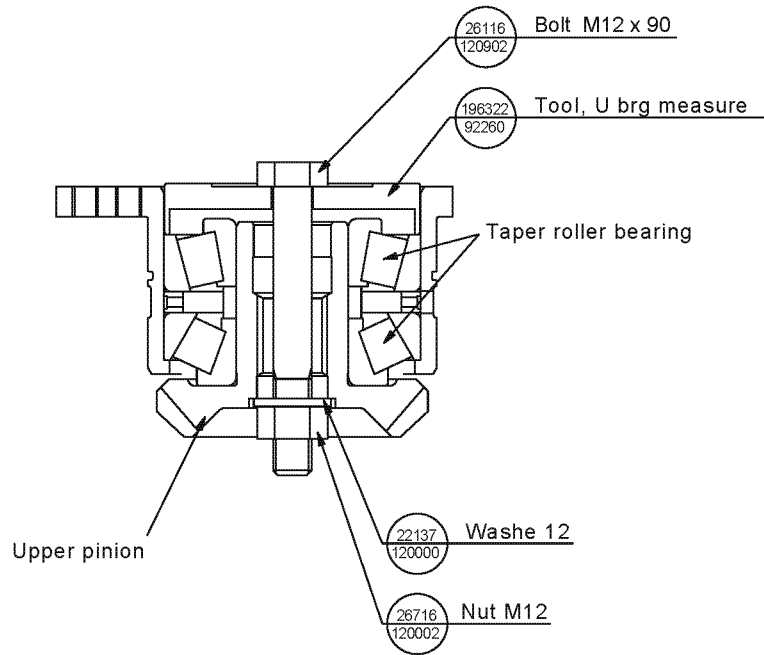


003913-00E

**Tools for measuring dimensions**

(1) For taper roller bearing at pinion shaft

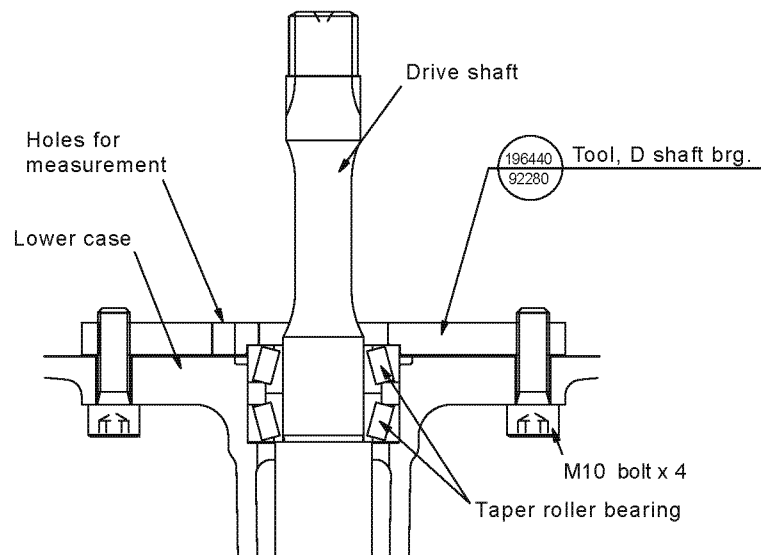
Use when measuring the dimension of L4(Refer to 5.2.1(1)).



003914-00E

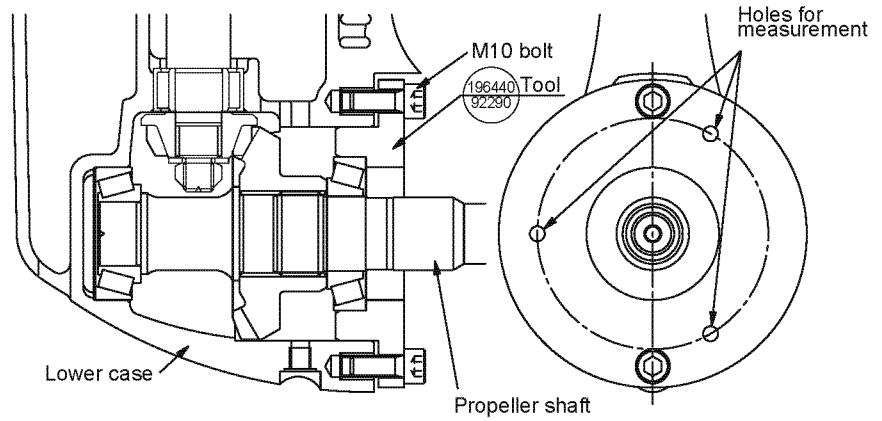
(2) For taper roller bearing at drive shaft

Use when measuring the dimension of M2(Refer to 5.3.1(1)).



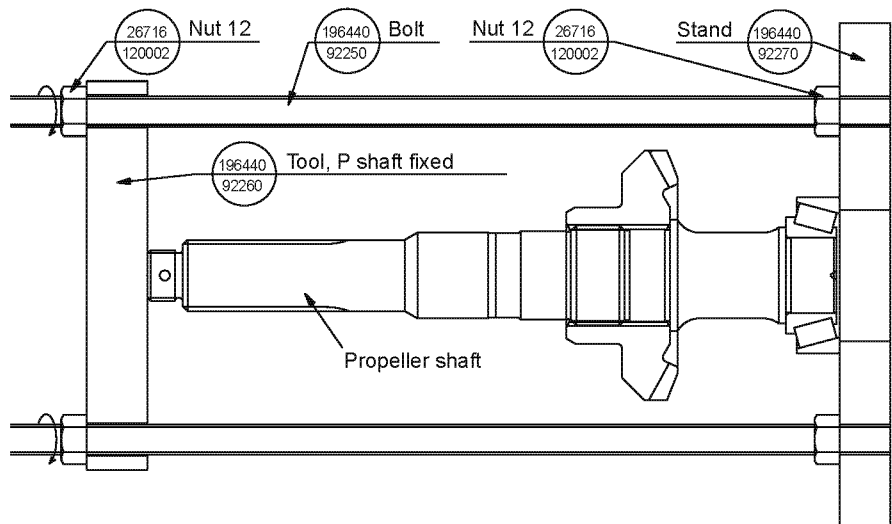
003915-00E

(3) For taper roller bearing at propeller shaft  
 Use when measuring the dimension of M4(Refer to 5.4.1(1)).



003916-01E

(4) For bevel gear on propeller shaft  
 Use when measuring the dimension of M3(Refer to 4.6.1).

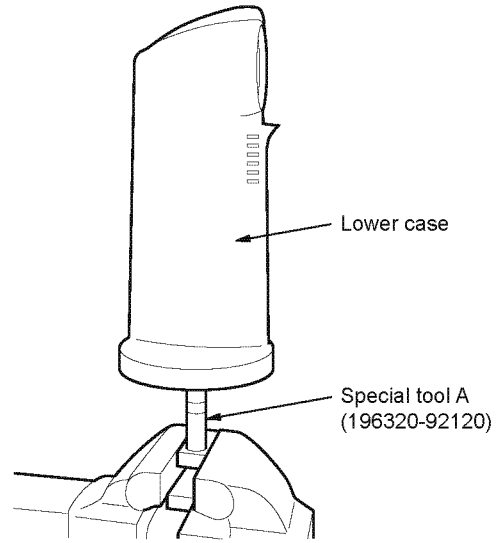


003917-00E

**Disassembly tools**

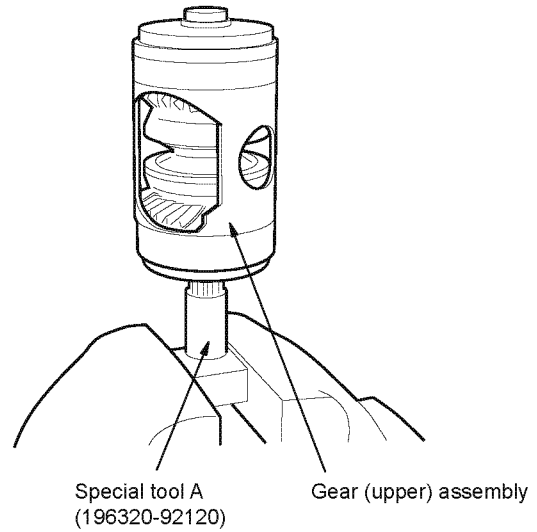
(1) Special tool A

1) Use when removing the drive pinion end nut.



003918-00E

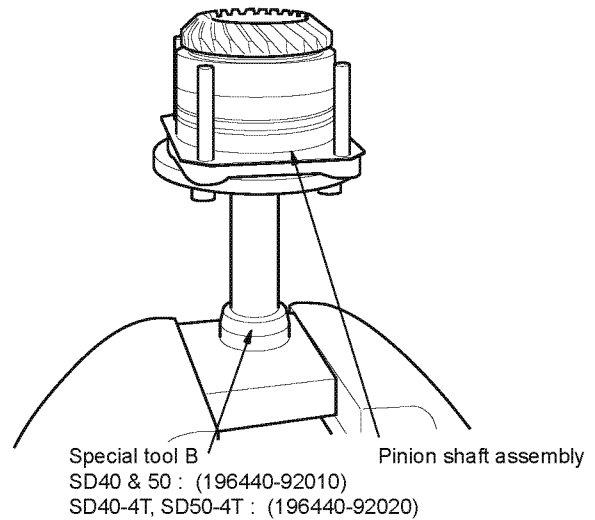
2) Use when disassembling the gear (upper) assembly.



003919-00E

(2) Special tool B

1) Use when disassembling the pinion shaft assembly.



002962-00E

## **1.9 Notes on disassembly, inspection and reassembly**

- (1) Carefully note the correct mounting position before removing or disassembling the unit.
- (2) To avoid mix-ups when disassembling, keep the parts in order.
- (3) Use liquid gasket wherever necessary to prevent oil or water leakage.
- (4) When the tightening torque is specified, tighten the bolt to the specified torque with a torque wrench.
- (5) Always use new gaskets, packing, and o-rings when reassembling.
- (6) Always use genuine YANMAR replacement parts.
- (7) Some repairs require special tools in fully equipped workshops.  
These repairs should be made with the proper tools and in the proper facilities.
- (8) Disassemble in the order specified in this Service Manual.

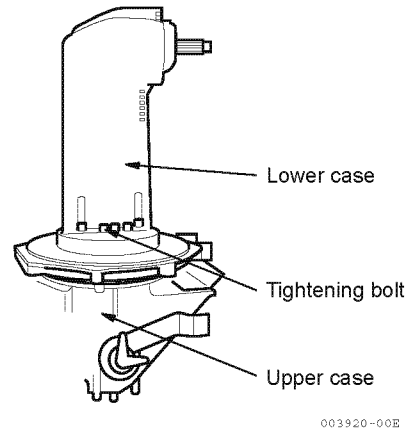
## 2 Disassembly

### 2.1 Disassembling the upper case

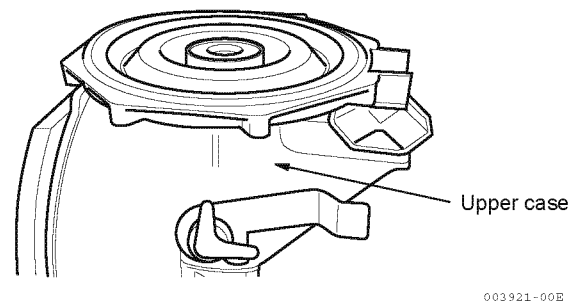
#### 2.1.1 Removal of the unit

(1) Separation from the lower case

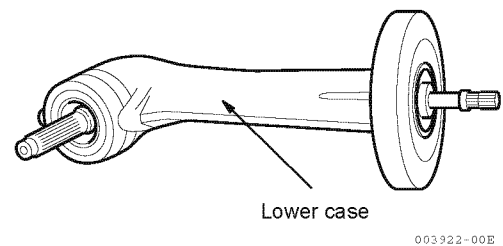
1) Remove the tightening bolts (M10) from the lower case.



2) Upper case separated from lower case.

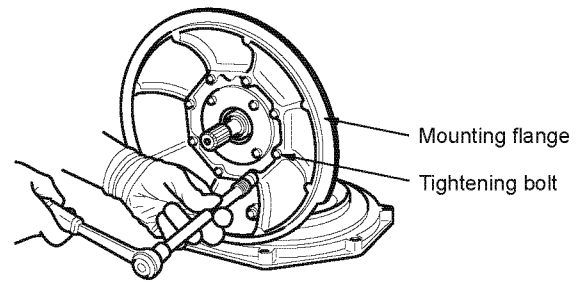


3) Lower case separated from upper case.



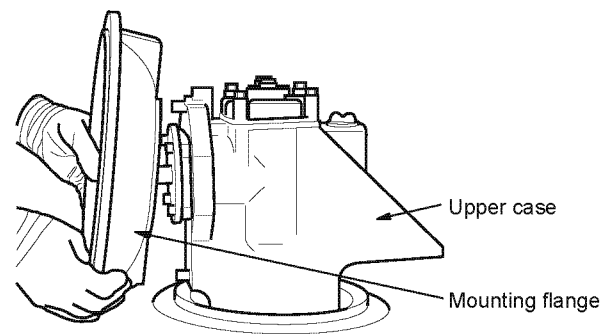
(2) Removal of the mounting flange

- 1) Remove the tightening bolts (M8) from the mounting flange and the upper case.



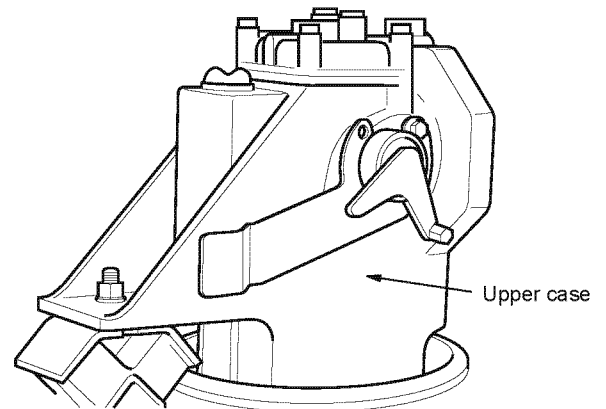
002028-00E

2) Removal of mounting flange.



002963-00E

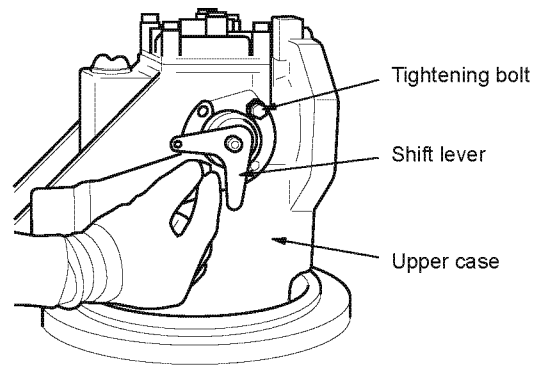
3) Upper case removed from mounting flange.



002964-00E

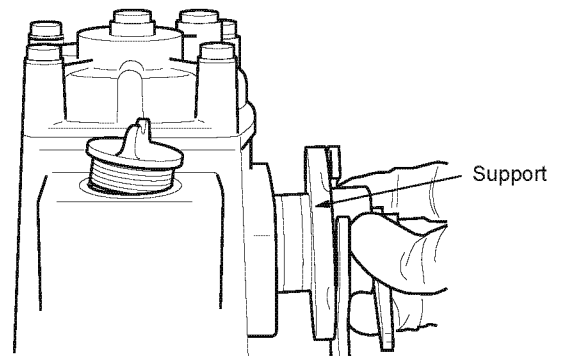
(3) Removal of the Shift Lever and Support

1) Remove the support tightening bolt (M8).



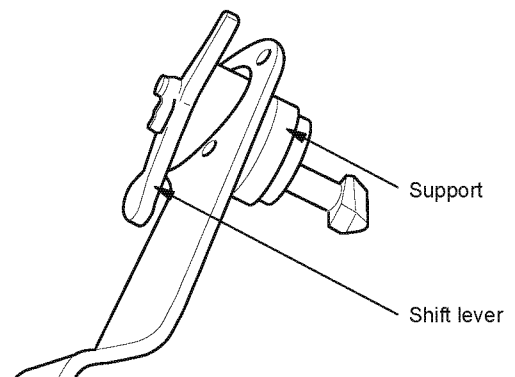
002965-00E

2) Remove the support.



002966-00E

3) Shift lever assembly after removal.

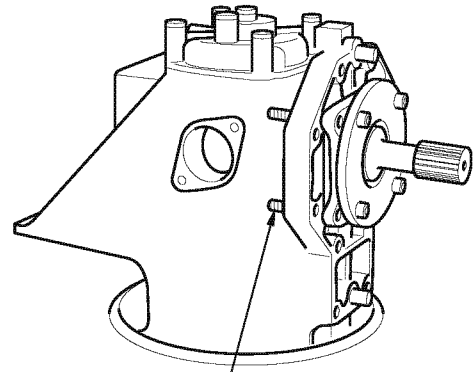


003923-00E



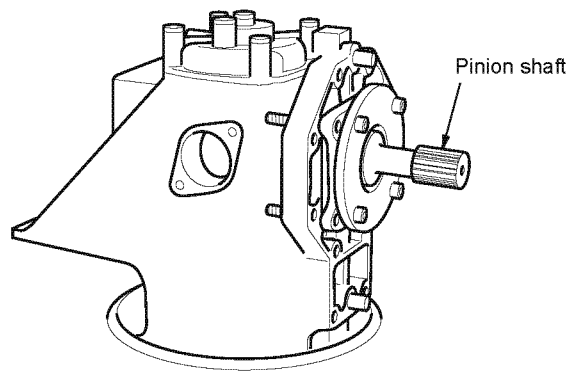
(4) Removal of the pinion shaft assembly

1) Remove the pinion shaft assembly nuts.



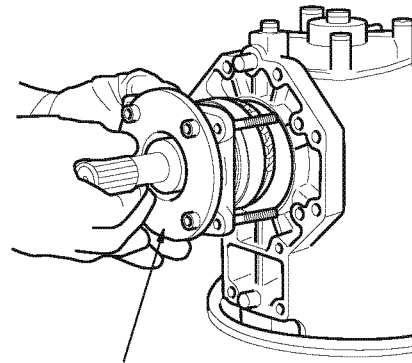
Tightening nut

002967-00E



003924-00E

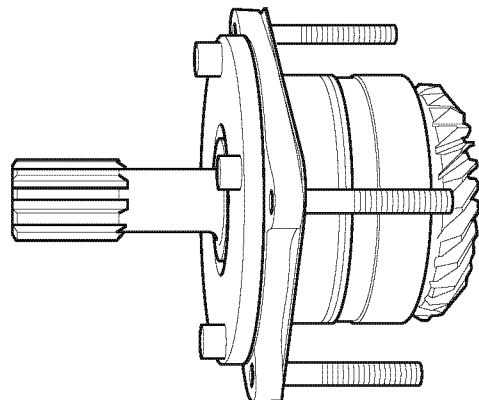
2) Remove the pinion shaft assembly from the upper case.



Pinion shaft assembly

003029-00E

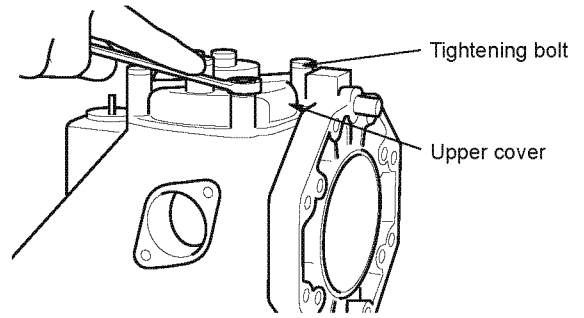
3) Pinion shaft assembly after removal.



003030-00E

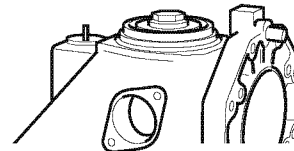
(5) Removal of the gear (upper) assembly

1) Remove the upper cover tightening bolts (M8).

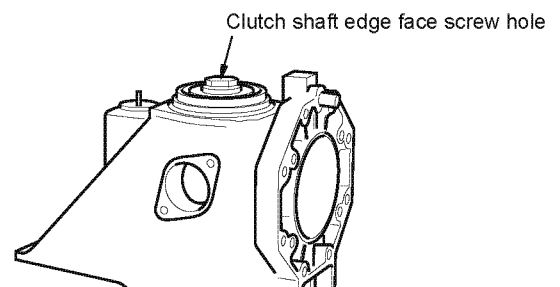


003031-00E

2) Remove the upper cover.

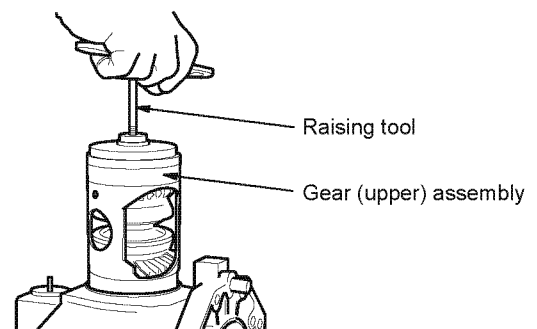


003032-00E



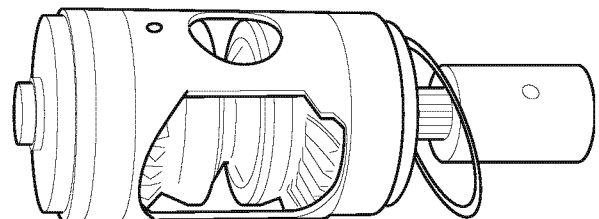
003033-00E

3) Screw the gear (upper) assembly raising tool into the thread (M8) of the clutch shaft edge face and lift out the assembly.



003034-00E

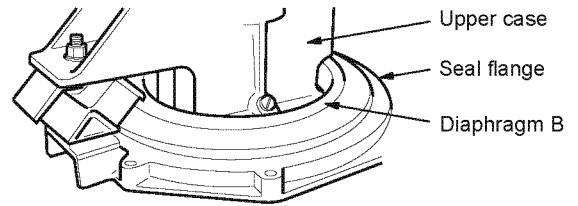
4) Gear (upper) assembly after removal.



003035-00X

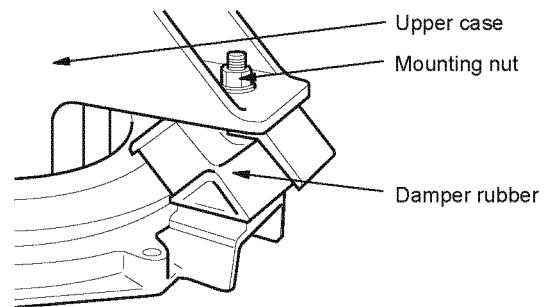
(6) Removal of the diaphragm

- Diaphragm A



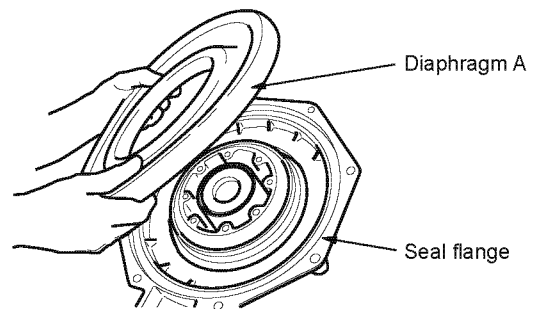
003036-00E

- 1) Remove the damper rubber mounting nut (M12) from the upper case.



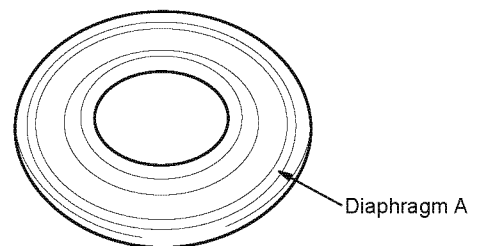
003925-00E

- 2) Remove the diaphragm A which was installed on the back of the upper case seal flange.



003926-00E

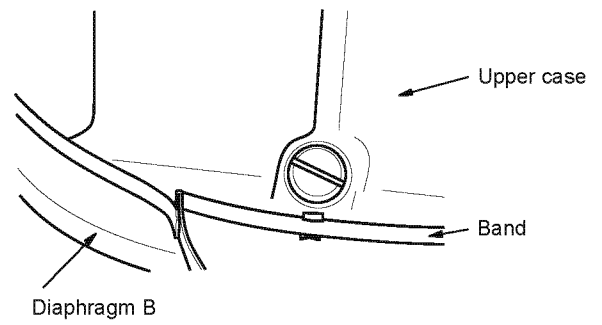
- 3) Diaphragm A after removal.



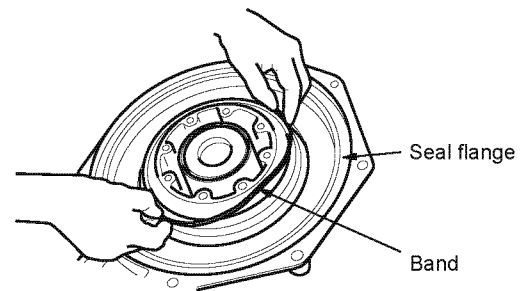
003927-00E

- Diaphragm B

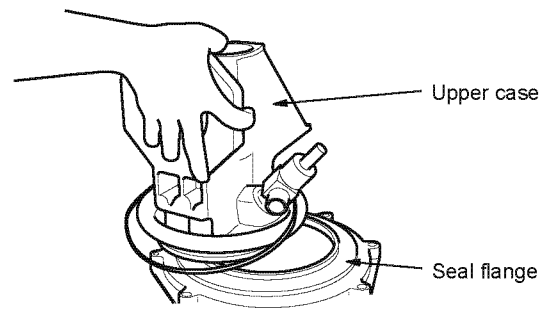
1) Remove the upper case bend.



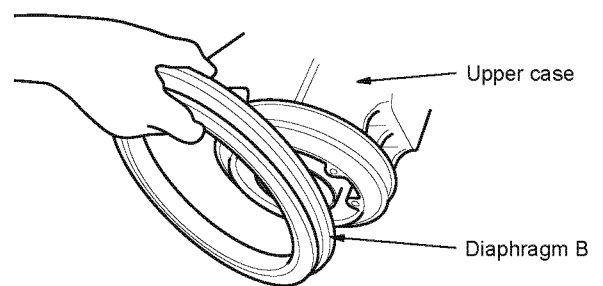
2) Remove the seal flange band.



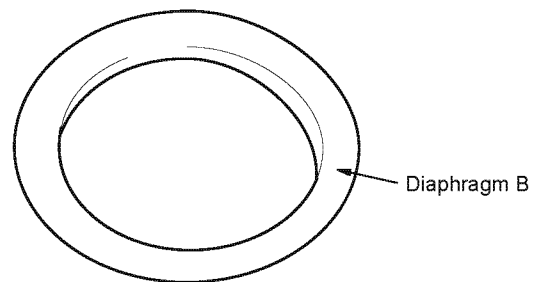
3) Remove the upper case and the seal flange.



4) Remove the diaphragm B from the upper case.



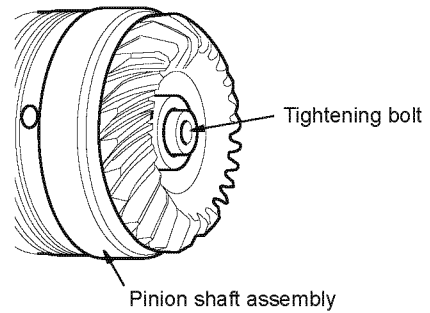
5) Diaphragm B after removal.



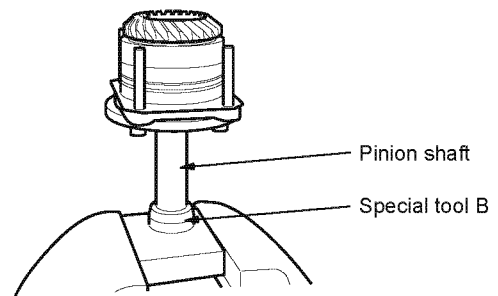
### 2.1.2 Disassembling the unit

(1) Disassembling the pinion shaft assembly

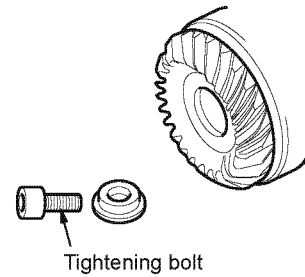
- 1) Remove the tightening bolt (M10) for pinion gear and the pinion shaft assembly to disassemble.



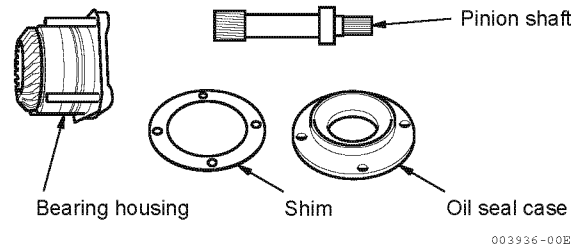
- 2) Insert the pinion shaft to the fixed special tool B (for stopping gear movement).



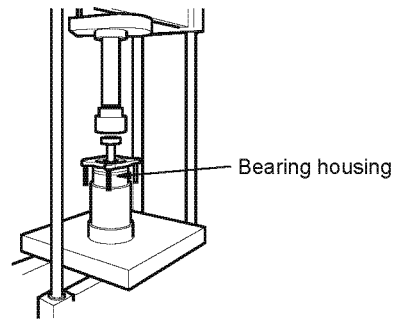
- 3) Remove the tightening bolt (M10).



- 4) Pinion shaft assembly after removal.

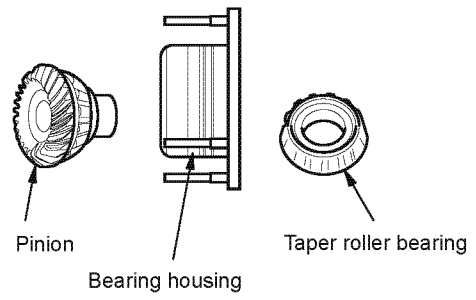


- 5) Push out the pinion by using the press to separate the pinion from bearing housing.



003937-00B

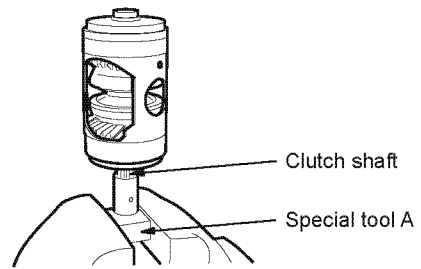
- 6) Pinion and taper roller bearing separated from bearing housing.



003938-00B

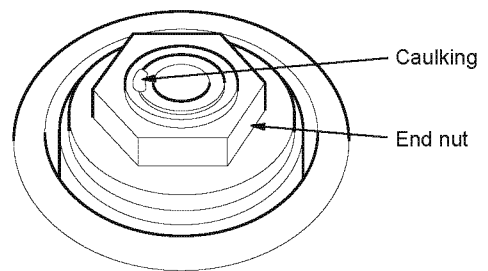
(2) Disassembling the gear (upper) assembly

- 1) Insert the clutch shaft to the fixed special tool A (for stopping gear movement)



003939-00E

- 2) The edge of the clutch shaft end nut (M16 x 1.5 left-hand screw) is caulked to the clutch shaft.



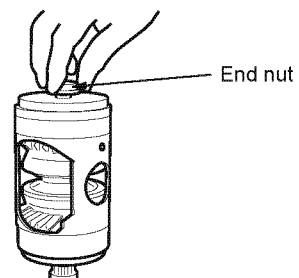
003940-00E

- 3) Lift up the caulking.



003941-00E

- 4) Remove the end nut.



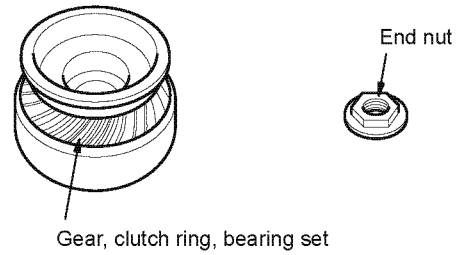
003942-00E

- 5) Pull out the gear, clutch ring and bearing as a unit.

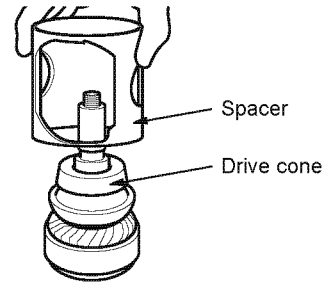


003943-00E

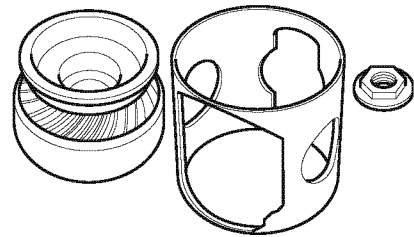
6) Gear, clutch ring and bearing as a unit after removal.



004751-00E

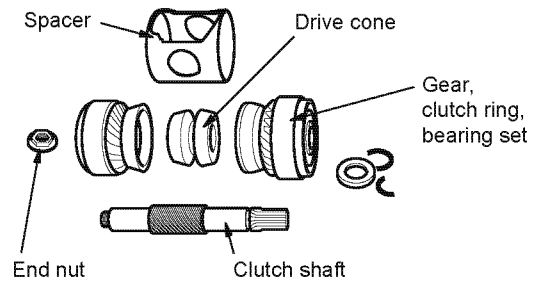


004752-00B



004753-00X

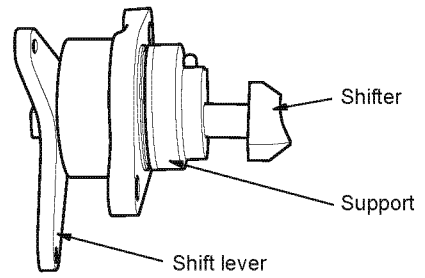
7) Gear (upper) assembly after disassembly.



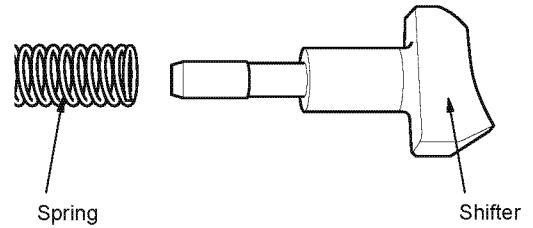
004754-01E



(3) Disassembling the shift lever assembly

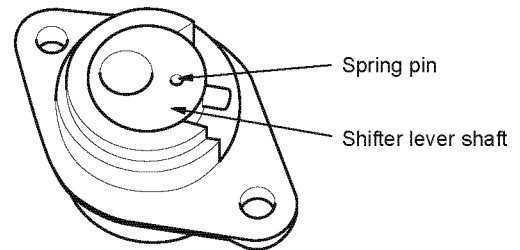


004755-00E



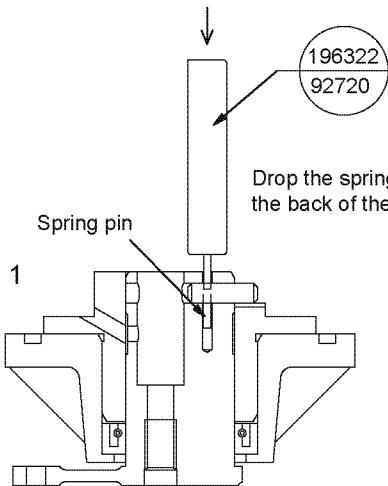
004756-00E

1) Disassemble in the order shown in the illustrations below.

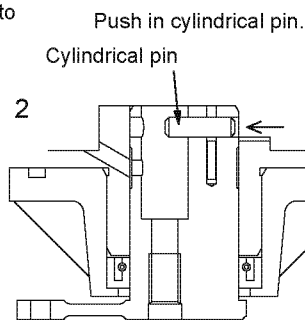


004757-00E

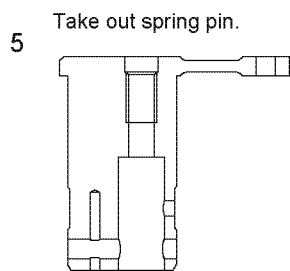
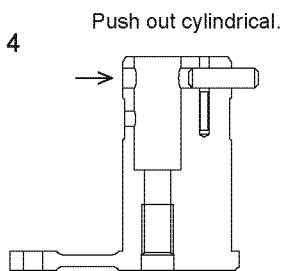
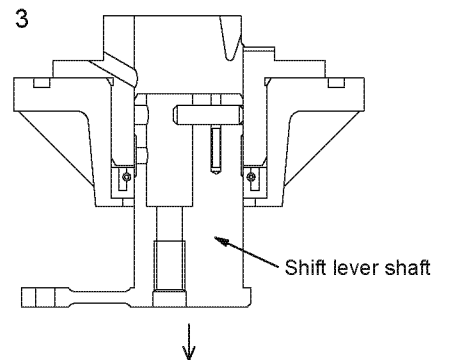
Disassemble in the order 1 - 5.



Drop the spring pin in to the back of the hole.



Pull out shift lever.



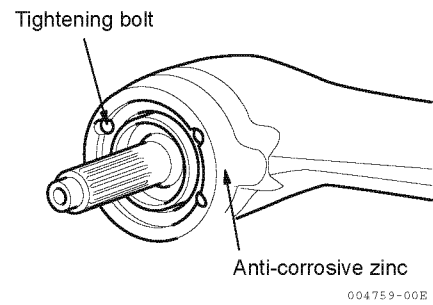
Spray with liquid detergent for easy removal.

004758-00E

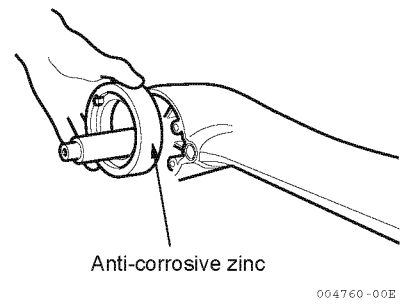
## 2.2 Disassembling the lower case

### 2.2.1 Removal of unit

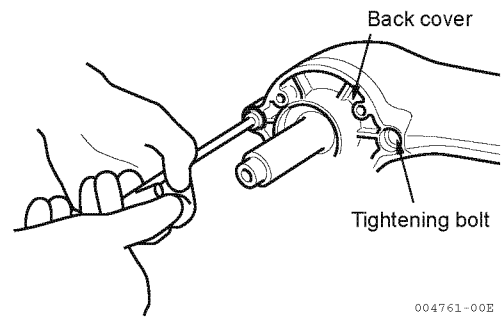
#### (1) Removal of anti-corrosive zinc



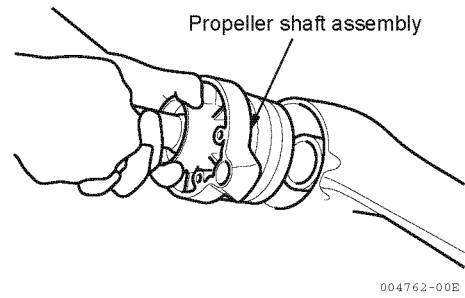
- 1) Remove the tightening bolts (M6) and take off anti-corrosive zinc.



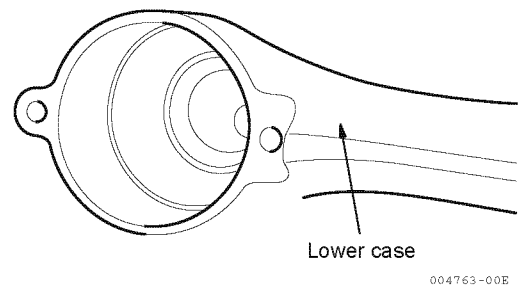
(2) Removal of the propeller shaft assembly



1) Remove the tightening bolts (M10) and take off propeller shaft assembly.

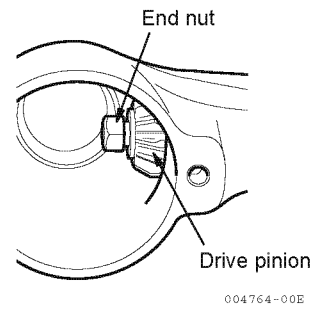


2) Lower case removed from propeller shaft assembly.

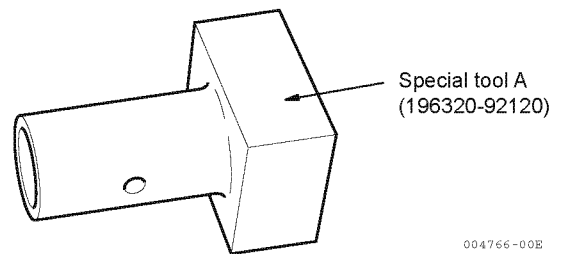
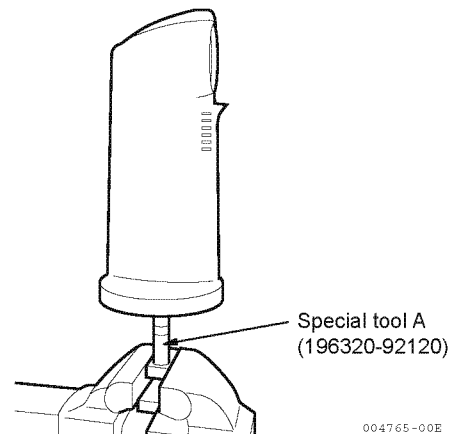


(3) Removal of the drive pinion end nut

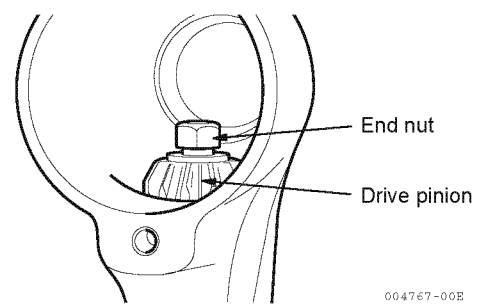
- 1) The drive pinion is positioned to the drive shaft with the end nut.



- 2) Insert the drive shaft to the fixed special tool A (for stopping the gear).  
Loosen the end nut (M14).

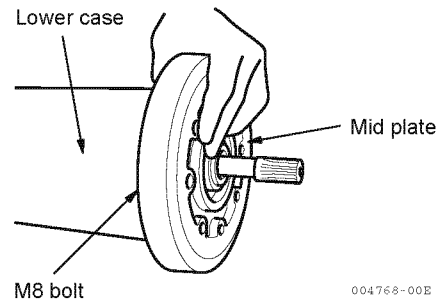


- 3) Remove the end nut (M14).



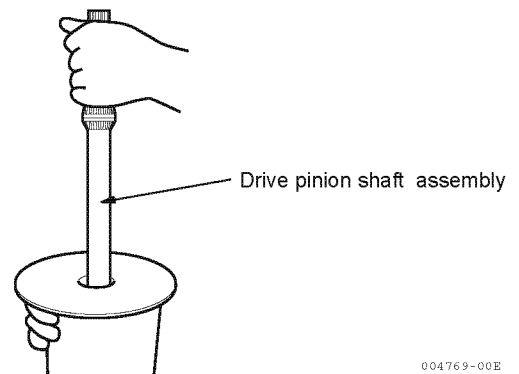
(4) Removal of the mid plate

- 1) Remove the two M8 bolts.  
Remove the mid plate.



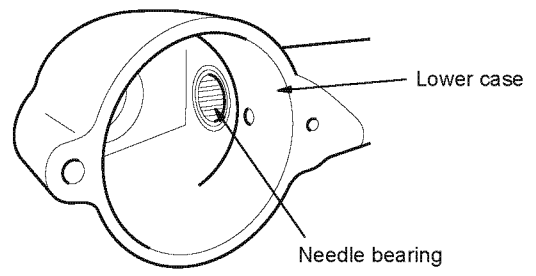
(5) Removal of the drive pinion shaft assembly

- 1) Remove the drive pinion shaft assembly.

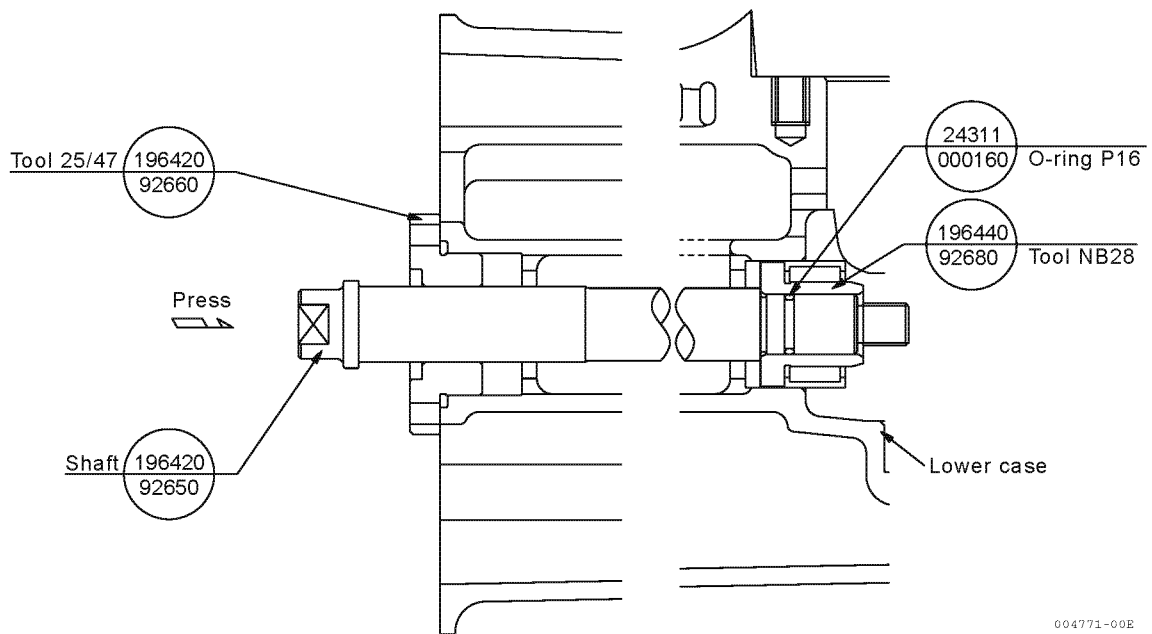


(6) Removal of the needle bearing

- 1) Remove the needle bearing with the tool shown in the illustration below.



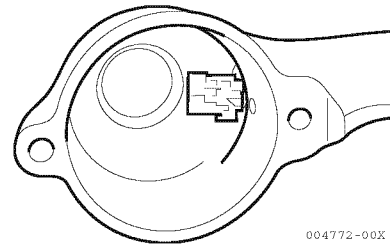
004770-00E



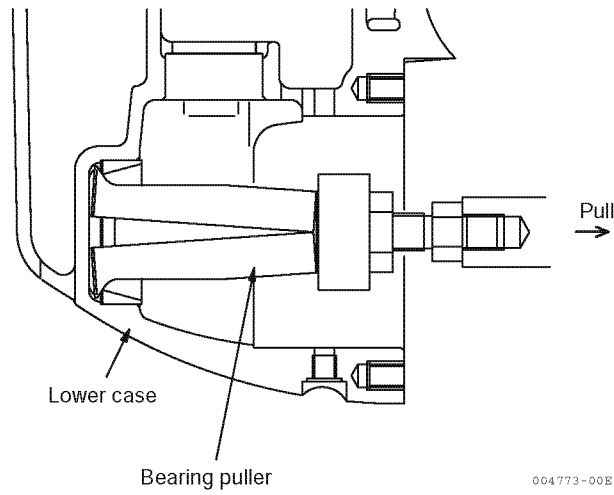
004771-00E

(7) Removal of the taper roller bearing outer race

- 1) Remove the taper roller bearing outer race with the tool shown in the illustration below.



004772-00X



004773-00E

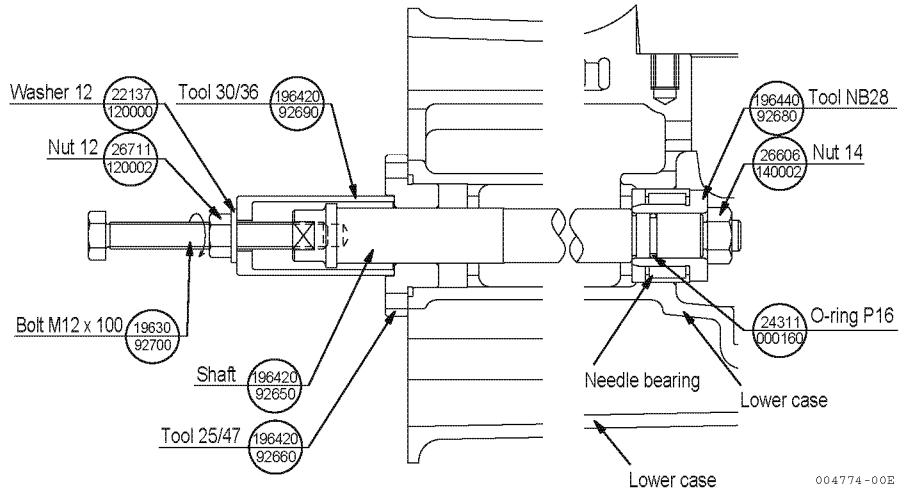
### 3 Reassembly

Reassemble parts in the reverse order from disassembly.  
Refer to Chapter 9 for tightening torque.

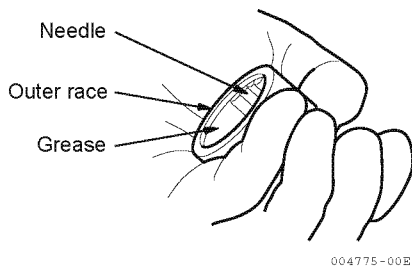
#### 3.1 Reassembling the bearing for lower case

##### 3.1.1 Needle bearing

- 1) Reattach the needle bearing using the special tool.

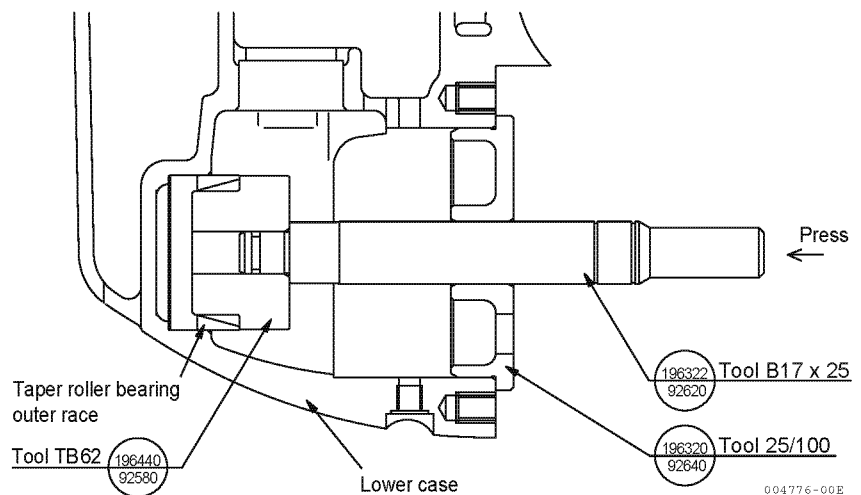


- 2) Fix the needle to the outer race with grease.



##### 3.1.2 Taper roller bearing outer race

- 1) Reattach using the special tool.

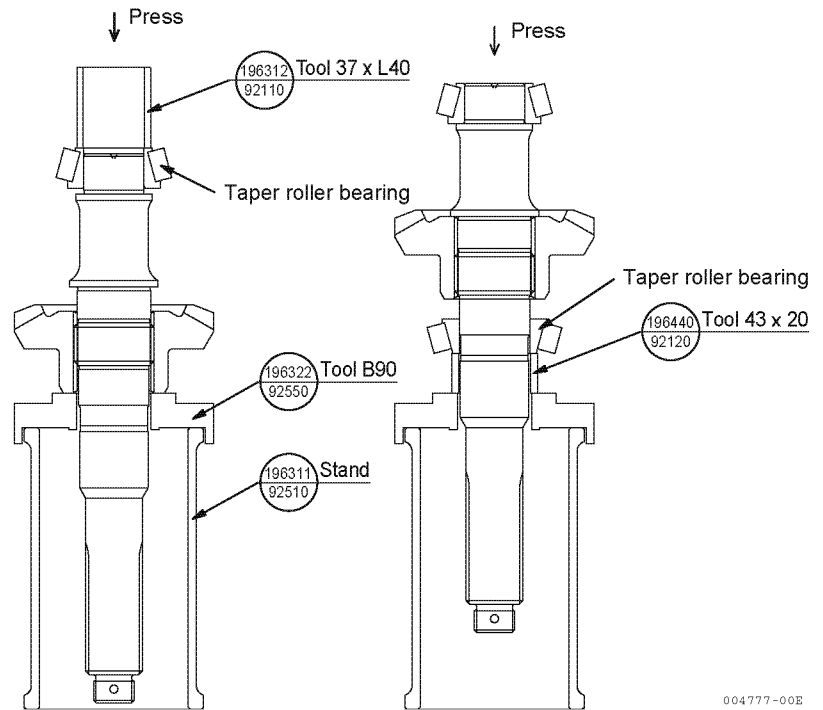




## 3.2 Reassembling the bearings of shaft

### 3.2.1 Propeller shaft

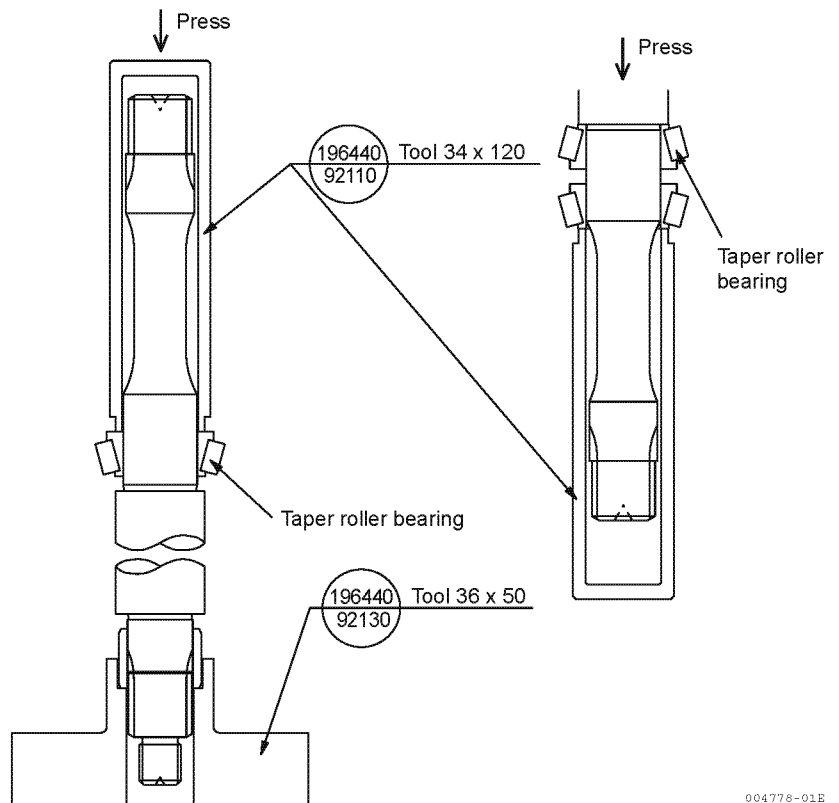
- 1) Reattach the taper roller bearing using the special tool.



004777-00E

### 3.2.2 Drive shaft

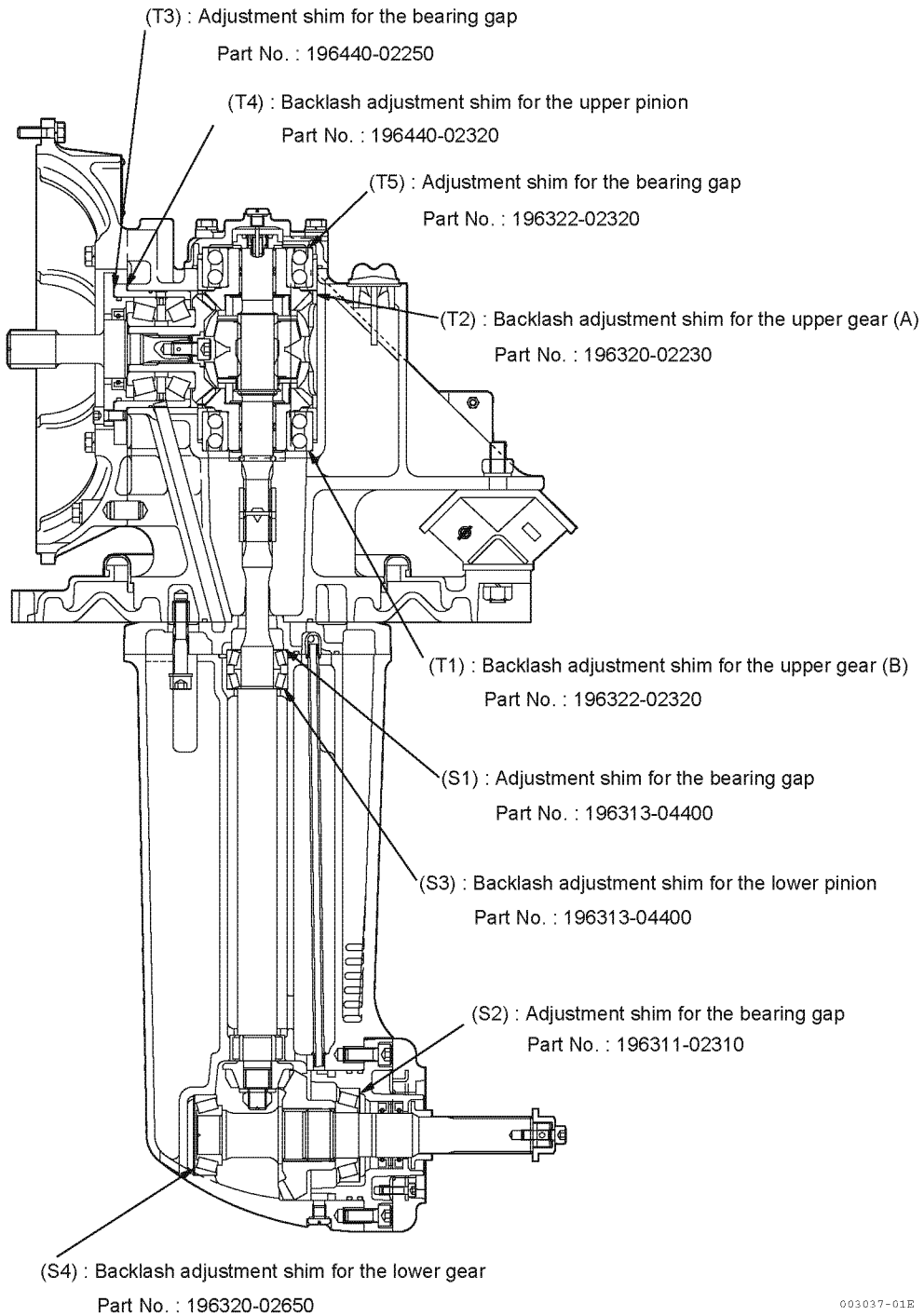
- 1) Reattach the taper roller bearing using the special tool.



004778-01E

## 4 Shim adjustment (Gear backlash adjustment)

### 4.1 Location of adjustment shims



## 4.2 Measurement of the dimensions of the cases

### 4.2.1 Upper case

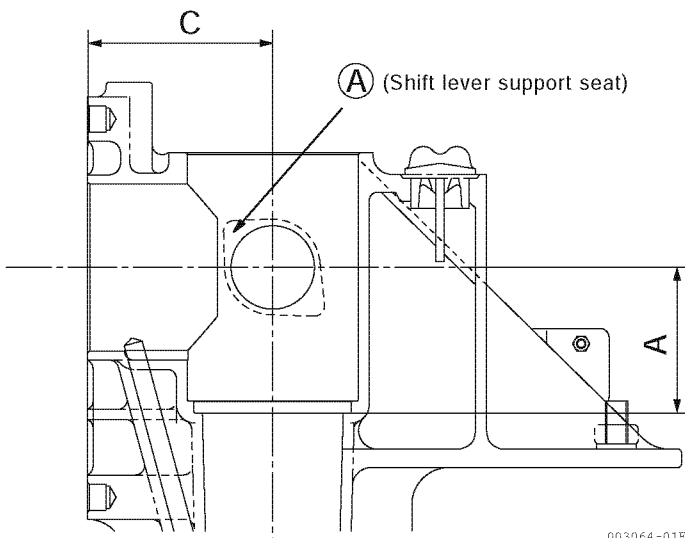
mm	
	Standard value
A	78.5
C	100

The actual dimension A is engraved on the part (A).

Example " A - 3 "

That shows

$$A = 78.5 - 0.03 = 78.47$$



### 4.2.2 Lower case

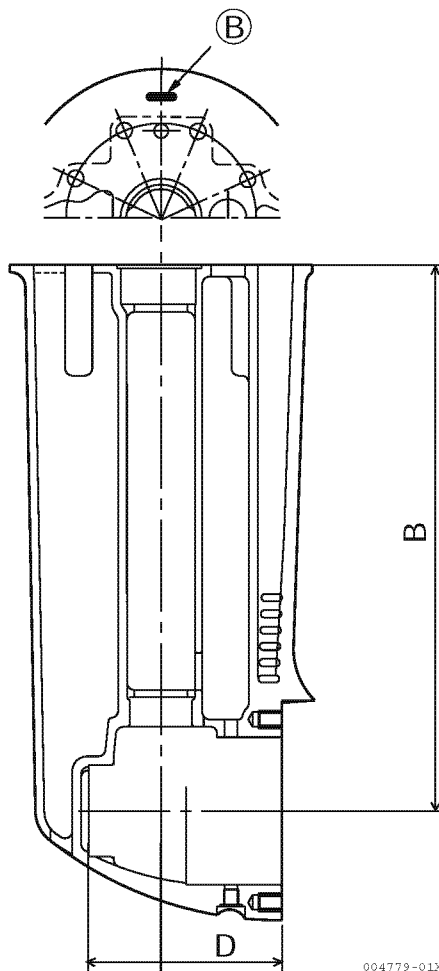
mm	
	Standard value
D	49
B	343

The actual dimension B is engraved on the part (B).

Example " B - 3 "

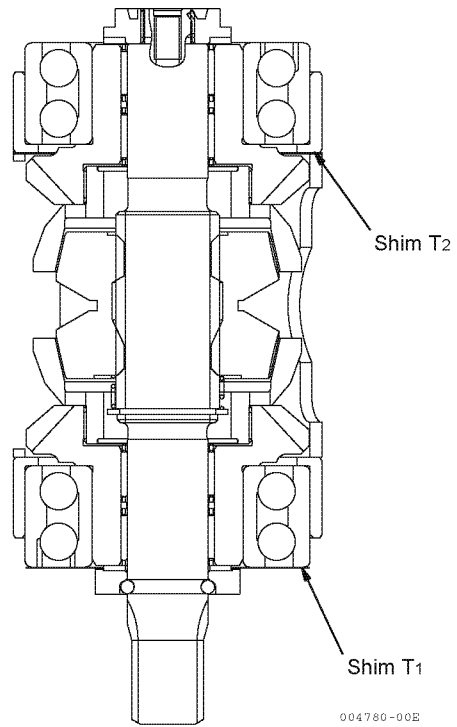
That shows

$$B = 343 - 0.03 = 342.97$$



### 4.3 Shim selection method for the clutch shaft

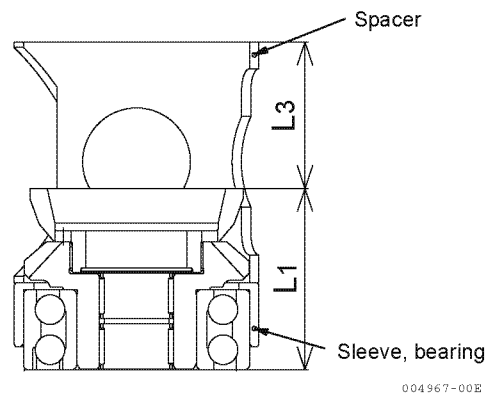
- 1) Calculate the thickness of the shim T1, shim T2 shown at the right with the following procedure.



#### 4.3.1 Measurement of the dimensions (L1, L2, L3) of the gear

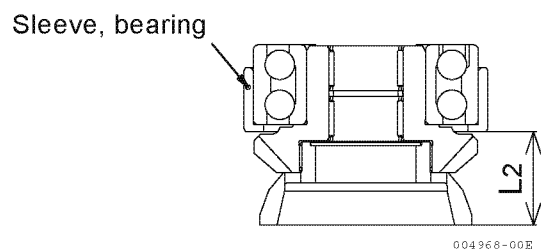
- (1) Under gear (B)

mm	
	Standard value
L1	68.2
L3	55.0



- (2) Upper gear (A)

mm	
	Standard value
L2	35.5



### 4.3.2 Calculation of the shim thickness

#### (1) Under gear (B)

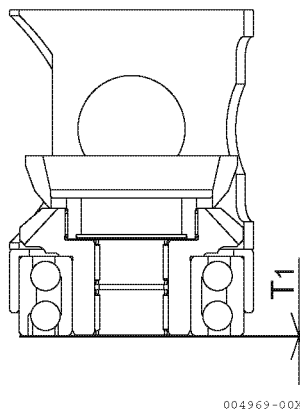
Formula

$$T1=(A-L1-10)$$

mm

	Standard value
A	See 4.2.1
L1	See 4.3.1(1)
T1	0.3

Make the thickness for the shim  
 $T1-0.025 \sim T1+0.025$ .



#### (2) Upper gear (A)

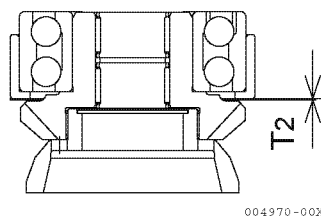
Formula

$$T2=(L2+20-L3)$$

mm

	Standard value
L2	See 4.3.1(2)
L3	See 4.3.1(1)
T2	0.5

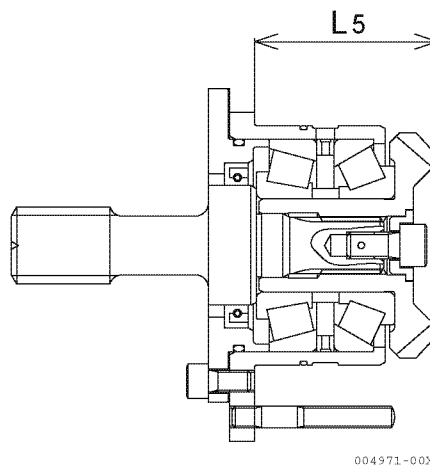
Make the thickness for the shim  
 $T2-0.025 \sim T2+0.025$ .



## 4.4 Shim selection method for the pinion shaft

### 4.4.1 Measurement of the pinion dimensions

mm	
	Standard value
L5	68.58



004971-00X

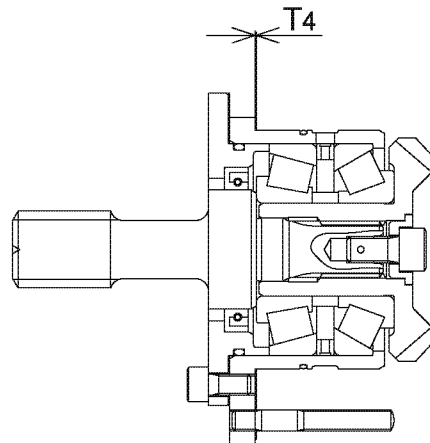
### 4.4.2 Calculation of the shim thickness

Formula

$$T_4 = (L_5 + 32 - C)$$

mm	
	Standard value
L5	See 4.4.1
B	See 4.2.2
T4	0.6

Make the thickness for the shim  
 $T_4 - 0.025 \sim T_4 + 0.025$ .

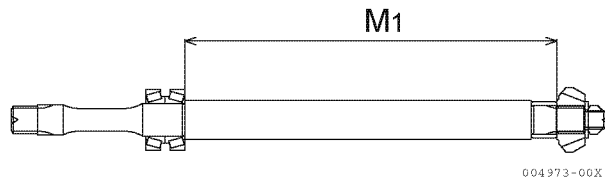


004972-00X

## 4.5 Shim selection method for the drive shaft

### 4.5.1 Measurement of the dimensions (M1) of the pinion

mm	
	Standard value
M1	286.5

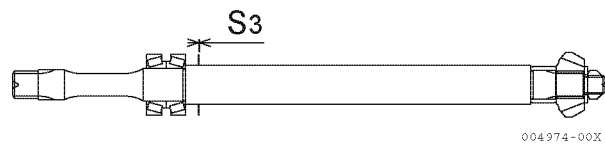


### 4.5.2 Calculation of the shim thickness

Formula

$$S_3 = (M_1 + 57 - B)$$

mm	
	Standard value
M1	See 4.5.1
B	See 4.2.2
S3	0.5

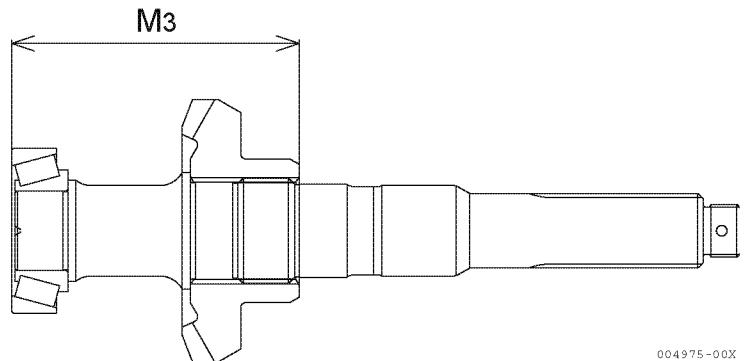


Make the thickness for the shim  
 $S_3 - 0.025 \sim S_3 + 0.025$ .

## 4.6 Shim selection method for the propeller shaft

### 4.6.1 Measurement of the dimensions (M3) of the gear

mm	
	Standard value
M3	108.25



004975-00X

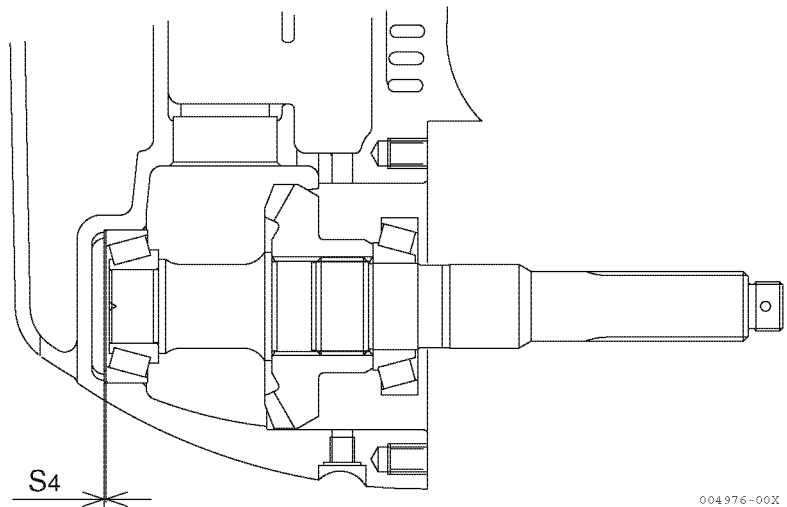
### 4.6.2 Calculation of the shim thickness

Formula

$$S4 = (D + 60 - M3)$$

mm	
	Standard value
D	See 4.2.2
M3	See 4.6.1
S4	0.75

Make the thickness for the shim  
 $S4 - 0.025 \sim S4 + 0.025$ .



004976-00X



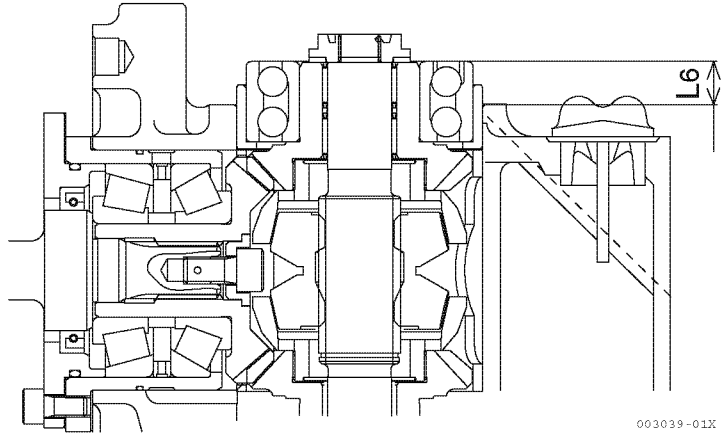
## 5 Adjustment of bearing assembly gap

### 5.1 Upper gear bearing

#### 5.1.1 Measurement of the dimension (L6) of the bearing

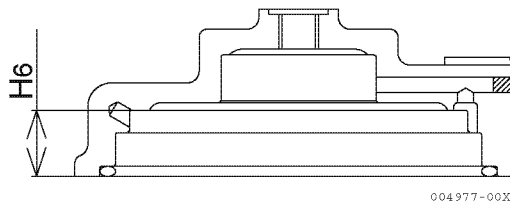
(1) Measurement of bearing lug

mm	
	Standard value
L6	16.2



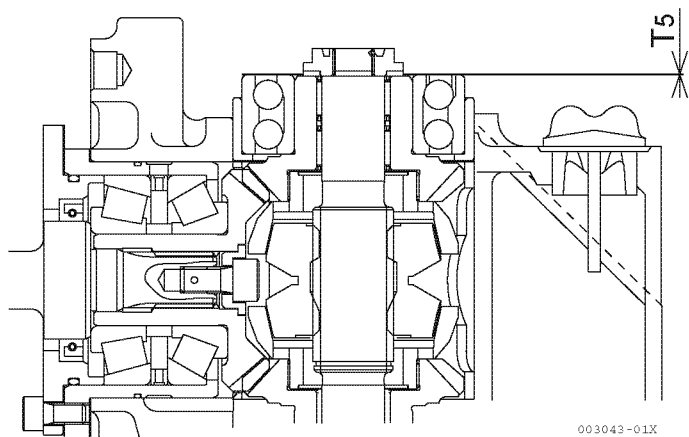
(2) Measurement of bearing case

mm	
	Standard value
H6	16.5



#### 5.1.2 Calculation of the shim thickness

mm	
	Standard value
T5	0.30

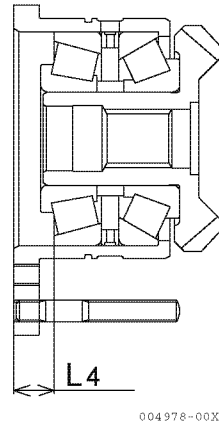


## 5.2 Pinion shaft bearing

### 5.2.1 Measurement of the dimension (L4) of the bearing

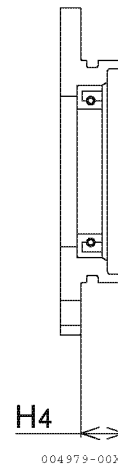
(1) Measurement of the bearing position

mm	
	Standard value
L4	15.0



(2) Measurement of oil seal case

mm	
	Standard value
H4	15.5

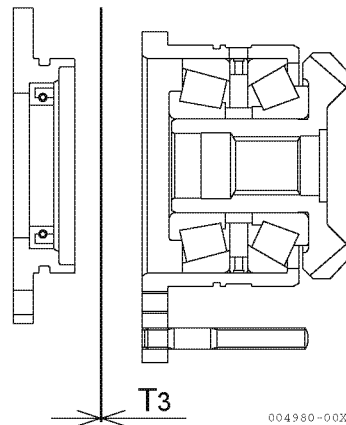


### 5.2.2 Calculation of the shim thickness

Formula  
 $T3 = (H4 - L4)$

mm	
	Standard value
H4	See 5.2.1(2)
L4	See 5.2.1(1)
T3	0.5

Make the thickness for the shim  
 $T3 - 0.1 \sim T3$ .

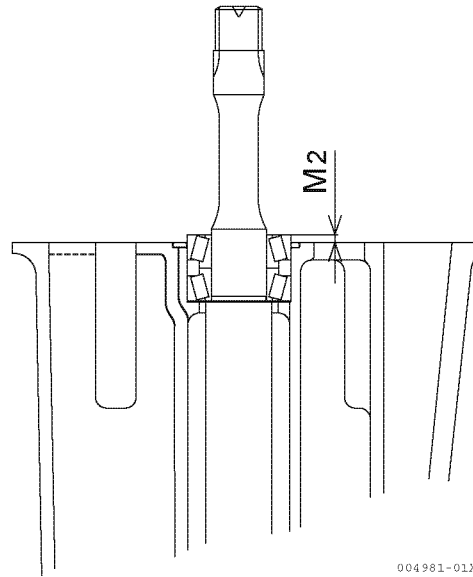


### 5.3 Pinion drive shaft bearing

#### 5.3.1 Measurement of the dimension (M2) of the bearing

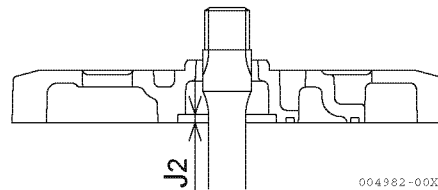
(1) Measurement of the bearing position

mm	
	Standard value
M2	3.50



(2) Measurement of middle plate

mm	
	Standard value
J2	4.0

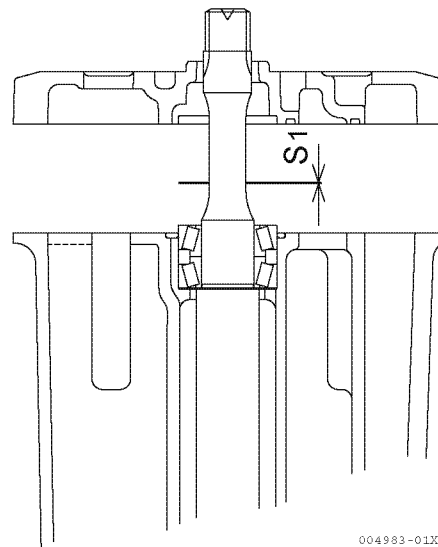


#### 5.3.2 Calculation of the shim thickness

Formula  
 $S_1 = (J_2 - M_2)$

mm	
	Standard value
J2	See 5.3.1(2)
M2	See 5.3.1(1)
S1	0.5

Make the thickness for the shim  
 $S_1 - 0.075 \sim S_1 - 0.025$ .

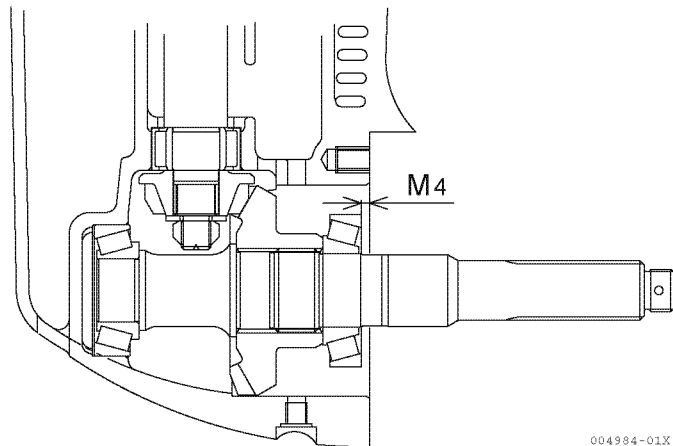


## 5.4 Propeller shaft bearing

### 5.4.1 Measurement of the dimension (M4) of the bearing

(1) Measurement of the bearing position

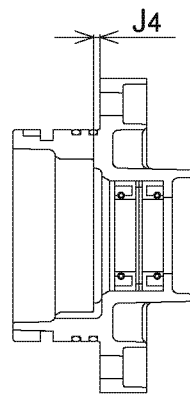
mm	
	Standard value
M4	3.75



004984-01X

(2) Measurement of bearing case

mm	
	Standard value
J4	3.0



004985-00X

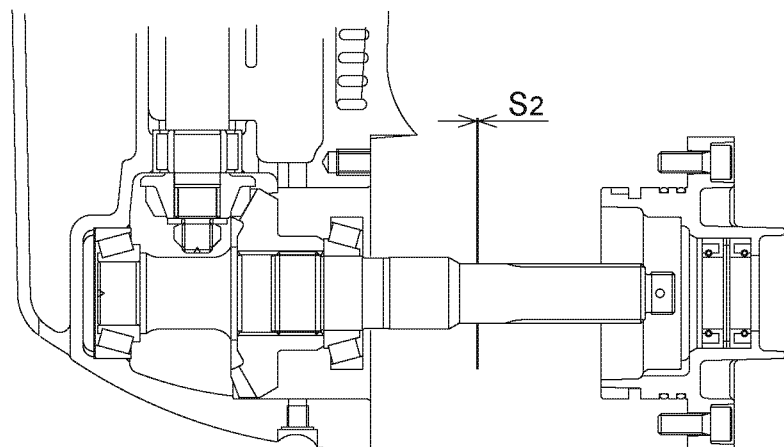
### 5.4.2 Calculation of the shim thickness

Formula

$$S2=(M4-J4)$$

mm	
	Standard value
M4	See 5.4.1(1)
J4	See 5.4.1(2)
S2	0.75

Make the thickness for the shim  
 $S2-0.075 \sim S2-0.025$ .

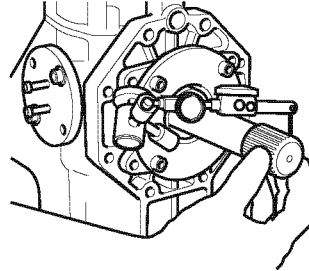


004986-01X

## 6 Adjustment of the gear backlash

### 6.1 Upper gear

- 1) The measurement for the backlash of the upper gear is shown in the figure to the right.

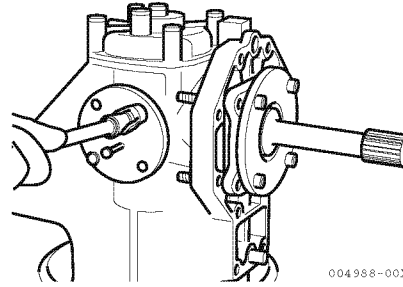


004987-00X

- 2) Use special tool (Part No. 196440-92300)

Stop the moving of the gear one and another by the bolt.

(Part No. 26116-060302)

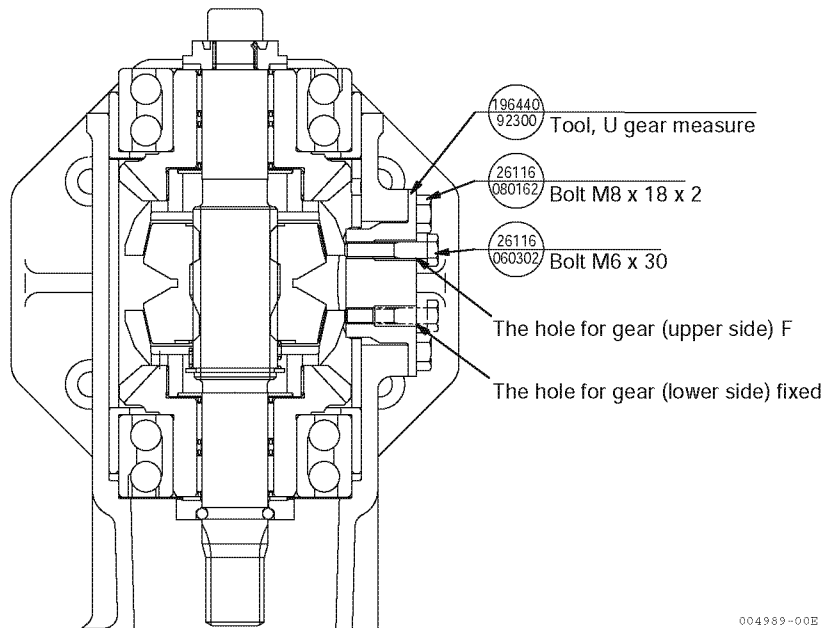


004988-00X

Reading of backlash mm

Dial gauge reading	Conversion value at gear
0.031~0.062	0.10~0.20

Find the gear conversion value at the dial gauge on the shaft.



004989-00E

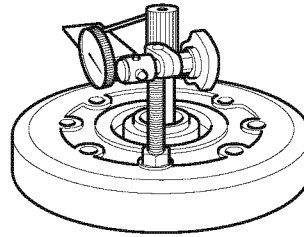
## 6.2 Lower gear

- 1) The measurement for the backlash of the lower gear is shown in the figure to the right.

Reading of backlash mm

Dial gauge reading	Conversion value at gear
0.056~0.113	0.14~0.28

Find the gear conversion value at the dial gauge on the shaft.

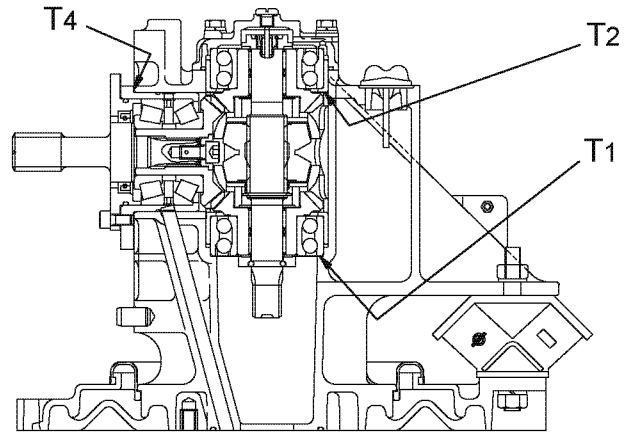


004990-00X

## 7 Adjustment of the gear dye pattern

### 7.1 Upper gear

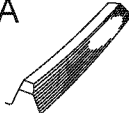
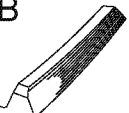
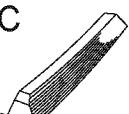
- 1) After deciding the shim thickness T1, T2 and T4 in accordance with the section 4.2, 4.3 and 4.4 check the dye pattern of the gear faces and then adjust it.



003040-01X

- 2) After checking the dye pattern, adjust according to the table.

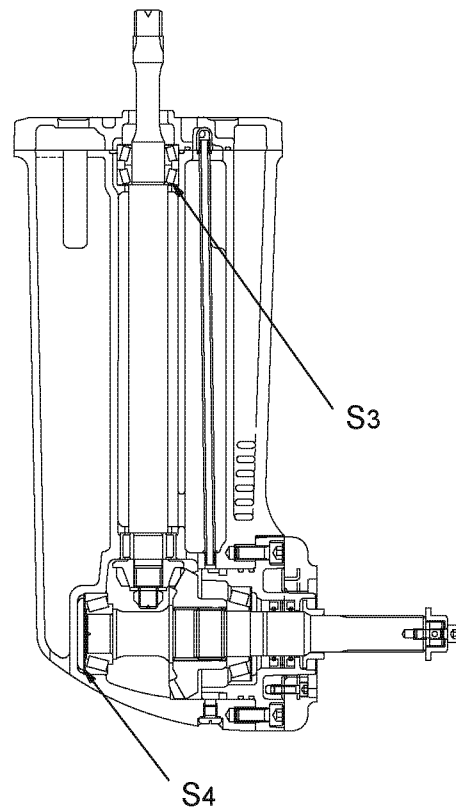
Check pinion dye pattern and follow the table below

GEAR, UPPER	
DYE PATTERN	ADJUST
<p>A</p> 	<p><u>GOOD</u> <u>NO ADJUSTING</u></p>
<p>B</p> 	<p><u>INCREASE THE SHIM THICKNESS "T1"</u> <u>DECREASE THE SHIM THICKNESS "T2"</u> <u>INCREASE THE SHIM THICKNESS "T4"</u></p>
<p>C</p> 	<p><u>DECREASE THE SHIM THICKNESS "T1"</u> <u>INCREASE THE SHIM THICKNESS "T2"</u> <u>DECREASE THE SHIM THICKNESS "T4"</u></p>

004991-00E

## 7.2 Propeller shaft

- 1) After deciding the shim thickness  $S_3$  and  $S_4$  in accordance with the section 4.5 and 4.6 check the dye pattern of the gear faces and then adjust it.



004992-01X

- 2) After checking the dye pattern, adjust according to the table.

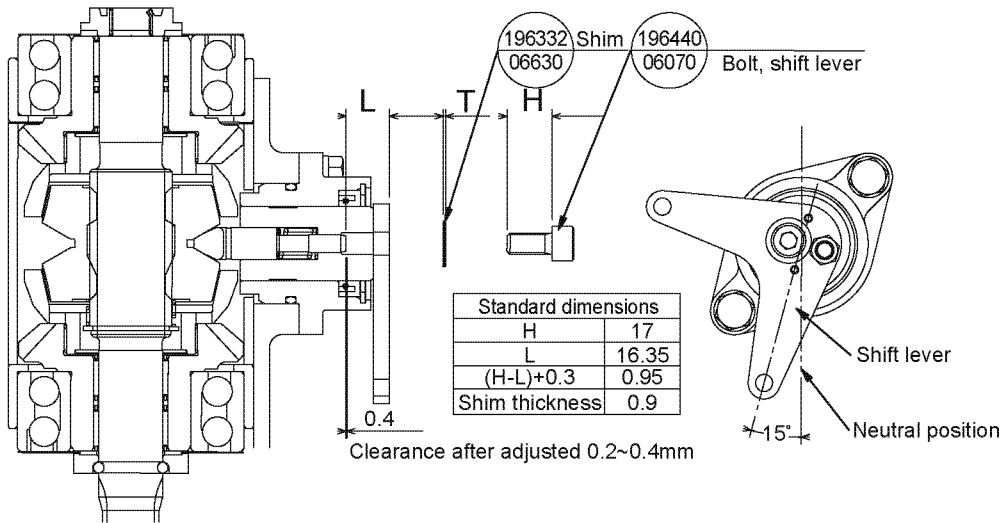
Check pinion dye pattern and follow the table below

GEAR, LOWER	
DYE PATTERN	ADJUST
<p><b>A</b></p>	<p><u>GOOD</u> <u>NO ADJUSTING</u></p>
<p><b>B</b></p>	<p><u>DECREASE THE SHIM THICKNESS "S3"</u> <u>INCREASE THE SHIM THICKNESS "S4"</u></p>
<p><b>C</b></p>	<p><u>INCREASE THE SHIM THICKNESS "S3"</u> <u>DECREASE THE SHIM THICKNESS "S4"</u></p>

004993-00E



## 8 Adjustment of the shift lever



Adjust the operation of the shift lever with the thickness of shim T.

003263-00E

### 8.1 Measurement of the dimensions (H, A)

#### 8.1.1 Shift Lever bolt

mm

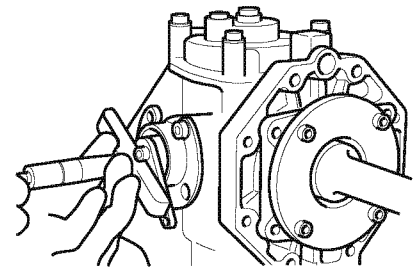
	Standard value
H	17.0

#### 8.1.2 Shifter pin position

- 1) The measurement figure for the shifter pin position (A dimension) is shown in the figure on the right.

mm

	Standard value
A	16.35



Keep the shift lever 10~15° from neutral position.

004995-00E

## 8.2 Calculation of the shim thickness

Formula

$$T = (H - A) + 0.3$$

mm

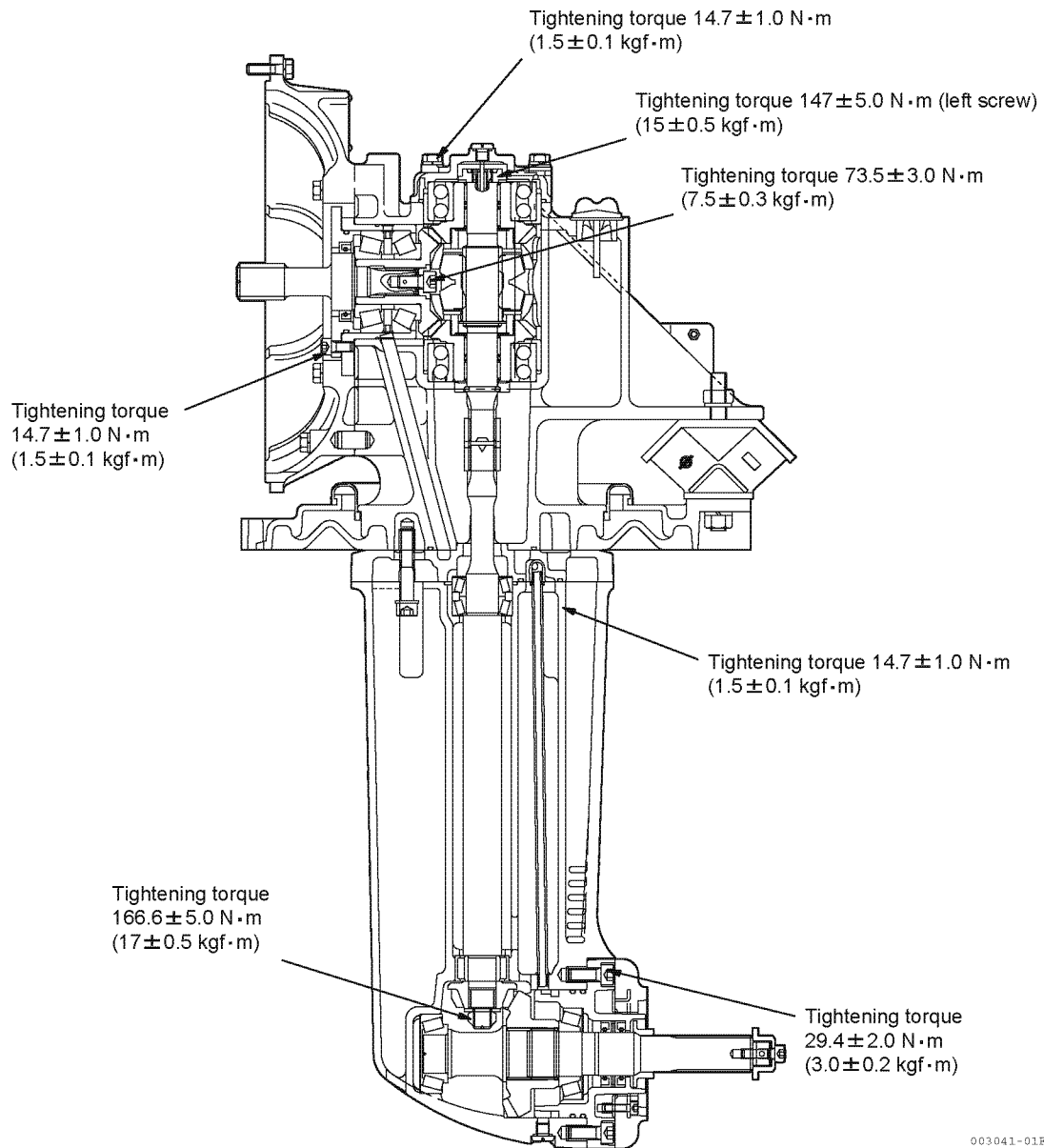
	Standard value
H	See 8.1.1
A	See 8.1.2
T	0.9

Calculation of the shim thickness  
make the thickness for the shim  
T-0.1~T+0.1.

## 8.3 Caution of reassembly

- Fasten the shift lever bolt (Part No. 196440-06070) with "Threebond 1104".
- Check the smooth rotation of propeller shaft when change shift lever  $\pm 15^\circ$  from neutral position.

## 9 Tightening torque for nuts and bolts



***SAIL DRIVE UNIT***  
**SD40/SD40-4T/SD50/SD50-4T**  
**SERVICE MANUAL**

Code No. M2215-04E140  
First Edition : March 2005

***YANMAR CO.,LTD.***

Published by : Quality Control Dept.  
Marine Factory  
Large Power Products Operations Division.  
Edited by : YANMAR TECHNICAL SERVICE CO., LTD.

# ***YANMAR CO.,LTD.***

## **HEAD OFFICE**

1-32, CHAYAMACHI, KITA-KU, OSAKA 530-8311, JAPAN

## **YANMAR MARINE INTERNATIONAL B.V.**

P.O. BOX 30112,1303AC ALMERE, THE NETHERLANDS  
BRUGPLEIN 11, 1332 BS ALMERE-DE VAART, THE NETHERLANDS  
PHONE: 31 36-5493211  
FAX: 31 36-5493549  
URL: [WWW.YANMARMARINE.COM](http://WWW.YANMARMARINE.COM)

## **YANMAR MARINE U.S.A CORPORATION**

101 INTERNATIONAL PARKWAY, ADAIRSVILLE, GA 30103, USA  
PHONE: 1 770-877-9894  
FAX: 1 770-877-7565

## **YANMAR ASIA (SINGAPORE) CORPORATION PTE LTD.**

4 TUAS LANE. SINGAPORE 638613  
PHONE: 65 6861-3855  
FAX: 65 6862-5195

## **YANMAR CO., LTD.**

MARINE FACTORY  
LARGE POWER PRODUCTS OPERATIONS DIVISION  
5-3-1, TSUKAGUCHI HONMACHI, AMAGASAKI-SHI, HYOGO 661, JAPAN  
PHONE: 81-6-6428-3123  
FAX: 81-6-6421-5549  
URL: [WWW.YANMAR.CO.JP](http://WWW.YANMAR.CO.JP)