



TOHATSU OUTBOARD MOTOR

M5B/M5BS

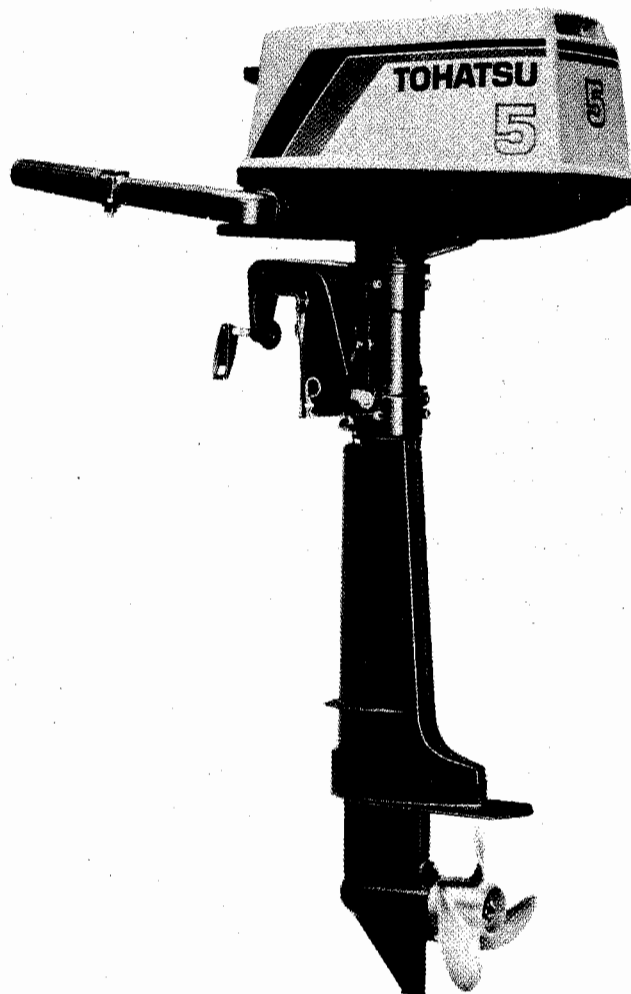
SERVICE MANUAL



TOHATSU OUTBOARD MOTOR

This service manual will explain the construction of the TOHATSU outboard motors and the best way to carry out periodical overhauls and maintenance. The information is based on the models M5B and M5BS produced in March 1984, but TOHATSU follows a policy of continuous product improvement, it reserves the right to make changes to specifications without prior notice. For further information please contact TOHATSU.

TOHATSU CORPORATION



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1. SPECIFICATIONS

Item		Model	M5B (369)	M5BS (369)	
Measurement	Overall length	(mm)	Approx. 700 (at horizontal handle position)		
	Overall width	(mm)	Approx. 310 (at horizontal handle position)		
	Overall height S	(mm)	Approx. 1007	Approx. 978	
	Overall height L	(mm)	Approx. 1134	Approx. 1105	
	Transom height S	(mm)	Approx. 446		
	Transom height L	(mm)	Approx. 573		
	Weight (transom S)	(kg)	Approx. 20	Approx. 19	
Performance	Maximum output	(PS/rpm)	5/5000		
	Maximum speed running range	(rpm)	4500 ~ 5500		
	Idling (clutch off)	(rpm)	1000		
	Trolling (clutch in)	(rpm)	850		
	Fuel consumption at maximum speed	(ℓ/hr)	2.5		
Engine	No. of cylinder		1		
	Bore x stroke	(mm)	55 x 43		
	Displacement	(cc)	102		
	Lubrication		Gasoline/oil mixture (TOHATSU ENGINE OIL) (50:1)		
	Cooling method		Water cooling (rotary rubber impeller)		
	Starting		Recoil type manual starter		
	Ignition		Flywheel magneto (C.D. ignition)		
	Spark plug		NGK BP7HS10 (gap: 1.0) or CHAMPION L82YC (gap: 1.0)		
	Ignition timing		BTDC 5° ~ BTDC 30°		
	Carburetor		KEIHIN SEIKI BCK 21 - 15		
	Rotating direction of engine		Clockwise		
Lower unit	Speed control		Handle grip (remote control: optional)		
	Clutch		Dog clutch		
	Gear reduction ratio		13 : 28		
	Maximum tilt-up angle		75°		
	Tilt angle		4° ~ 24°		
	Tilt adjustment position		6		
	Shallow water position		32.5°		
	Steering angle		360°		
	Permissible thickness of transom board (mm)		30 ~ 55		
	Exhaust method		Prop exhaust		
	Fuel tank capacity		2.5 ℓ	13 ℓ (portable)	
	Propeller (No. of blades x diameter x pitch)		8 (3 x 200 x 200) transom S, L standards		
Optional parts	Optional propeller (No. of blades x diameter x pitch)		7 (3 x 200 x 178) for heavy loads 9 (3 x 200 x 229) for light loads		
			Lighting coil (12V 40W) (for lighting) Rectifier (for charging) Safety switch Vertical starting accessories Remote control (Cable length: 2 to 6 m) Testing propeller (Murine) Flashing plug Flywheel puller Neutral starter		

2. FEATURES

- (1) Compactly constructed, reduced in weight. Fully meets the requirements of the outboard motors of its class.
- (2) As light as 20kg, the lightest in its class.
- (3) 5-port cylinder employed reduces the fuel consumption to 2.5ℓ per hour when throttle valve is fully opened.
- (4) The magneto is of a pointless C.D. ignition (BTDC 5° at the time of full lead angle) — an electric lead angle type in which the optimum lead angle can be obtained according to the rpm.
- (5) The carburetor fitted with a fuel pump ensures a correct fuel supply to it.
- (6) The motor cover itself is fitted with a grip for the tilt and an air inlet is provided from which the air needed is inhaled in the engine — a device provided prevents the water spray to enter the engine during cruising. Another device adopted prevents the rain water to enter the engine.
- (7) The shift lever and the reverse lock arm are linked with each other so that the reverse lock arm is released when the shift lever is set at its neutral and forward positions, thus allowing that the shallow water running position or tilt up is quickly set by merely moving the motor cover rear toward you.
When changing to the tilt down position from the shallow water running position slightly move the grip toward you but it is unnecessary to operate the tilt stopper.
Provided with the so-called "automatic tilt/automatic shallow water device" in which the tilt stopper is manually released only when changing to the tilt down position from the tilt up position.
- (8) A "neutral start mechanism" is adopted so as to ensure safe operation.
- (9) Can easily be carried one-handed due to its superior weight-balance. The space between the motor cover lower and the carrying handle is expanded.
- (10) A "prop-exhaust" method is employed in order to permit optimum power matching with the 5-port cylinder, thus improving the speed performance and fuel consumption and reducing the exhaust sound.

3. STRIPPING, SERVICING AND ASSEMBLING

1. General precautions

When stripping, servicing and assembling the power head and the drive unit give due attention to the following precautions.

- (1) When servicing the outboard motor make sure that it is firmly secured to the work bench.
- (2) When working on the motor, care should be taken that painted surface, inside and matching surfaces of cylinders and crankcase are not damaged or scratched.
- (3) Packings, gaskets, O-rings, split pin and other parts should be replaced with new every time the engine is taken down. Also replace any deformed snap rings.
- (4) Always use TOHATSU genuine parts and TOHATSU outboard motor oil or oil recommended by TOHATSU.
- (5) Only use the special tools specified. Never use any other tools. Servicing must be carried out in a correct and accurate manner according to Section 6 of this Chapter.
- (6) When stripping any assembly, take special note of the match marks. If no match marks can not be seen, it is advisable to make your own so that mistakes are not made when reassembling the parts.
- (7) Small parts, bolts, nuts and washers, when they have been removed, should be temporarily placed in their original positions, so that they are not lost.
- (8) All parts as they are taken down should be cleaned and washed with detergent oil or gasoline and checked for wear and damage.
- (9) During reassembling, take note of fitting of matching parts, packings, wiring and piping as well as greasing, centering and sealing.

Bolts and nuts (e.g., cylinder head and crankcase) should be tightened progressively in a criss-cross pattern from inner side to outer side. (Loosening should be carried out in the reverse order.)

When installing an oil seal, care should be taken not to scratch the oil seal lip. Make sure not to reverse its correct position. Be sure to pack the oil seal cavity with the specified grease.

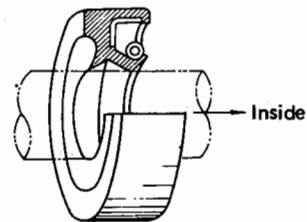
Be sure to apply the proper amount of liquid packing agent. If too much is used, it may overflow into the crankcase or elsewhere. Before using adhesives, read the directions carefully.

If any bolt or nut is hard to remove because of rust, spray on liquid loosening agent (Three Loosen) or some similar preparation and wait more than five minutes for the oil to penetrate the threads.

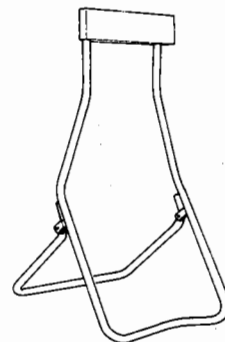
For service data, tightening torque and correct application of sealing agents, adhesives and grease please refer to the following section of this Chapter.

Keys to symbols used in this manual: –

H820	Hexagon bolt	Diameter 8mm	Length 20mm
Coarse 8	Hexagon nut	Diameter 8mm	
Lock 8	Hexagon jam nut	Diameter 8mm	
W6	Washer	Diameter 6mm	
SW6	Spring washer	Diameter 6mm	
Pan 620	Pan head screw	Diameter 6mm	Length 20mm

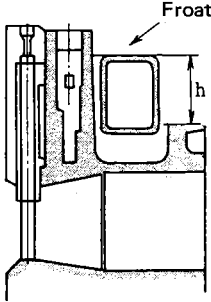


Oil seal



Work bench (for motor stand)

2. Service data

Parts name	Items	Standard value	Limit for adjustment or replacement
Engine			
Piston	Clearance between piston and cylinder wall (minimum clearance in the direction right-angled to the pin at the point 16mm from the piston skirt)	0.03 ~ 0.06	Over 0.15
	Clearance between piston pin and piston pin hole.	Tight 0.001 Loose 0.008	Over 0.15
Cylinder head	Deformation of fitting surface.		Over 0.05
Piston ring	Gap between piston ring ends.	0.2 ~ 0.4	Over 0.8
	Clearance with piston ring groove. Top 2nd	0.03 ~ 0.07 0.02 ~ 0.06	Over 0.1 Over 0.09
Connecting rod	Big end side gap.	0.13 ~ 0.37	Over 0.5
Crankshaft	Off-centering of crankshaft	0.05	Over 0.05
Reed valve	Lift (reed valve stopper tip height)	6 ~ 6.2	Except 6 to 6.2
Compression pressure	Measure the compression pressure of cylinder. (Measure it after warming run.)	Over 5.5kg/cm ² / 500rpm	4.5kg/cm ² or less/500 rpm
Ratchet guide B	Wire diameter (partial wear)	φ1.2	φ1.0 or less
Oil seal	Crankshaft oil seal		Replace when lip portion is deformed or damaged or it hardens and also when the interference with shaft is 0.5 mm or less.
Fuel line			
Carburetor	 <p>Inlet port diameter Outlet port diameter Venturi diameter Main Jet (M.J.) Main Air Jet (M.A.J.) Slow Jet (S.J.) Slow Air Jet (S.A.J.) Adjust screw return rotation (P.S.) Float level (height up to float sheet surface of the main body)</p>	φ27 φ21 φ15 #78 #100 #55 #100 2 ± 1/4 h = 14 ± 2	
Cooling system			
Water pump	Pump case liner, water pump guide plate.		Replace when sliding portion of the pump impeller is worn out.
	Pump impeller		Replace when circumference, tip, side and convex portions are worn out. Also replace when cracks are present.
Electrical equipment			
Magneto	Ignition timing (when throttle valve is fully opened after warm up)	BTDC 30° ± 2°/ 500 rpm	
Spark plug	NGKBP7HS10 (gap: 1.0)	0.9 ~ 1.0	Over 1.25
	CHAMPION L82YC (gap: 1.0)	0.9 ~ 1.0	Over 1.25
Power transmission			
Bevel gear	Backlash between bevel gears A and B.	(0.16 ~ 0.49)* 0.05 ~ 0.15	(Over 0.98) * Over 0.3
	Clearance between bushing for bevel gear A and propeller shaft.	0.030 ~ 0.058	Over 0.1
	Clearance between bushing for bevel gear C and propeller shaft.	0.040 ~ 0.070	Over 0.1
Drive shaft bushing	Clearance between drive shaft and the bushing.	0.016 ~ 0.073	Over 0.5
Propeller (7)	Outer diameter x pitch	200 x 178	Replace when reduction in outer diameter, bend or damage is excessive.
Propeller (8)	Outer diameter x pitch	200 x 200	
Propeller (9)	Outer diameter x pitch	200 x 229	
Oil seal	Oil seal, crankcase head		Replace when lip portion is deformed, damaged, or it hardens or also when interference with the shaft is 0.5mm or less.
	Oil seal, propeller shaft		
	Oil seal, pump case lower		

3. Sealing, bonding and lubrication points

Parts names	Markings	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	Remarks
	Brands	Instantaneous adhesive agent (Three Bond 1741)	Three Bond 1401	Three Bond G-17	Three Bond 1104	Moliton grease	Moliton grease	Cold service grease (NIPPECO LT2)	TOHATSU grease	Cup grease	TOHATSU engine oil	TOHATSU gear oil	
Piston											•		Skirt, ring groove
Piston ring											•		
Piston pin											•		
Small end bearing											•		Rotating portion, bearing
Big end bearing											•		Rotating portion, bearing
Main bearing											•		Rotating portion, bearing
Cylinder liner											•		Inner wall
Fitting face of cylinder & crank case					•								
Oil seal, crankshaft										•			Lip portion
Oil seal, crankcase head										•			Lip portion
Baffle plate sponge				•									
Choke rod grommet									•				Inner surface
Starter shaft								•					Bearing circumference, ratchet guide B
Spring guide plate								•					
Starter spring								•					
Spring slide plate								•					
Ratchet								•					
Ratchet guides A and B								•					
Starter lock									•				Sliding portion (optional)
Starter lock cam									•				Sliding portion (optional)
Gear case lubricating oil											•		195 cc
Bolt, gear case front									•				Thread portion
Bolt, gear case rear									•				Thread portion
Propeller shaft housing									•				Gear case pilot
"O" ring, propeller shaft									•				
Oil seal, propeller shaft									•				Lip portion
Bolt, propeller shaft housing									•				Thread portion
Stern bracket plate									•				

Markings	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	Remarks
Brands	Instantaneous adhesive agent (Three Bond 1741)	Three Bond 1401	Three Bond G-17	Three Bond 1104	Moliton grease	Moliton grease	Cold service grease (NIPPECO LT2)	TOHATSU grease	Cup grease	TOHATSU engine oil	TOHATSU gear oil	
Parts name												
Clamp screw								•				Thread portion
Bolt, propeller shaft housing								•				
Thrust plate						•						
Steering bushing upper						•						Inner and outer diameter
Steering bushing lower						•						Inner and outer diameter
Bushing, tilt stopper								•				
Steering handle								•				Grip portion
Steering bushing								•				
Sliding piece								•				
Throttle wire								•				Grip portion
Bracket distance plate screw		•										
Damper, steering handle								•				Head portion
Seal rubber, starter	•											
Bushing, hook lever								•				
Seal ring, hook lever								•				
Propeller shaft								•				Propeller mounting portion
Drive shaft					•							Sprine, crankshaft side
Bushing, drive shaft					•							
Bushing, cam shaft											•	
"O" ring A, cam shaft								•				
"O" ring B, cam shaft								•				
Shift lever shaft								•				Sliding portion
"O" ring, shift lever								•				
Bushing, shift lever								•				
Bolt, pump case								•				Thread portion
Pump case lower								•				Gear case pilot
Oil seal, pump case								•				Lip portion
Seal, water pipe lower								•				Thread portion

4. Tightening torque

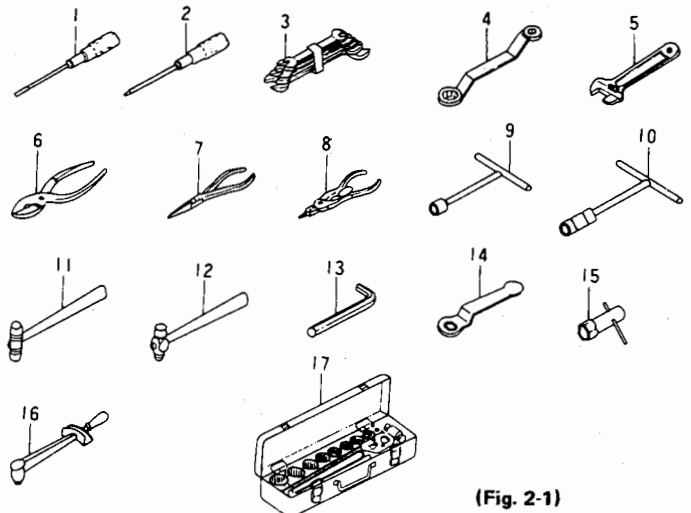
Item	Diameter of thread (mm)	Tightening torque (kg-m)
1. Cylinder head tightening bolt	8	2.4 ~ 2.6
2. Crankcase tightening bolt	6	1.0 ~ 1.1
3. Magneto tightening nut	12	5 ~ 6
4. Spark plug	14	2.5 ~ 3.0
5. Other bolts and nuts	4	0.13 ~ 0.18
	5	0.27 ~ 0.36
	6	0.47 ~ 0.64
	8	1.14 ~ 1.54

5. Service tools and measuring instruments

The following service tools and measuring instruments are required for servicing TOHATSU outboard motors. Be sure to use the special tools when noted as (use special tool). (Fig. 2-1)

(1) General tools

- | | |
|-------------------------------|------------------------|
| 1. Slotted-head screwdriver | (200mm) |
| Slotted-head screwdriver | (150mm) |
| Slotted-head screwdriver | (100mm) |
| 2. Phillips-head screwdriver | (200mm) |
| Phillips-head screwdriver | (150mm) |
| Phillips-head screwdriver | (100mm) |
| 3. A set of open-end wrenches | (6 wrenches set) |
| 4. Box wrench | (10 x 13mm) |
| Box wrench | (17 x 21mm) |
| Box wrench | (21 x 23mm) |
| 5. Adjustable wrench | (300mm) |
| 6. Pliers | |
| 7. Long-nose pliers | |
| 8. Clip pliers | |
| 9. T-handle socket wrench | (10mm) |
| T-handle socket wrench | (13mm) |
| T-handle socket wrench | (17mm) |
| 10. T-handle universal wrench | (10mm) |
| T-handle universal wrench | (13mm) |
| 11. Plastic-head hammer | |
| 12. Hammer | 3/4 lb |
| 13. Allen wrench | (8mm) |
| Allen wrench | (10mm) |
| 14. Spark plug wrench | (21mm) |
| 15. Spark plug wrench | (21mm) |
| 16. Torque wrench | (500kg-cm) (1500kg-cm) |
| 17. Socket wrench set | |



(Fig. 2-1)

(2) Compression gauge (0 to 14kg/cm²)

(3) Test propeller (Murine)

(4) Measuring instruments

The following instruments are available on the market:

- | | |
|------------------|--|
| Tachometer | 600 to 10,000 rpm
or TOHATSU tachmeter |
| Universal tester | (Resistance x 1,000, 10 kΩ,
30 to 300VAC, 30VDC,
Battery 3V or less) |

- | | |
|---|---|
| Vernier calipers | (JIS B7507 M1 type vernier calipers
300mm) |
| Micrometer | (JIS B7502, 0.01mm scale, outside
micrometer) |
| Cylinder gauge | (JIS B 7515, 50 to 100mm scale
cylinder gauge) |
| Ring gauge | (JIS B7420, 55φmm) |
| Dial gauge | (JIS B 7503, 0.01mm scale) |
| Feeler gauge | (JIS B7524 0.03 to 0.3mm
measurements) |
| V-blocks | (JIS B7540) |
| Surface plate | (JIS B7513, 500 x 500mm) |
| Dial gauge with magnetic base or dial gauge stand | |

6. How to use the special tools

1. Flywheel magneto puller (336-72214-1)

1) Dismantling

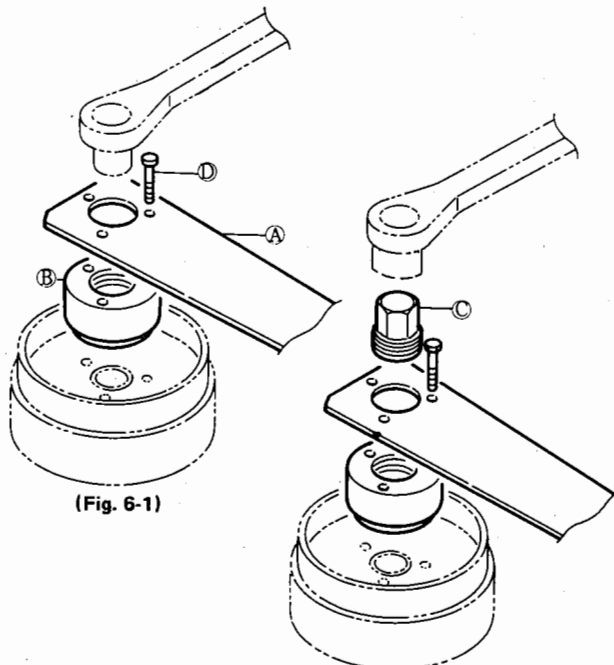
Fasten the tools (A) and (B) to the flywheel magneto by means of the three screws (D) and remove the magneto nut (left hand thread) by means of the socket wrench (nominal size 17) (Fig. 6-1). Then, screw into the threaded center of tool (B) and tightening the tool (C) by means of the socket wrench (nominal size 24) will withdraw the flywheel. (Fig. 6-2) (Use three screws.)

2) Reassembling

When replacing the flywheel tighten the magneto washer and nut after checking that the magneto key on the crank shaft is in position.

Attach the tools (A) and (B) to the flywheel, and then, with a torque wrench, tighten the magneto nut to the rated torque.

(Tightening torque: 5 to 6kg-m)

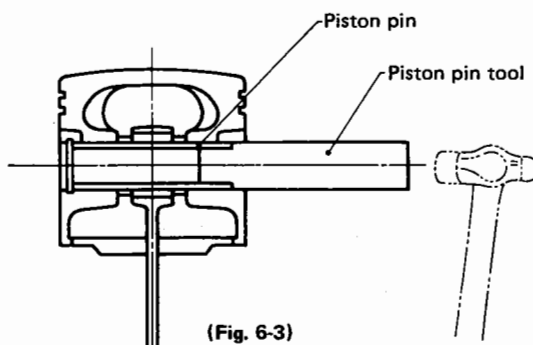


(Fig. 6-1)

(Fig. 6-2)

2. Piston pin tool (332-72215-0)

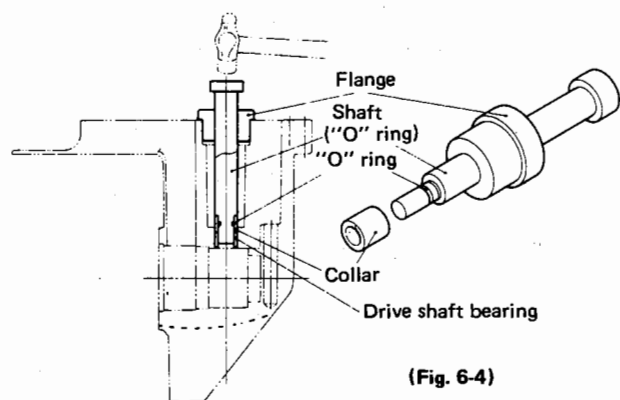
Remove the piston pin clip and position the tip of the piston pin tool in the recess of the pin. Hit lightly on the end surface with a hammer. Make sure that the connecting is not bend during removal. (The tool can also be used for replacing the pin.) (Fig. 6-3)



(Fig. 6-3)

3. Drive shaft bearing tool (369-72256-0)

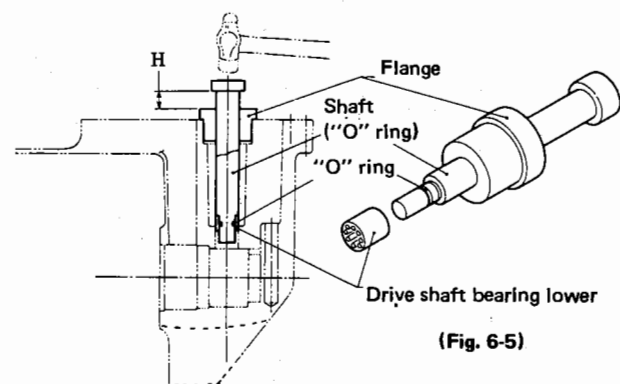
1) Dismantling



(Fig. 6-4)

2) Reassembling

Attach the drive shaft bearing lower to the shaft as shown in Fig. 5 and push it in the clearance H.



(Fig. 6-5)

4. Back lash measuring tools

(1) The method of measuring

- Assemble as shown in Fig. 6-6.
- Pull the drive shaft in (X) direction.
- Insert the slotted-head screwdriver into the slot of the shaft B and tighten the coarse 6 nut. (This will fix the bevel gear A and the shaft. Do not tighten too much in this case.)
Apply the dial gauge to (A) portion.
- Push the arm in (B) direction. (This fixes the bevel gear B).
- While pushing the shaft A in (Z) direction turn it in the "5 turn" direction and read the deflection of pointer on the dial gauge. (In this case make sure to push the arm in (B) direction simultaneously.)
- The normal reading on the dial gauge is between 0.16 and 0.49 mm. So adjust using adjust shim.

The thicknesses of adjust shim: 0.1 and 0.15 mm

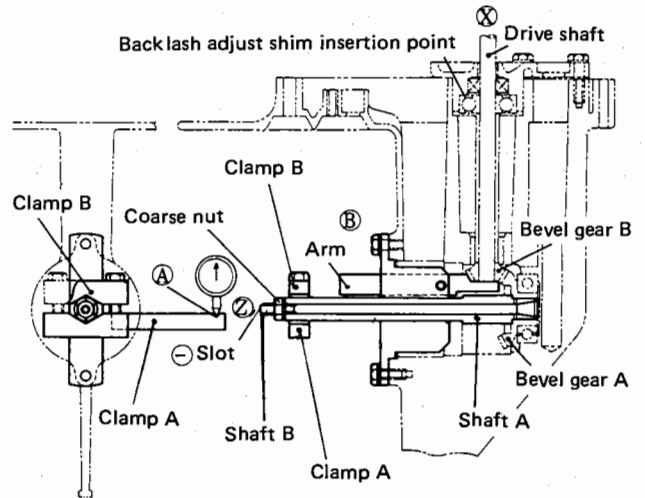
(2) Stripping

Loosen the coarse 6 nut and gently strike the slot portion of the shaft B in the (Z) direction. And striking the shaft B will release the bevel gear A and shaft A.

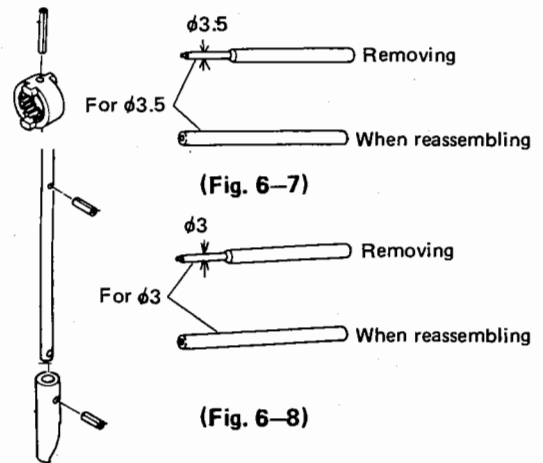
5. Spring pin tool

The clutch pin and clutch cam pin use a spring pin. Use the exclusive tool.

- When removing and reassembling the clutch pin carry out with tools as shown in Fig. 6-7.
- When removing and reassembling the clutch cam pin carry out with tools as shown in Fig. 6-8.



(Fig. 6-6)



(Fig. 6-7)

(Fig. 6-8)

7. Dismantling and stripping the power unit

7. Dismantling and stripping the power unit

The inspection and maintenance of the main part of engine shall be performed after removing the power unit from the Machine.

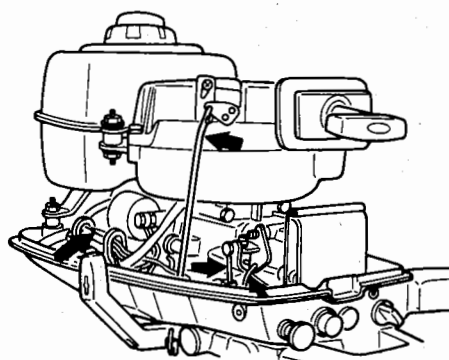
However, the inspection and maintenance of the cylinder head, recoil starter, magneto and carburetor can be carried out without removing the power unit from the Machine.

(1) Removing the power unit

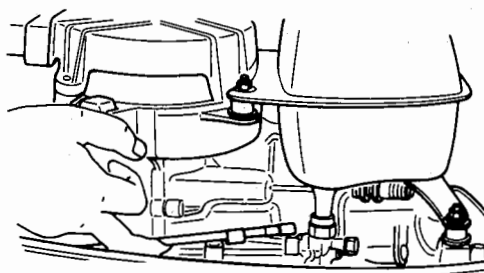
- 1) Take off the connection of the C.D. unit.
 - 2) Detach the earth lead wire (ignition coil attaching portion) (stop switch and C.D. unit).
 - 3) Remove the starter lock rod.
 - 4) Remove the choke rod and throttle Bowden.
- For paragraphs (1) to (4) please refer to (Fig. 7-1).

• When removing the carburetor only remove the fuel pipe first.

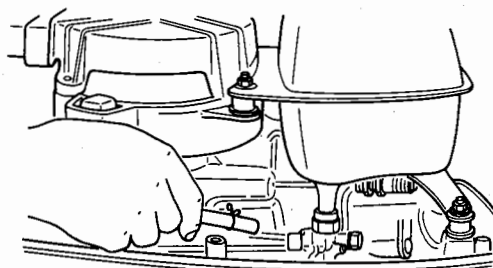
- 5) Remove the fuel cock rod. (Fig. 7-2)
- 6) Remove the fuel pipe. (Fig. 7-3)
- 7) Remove the fuel tank installing nuts (coarse 6-6) and remove the fuel tank. (Fig. 7-4)
- 8) Remove the power unit installing bolts (H630-6) and remove the power unit by pulling upward straight. (Fig. 7-5)



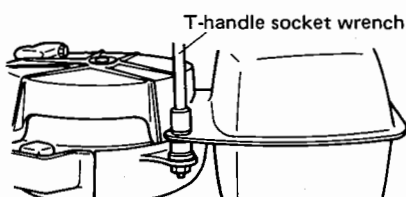
(Fig. 7-1)



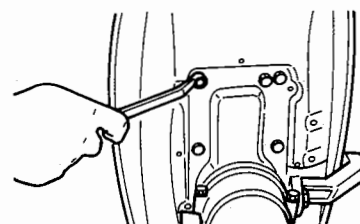
(Fig. 7-2) Removing the fuel cock rod



(Fig. 7-3) Removing the fuel pipe



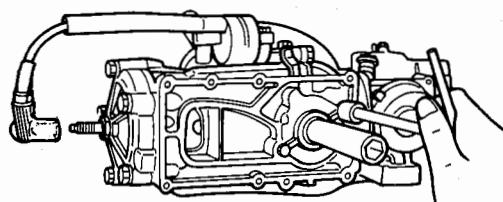
(Fig. 7-4) Removing the fuel tank



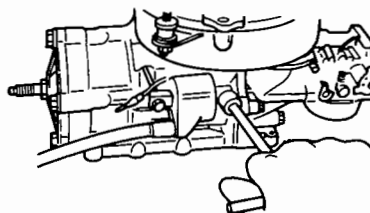
(Fig. 7-5) Removing the fuel tank

(2) Dismantling the power unit

- 1) Removing the crankcase head
Remove the crankcase head bolts (H620-2). Also remove the crankcase head oil seal and crankcase head gasket. (Fig. 7-6)



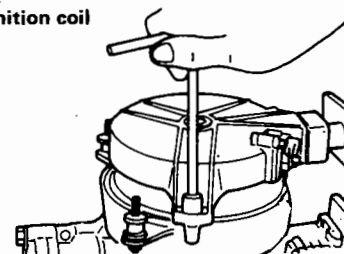
(Fig. 7-6) Removing the crankcase head



(Fig. 7-7) Removing the ignition coil

(Note)
When removing the crankcase head be sure to remove the check valve spring and the check valve from the case in advance. (See illustration page 14.)

- 2) Removing the ignition coil
• Take off the high tension cord from the spark plug.
• Remove the ignition coil installing bolt (H622-2) and remove the ignition coil. (Fig. 7-7)
- 3) Remove the spark plug.
- 4) Removing the recoil starter.
Remove the recoil starter bolts (H623-3) so as to dismantle recoil starter. (Fig. 7-8)



(Fig. 7-8) Removing the recoil starter

5) Removing the flywheel magneto

- Remove the flywheel cup by means of the flywheel magneto tool (special tool). (Fig. 7-9/7-10)

(Note)

- For instructions on handling please refer to the use of Special Tool.
- A flywheel fastening nut is a right-handed screw.

- Remove the exciter coil installing screws so as to remove the exciter coil. (Fig. 7-11)
- Remove the pulser coil installing screws so as to remove the pulser coil. (Fig. 7-11)

6) Removing the carburetor

Remove the baffle plate and then carburetor installing bolts (H685-2) so as to remove the carburetor from the engine. (Fig. 7-12)

(Note)

The carburetor is one unit with the fuel pump.

7) Removing the cylinder head

Remove the cylinder head tightening bolts (H835-5) so as to remove the cylinder head. (Fig. 7-13)

(3) Cylinder crankcase

- 1) Remove the crankcase fastening bolts A (H655-4) and B (H635-2). (Fig. 7-14)
- 2) Dismantle the crankcase.
(When dismantling widen the groove provided in the matching surface between the crankcase and the cylinder by means of the slotted-head screwdriver. (Fig. 7-15)
- 3) Remove the crankshaft from the cylinder by lifting upward straight.

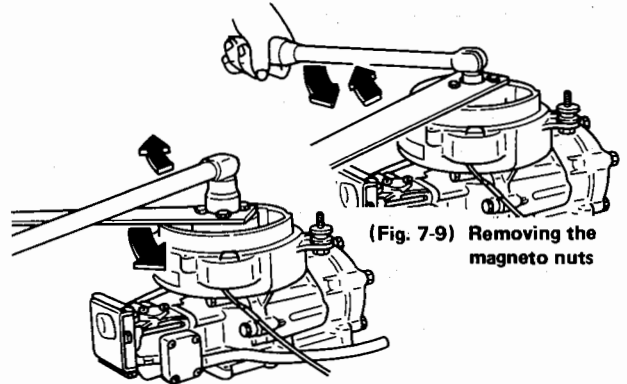
- Be sure to check in advance that the knock pin and the thrust plate are normal. (Fig. 7-16)

(Note)

It is very difficult to dismantle and reassemble the crankshaft. When it is worn or damaged please replace it with new.

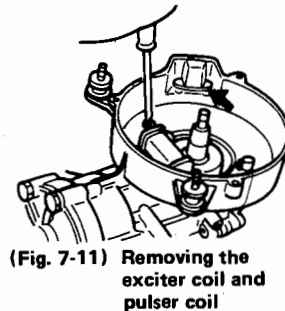
(4) Crankshaft pin

- 1) Remove the piston pin clip.
- 2) Remove the piston pin from the piston pin connecting rod by means of the piston pin tool (special tool). (Fig. 7-17)
- 3) Remove the small end bearing.
- 4) Remove the piston ring.
(No. 1 and 2 common plane type)

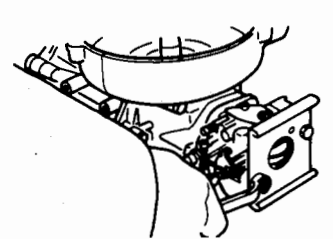


(Fig. 7-9) Removing the magneto nuts

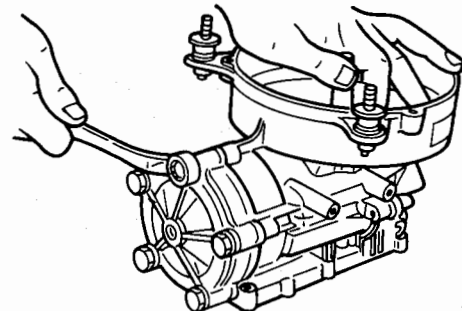
(Fig. 7-10) Removing the flywheel



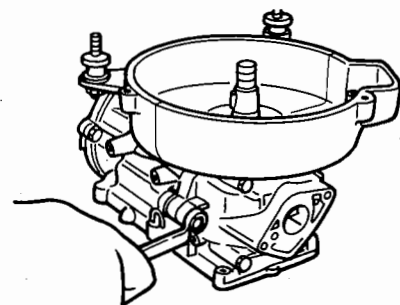
(Fig. 7-11) Removing the exciter coil and pulser coil



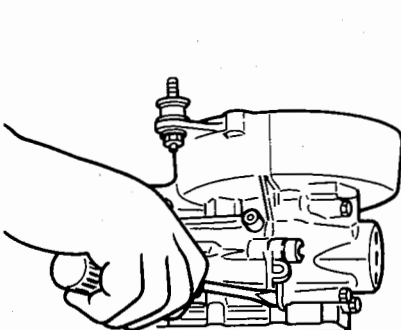
(Fig. 7-12) Remove the carburetor.



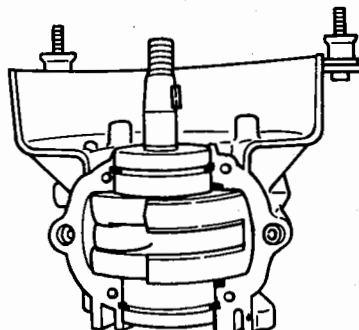
(Fig. 7-13) Removing the cylinder head



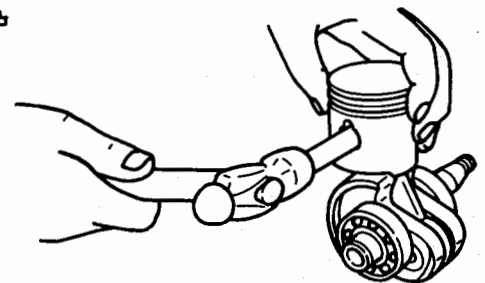
(Fig. 7-14) Removing the crankcase installing bolts



(Fig. 7-15) Removing the crankcase

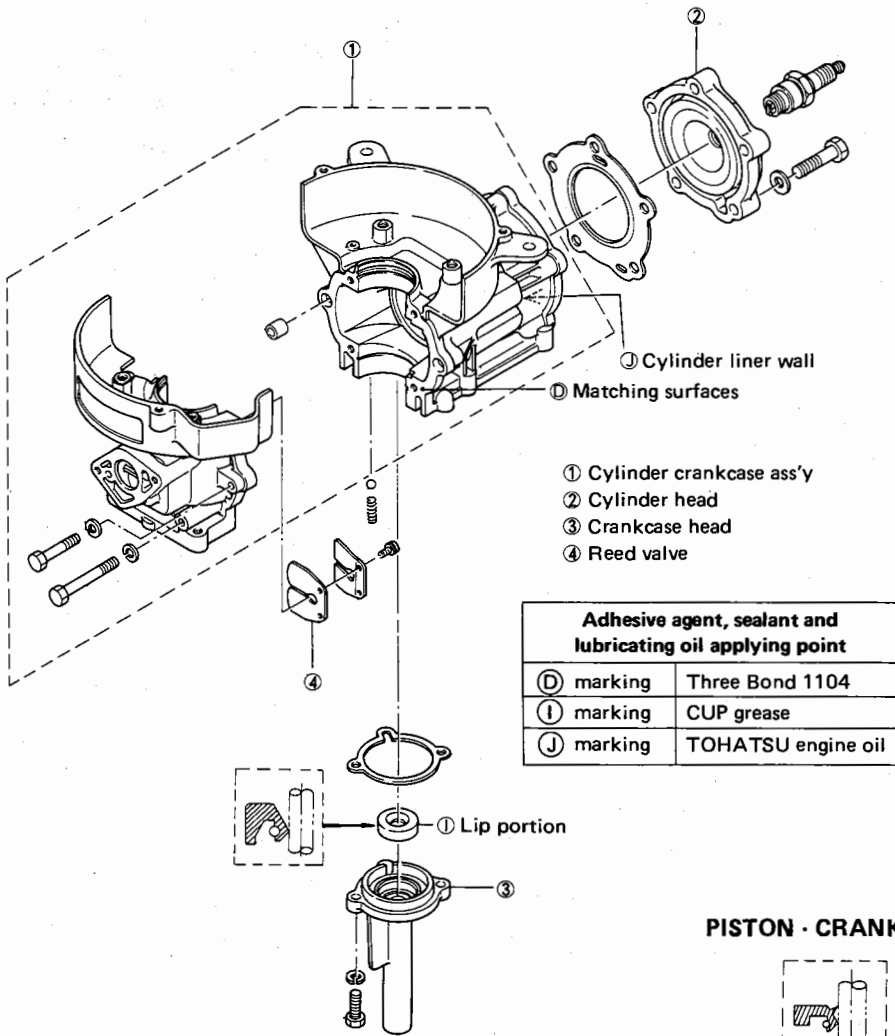


(Fig. 7-16) Cylinder crankshaft

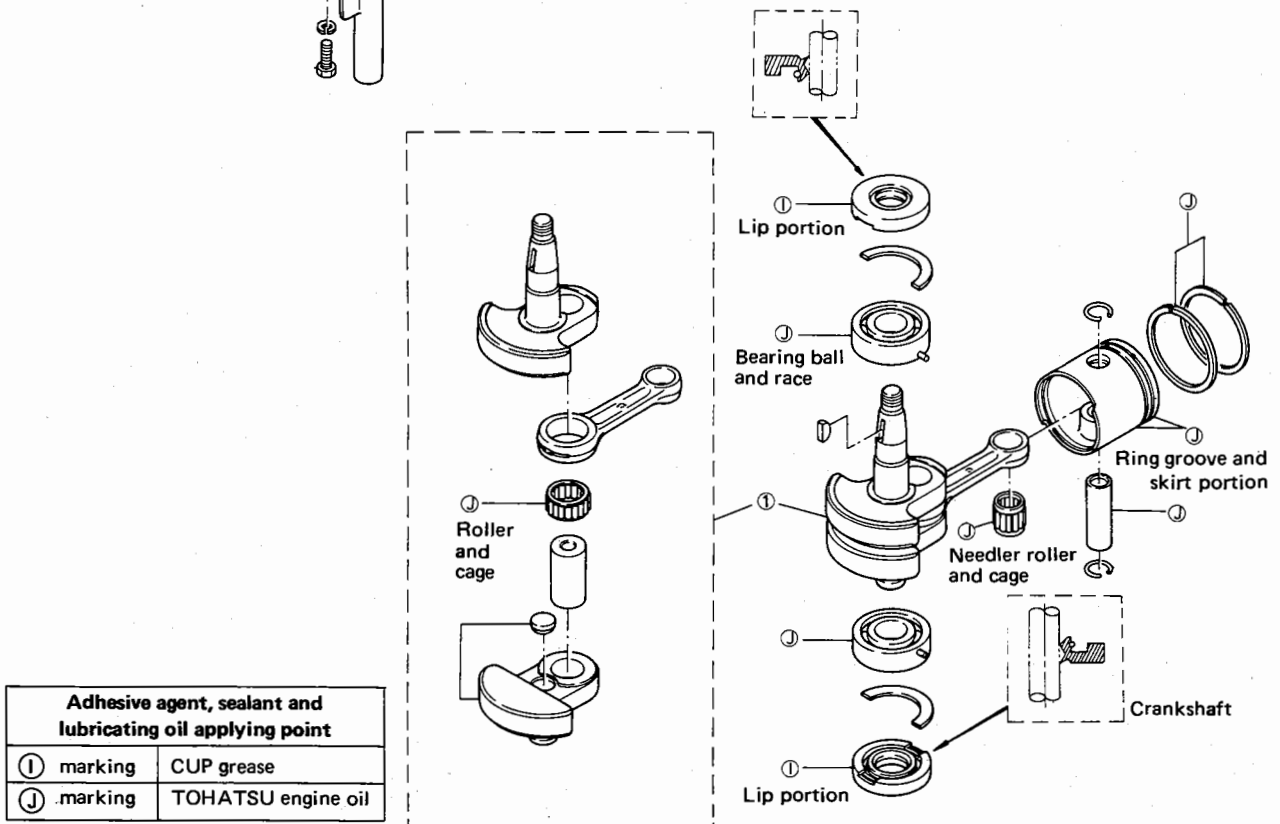


(Fig. 7-17) Removing the piston

CYLINDER-CRANKCASE



PISTON - CRANK SHAFT

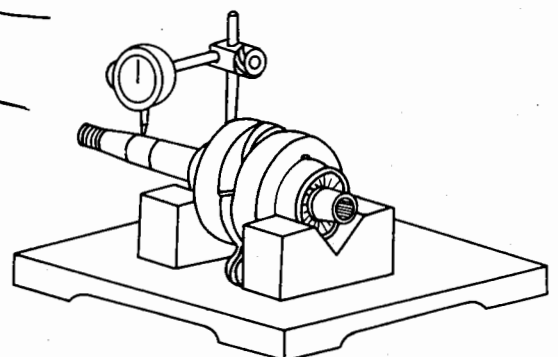
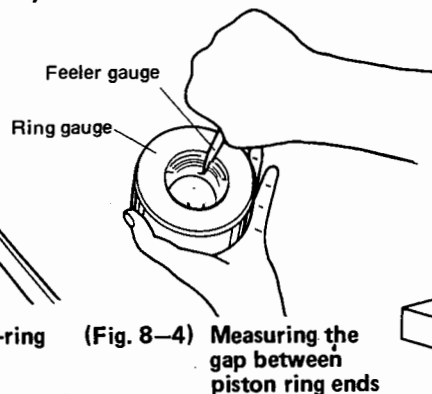
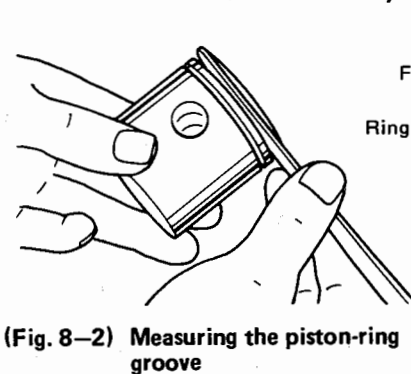
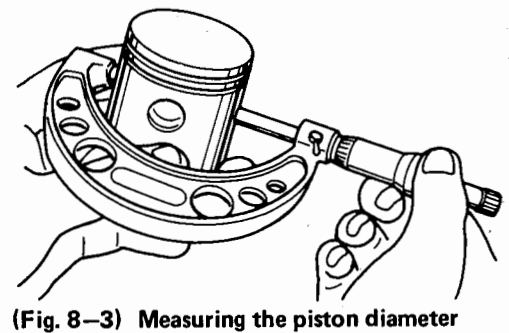
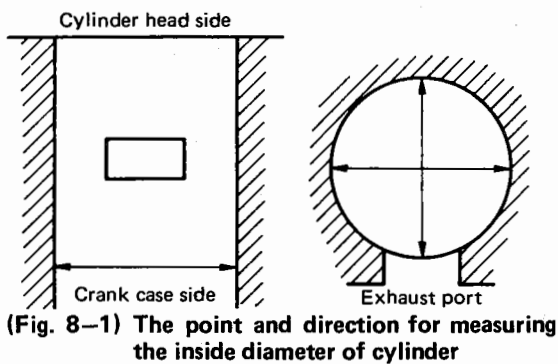


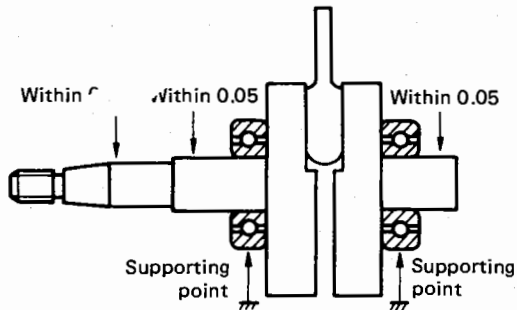
8. Checking the power unit parts

For correction and replacement standards please refer to the Service Data

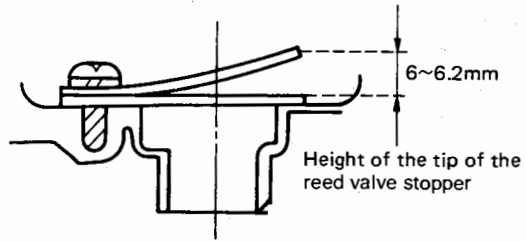
Parts name	Inspection item	Actions to be taken
Cylinder head	<ol style="list-style-type: none"> 1. Adhesion of carbon on the inner wall of the combustion chamber. 2. Distortion of the installation face. 3. Corrosion of the abutting face of cylinder head. 4. Choke of cooling water passage. 	<ol style="list-style-type: none"> 1. Remove by cleaning. 2. Correct by applying the sandpaper of No. 200 and over laid on the surface plate. 3. Correct. Replace if excessive. 4. Remove by cleaning.
Cylinder	<ol style="list-style-type: none"> 1. Adhesion of carbon around the exhaust port. 2. Deposit in the water jacket. 3. Extent of abrasion of the bore. (Fig. 8-1) 4. Seisure. 5. Scar on the inner surface of the cylinder. 	<ol style="list-style-type: none"> 1. Remove by cleaning. 2. Remove by cleaning. 3. If exceeding the limit, either replace or carry out boring and finish with honing. 4. Use the over-sized piston after replacing or boring. 5. Correct if required. (Sandpaper No. 400 to 600)
Piston	<ol style="list-style-type: none"> 1. Adhesion of carbon on the piston crown and the ring groove. 2. Scar on the sliding surface. 3. Measure the gap between the piston ring and ring groove. (Fig. 8-2) 4. Measure the bore diameter of the piston pin. 5. 12mm above the bottom on the outer diameter of the piston skirt (in the exhaust direction). (Fig. 8-3) 	<ol style="list-style-type: none"> 1. Remove by cleaning. 2. Correct if required (Sandpaper No. 400 to 600) 3. Replace if exceeding the limit. 4. Replace if exceeding the limit. 5. Replace if exceeding the limit.
Piston ring	<ol style="list-style-type: none"> 1. Measuring of the gap between the piston ring ends. (Fig. 8-4) In case ring gauge is not available carry out at the lower part of the cylinder bore where abrasion is small. 	<ol style="list-style-type: none"> 1. Replace if exceeding the limit.
Crankshaft	<ol style="list-style-type: none"> 1. Deflection of the crankshaft (Main bearings shall be supported at the crankshaft bearing by V block). (Fig. 8-5) (Fig. 8-6) 2. Side gap on the big end. 	<ol style="list-style-type: none"> 1. Correct. Replace if exceeding the limit. 2. Replace if exceeding the limit.
Reed valve	<ol style="list-style-type: none"> 1. Height of the valve stopper. (Fig. 8-7) 2. Cracks and breakage of the reed valve. 	<ol style="list-style-type: none"> 1. Correct. 2. Replace.

Checking the parts of power unit





(Fig. 8-6) Measuring point for the deflection of the crankshaft



(Fig. 8-7) Measuring the height of the lift

9. Assembling the power unit

9. Assembling the power unit

Assembling shall be carried out in the reverse order of dismantling.

- Carry out according to the instructions appearing in the paragraph 1).
- Carry out the inspection and confirmation according to the service data appearing in the paragraph 2).
- Apply sealing and bonding agents and lubricating oils referring to the paragraph 3) "Sealing, bonding and lubrication points".

(1) Installing the piston

- 1) Install the small end bearing on the small end of the connecting rod. Tap the piston pin lightly in the piston, match with the rod, and further tap lightly to insert it with the piston pin tool (special dismantling tool) applied to the pin. (Fig. 9-2)

(Note)

Install the piston so that the head mark UP is on the magneto side of the crankshaft.

- 2) Correctly insert the piston pin clip into the piston pin hole groove.

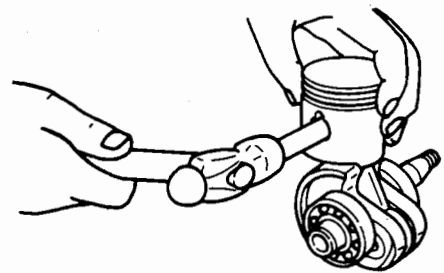
(Note)

When reassembling replace the piston pin clip with new.

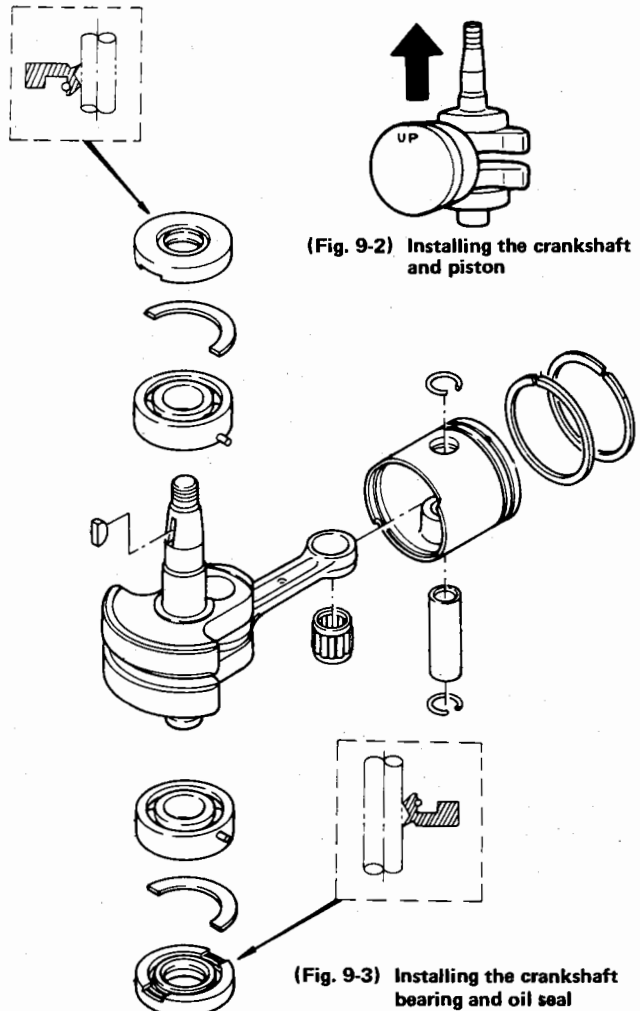
- 3) Install the piston ring into the position by setting it to the detent knock position on the piston.

(2) Crankshaft

- 1) The main bearing shall be pressed into by pushing down the inner ring.
- 2) The knock of the main bearing shall be assembled so that the crankshaft (Fig. 9-3) centers. Moreover, confirm that the knock is correctly pressed into in position.
- 3) Be sure to install the crankshaft oil seal in the direction as shown in Fig. 9-3.
- 4) Apply TOHATSU engine oils to all the sliding and revolving portions.



(Fig. 9-1) Installing the piston



(Fig. 9-3) Installing the crankshaft bearing and oil seal

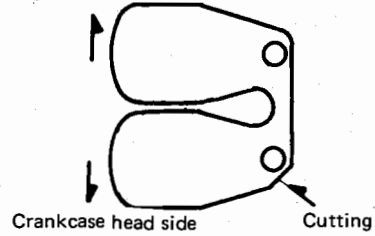
(3) Reassembling the reed valve

- 1) Confirm that the reed valve is free of burrs, fins or scars and that the sheet surface is not uneven, and install so that the cut shown in Fig. 9-4 is fit to the cut of the valve stopper.
- 2) Five due attention to the lift of the valve stopper (lift height: 6 to 6.2mm)

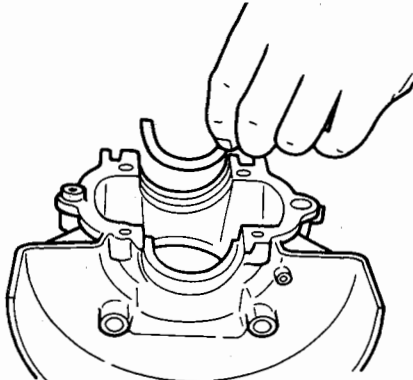
(Notes)

- Lift height: 6 to 6.2mm
- When tightening be sure to apply Three Bond 1041 to the valve set bolts and nuts.

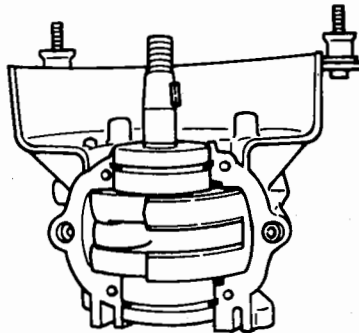
Magneto side



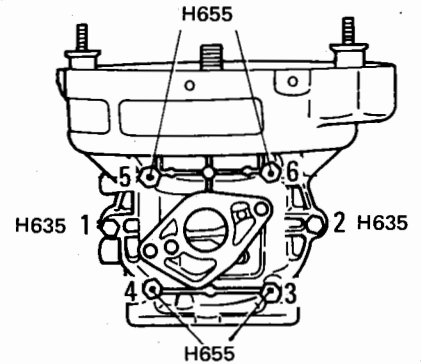
(Fig. 9-4) Installing the reed valve



(Fig. 9-5) Installing the thrust plate



(Fig. 9-6) Installing the crankshaft cylinder



(Fig. 9-7) Installing the crankcase

(4) Installing the crankshaft to the cylinder and reassembling the crankcase

- 1) Correctly insert the thrust plate into the cylinder case groove. (Fig. 9-5)
- 2) Install the crankshaft to the cylinder. (Fig. 9-6)
- 3) Take note of the direction of the main bearing knock so that it is placed in the notch.
- 4) Make sure that the fitting face between the cylinder and crankcase is free of deposit of burrs or adhesion of foreign matters. Moreover, confirm that two knocks are provided and degrease them and apply Three Bond 1104 packing agent to the cylinder case.

With the crankshaft install the crankcase after pressing the crankshaft oil seal against the main bearing side and drying the packing agent.

- 5) Tighten the crankcase fastening bolts A (H665-4) and B (H635-2) to the specified tightening torque.

Tightening torque: 1.0 to 1.1kg-m

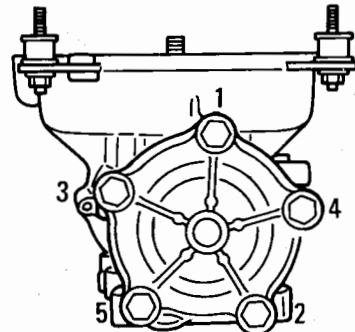
(Note)

The crankcase fastening bolts use the high tensile strength bolts. Be sure not to use other type bolts with them. Tighten them in the order as shown in (Fig. 9-7).

(5) Installing the cylinder head

- 1) Be sure to use the high tensile strength bolts only for tightening. Never use other type bolts together with them. Tighten them in the order as shown in Fig. 9-8.

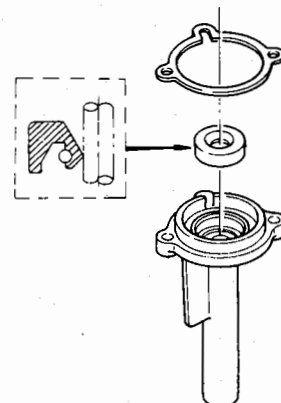
Tightening torque: 2.4 to 2.6kg-m



(Fig. 9-8) Installing the cylinder head

(6) Installing the crankcase head

- 1) When installing the crankcase head confirm that the check valve and the check valve spring are installed on the cylinder.
- 2) Install the crankcase head oil seal in the direction as shown in Fig. 9-9.



(Fig. 9-9) Installing the crankcase head oil seal

(7) Installing the magneto

- 1) Install the exciter coil on the "EXCITER" marked portion of the cylinder. Fix the lead wire to the cylinder with the cord clamp.
- 2) When installing the flywheel confirm that the magneto key is fitted to the crankshaft.
- 3) When installing the magneto wheel be sure to completely degrease the tapered portion of the crankshaft.
- 4) Tighten the magneto nuts to the specified torque by means of the special tool (right-handed screw). (Fig. 9-10).

Specified torque: 5 to 6kg-m

(Notes)

- When installing or dismantling the engine make sure that no shock due to the hammer is applied to the external surface of the flywheel.
- Be sure not to allow the flywheel to fall. Should it fall never use it as a rule. (When using visually check that the magneto is free of cracks and that the adhesion does not fail or it is free of cracking.)
- Take care that the circumference of the flywheel is free of scars.

(8) Wiring

- 1) Wiring shall be carried out correctly referring to the wiring diagrams.

(Note)

Forcible bending and contact to other parts shall be avoided, since these result in breakage or disconnection.

- 2) Tighten the C.D. unit together with the earth lead for the stop switch by means of the ignition coil installing bolts. In this case attach the two earth leads one above other. Securely tighten other installing bolts using spring washers. (Fig. 9-11)
- 3) Connect terminals at positions between the front and rear of the C.D. unit damper rubber after passing the holes provided for them. (Fig. 9-12)
- 4) When connecting the ignition coil high-tension cord with the plug cap connect so that the plug cap is inclined 60° as shown in Fig. 9-13.

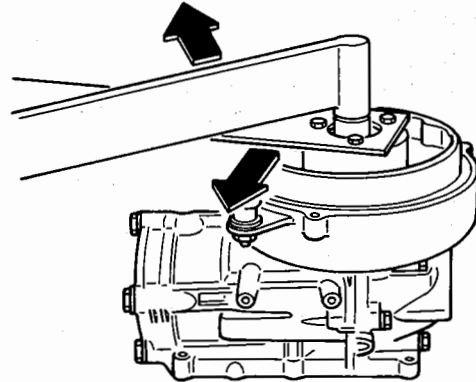
(9) Choke

- 1) Apply TOHATSU grease to the inner surface of the choke rod grommet.
- 2) Confirm that the choke valve is fully closed when the choke rod is pulled toward you to the full and it fully opens when it is pushed forwards to the full. (Fig. 9-14)
- 3) Make sure that the choke rod smoothly operates.

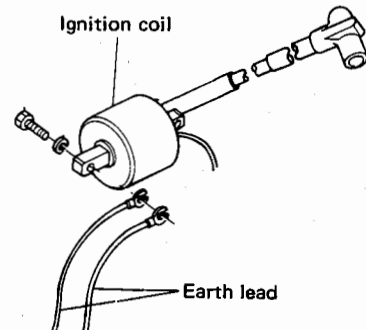
(10) Spark plug

When tightening the new spark plug gives about 3/4 turn by means of the spark plug wrench after the gasket have come into contact with the installing washer.

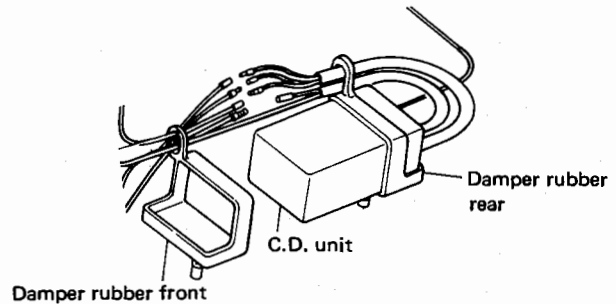
Tightening torque: 2.5 to 3kg-m



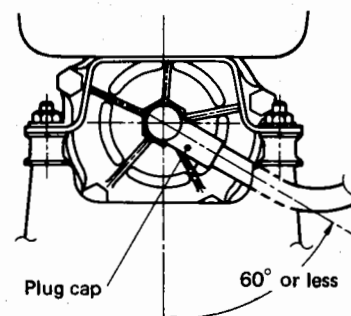
(Fig. 9-10) Tightening the flywheel



(Fig. 9-11) Connecting the earth lead



(Fig. 9-12) Connecting the terminals



(Fig. 9-13) Attaching the plug cap



(Fig. 9-14) Checking the choke valve

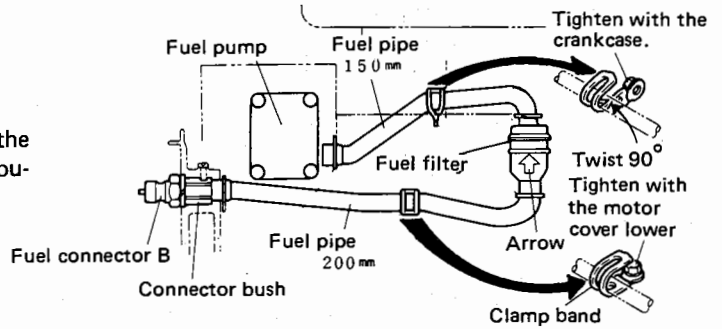
(11) Fuel tank

(1) Integral fuel tank

Cover the joint portion with fuel cock rod tube.

(2) Separate tank

When installing the fuel filter take care that the arrow points to the fuel pump side of the carburetor.

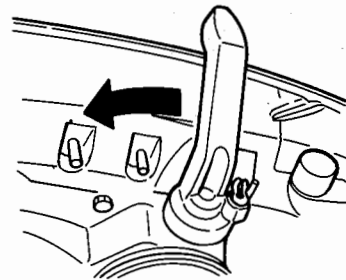


(Fig. 9-15) Installing the fuel filter

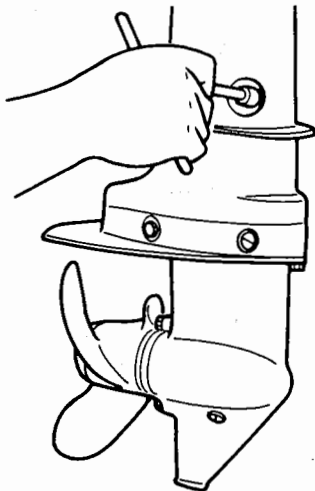
10. Stripping the gear case

(1) Removing the gear case

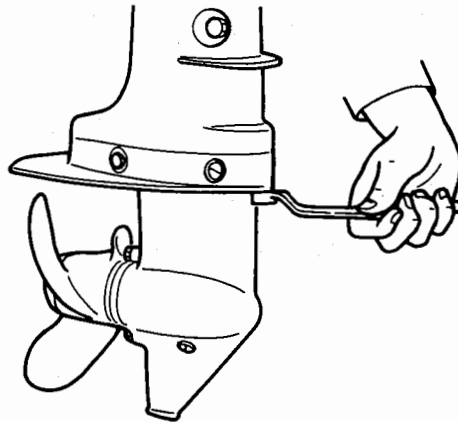
- 1) Set the shift lever at the REVERSE position.
- 2) Remove the drive shaft housing grommet and tighten the shift rod joint bolts (H616-1) by means of T-handle universal wrench. (Fig. 10-2)
- 3) Draw out the gear case removing the gear case installing bolts front (H645-1) and rear (H835-1). (Fig. 10-3)



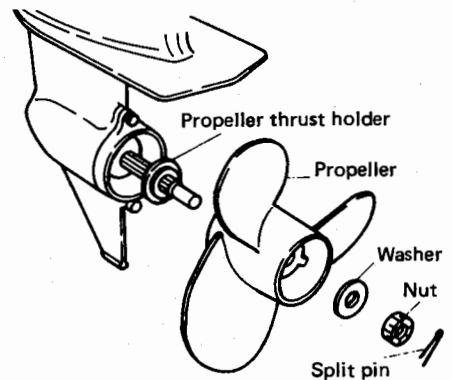
(Fig. 10-1) Setting the shift lever at the REVERSE position



(Fig. 10-2) Loosening the shift rod joint



(Fig. 10-3) Dismantling the gear case



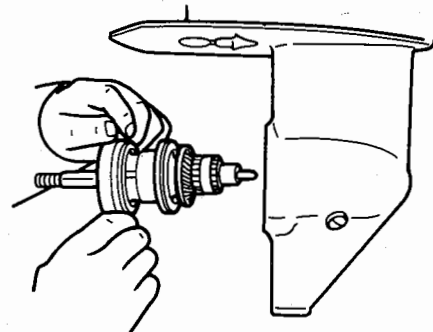
(Fig. 10-4) Removing the propeller

(2) Removing the propeller

- 1) Remove the split pin for the propeller nut. (Fig. 10-4)
- 2) Remove the propeller nut, washer, propeller and thrust holder from the propeller shaft one after another in this order. (Fig. 10-4)

(3) Stripping the propeller shaft and clutch

- 1) Remove the oil plugs positioned on the upper and lower sides of the gear case so as to remove the gear oil in advance.
- 2) Remove the propeller shaft housing installing bolts (H616-2) so as to remove the propeller shaft housing, propeller shaft and bevel gear C. (Fig. 10-5)

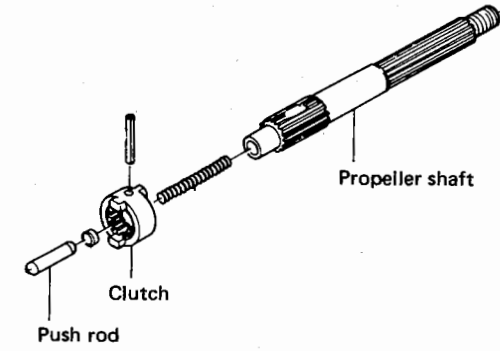


(Fig. 10-5) Removing the propeller shaft housing

- 3) Draw out the clutch pin by lightly pressing the push rod. (Fig. 10-6)

(Note)

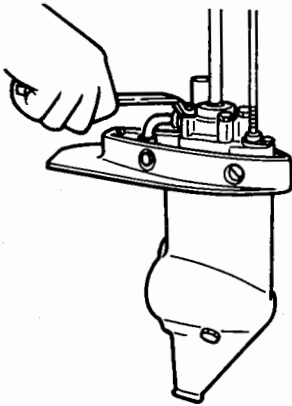
Be careful when drawing out the clutch pin since the push rod and clutch spring will fly out.



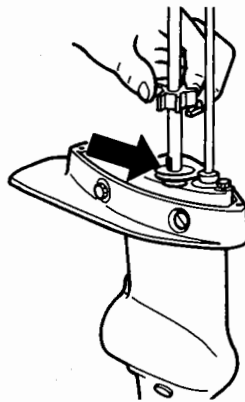
(Fig. 10-6) Removing the clutch

(4) Stripping the water pump case

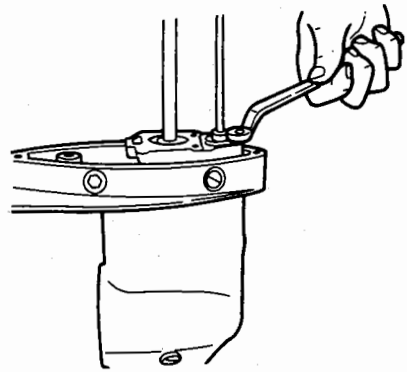
- 1) Remove the pump case installing bolts (H645-4) so as to remove the pump case. (Fig. 10-7)
- 2) Draw out the water pump impeller, pump impeller key, pump case gasket, water pump guide plate and pump guide plate gasket one after another. (Fig. 10-8)



(Fig. 10-7) Removing the pump case



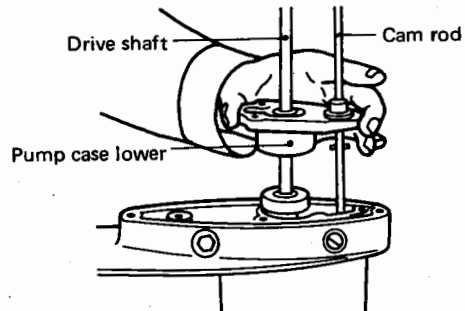
(Fig. 10-8) Removing the pump impeller, impeller key, etc.



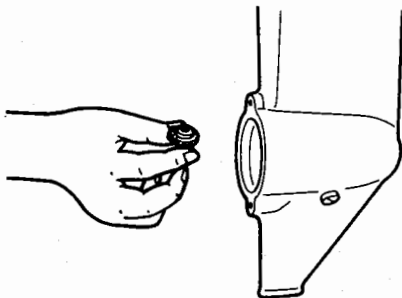
(Fig. 10-9) Removing the cam rod bushing stopper

(5) Removing the cam rod, drive shaft and bevel gear

- 1) Remove the cam rod bushing stopper installing bolts (H625-1) so as to draw out the cam rod bushing stopper. (Fig. 10-9)
- 2) The pump case lower and the cam rod and drive shaft are removed as an assembly. (Fig. 10-10)
- 3) Remove the bevel gear B. (Fig. 10-11)

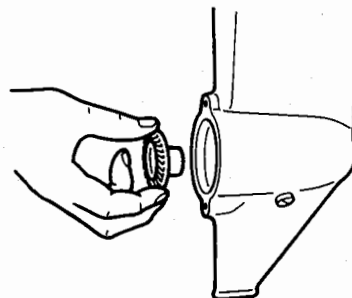


(Fig. 10-10) Removing the pump case lower, cam rod and drive shaft as an assembly



(Fig. 10-11) Removing the bevel gear B

- 4) Remove the bevel gear A. (Fig. 10-12)



(Fig. 10-12) Removing the bevel gear A

11. Checking the gear case parts

Parts name	Check item	Action to be taken
Bevel gears A, B and clutch	<ul style="list-style-type: none"> • Abrasion on the tips of the bevel gears A and C. • Abrasion of the tip of the clutch. • Rub on the teeth of the bevel gears A, B and C. • Abrasion on the bearings for the bevel gears A and C. 	Replace. Replace. Replace if required. Replace if required.
Propeller shaft	<ul style="list-style-type: none"> • Clearance on the engaging portion (spline) with the clutch. 	Replace if required.
Drive shaft	<ul style="list-style-type: none"> • Deflection of the drive shaft. • Abrasion on the spline portion. 	Correct or replace. Replace if required.
Water pump	<ul style="list-style-type: none"> • Damage to the pump impeller. • Abrasion and deformation on the pump case liner. 	Replace. Replace.
Anode	<ul style="list-style-type: none"> • Abrasion on the gear case anode. 	Replace.

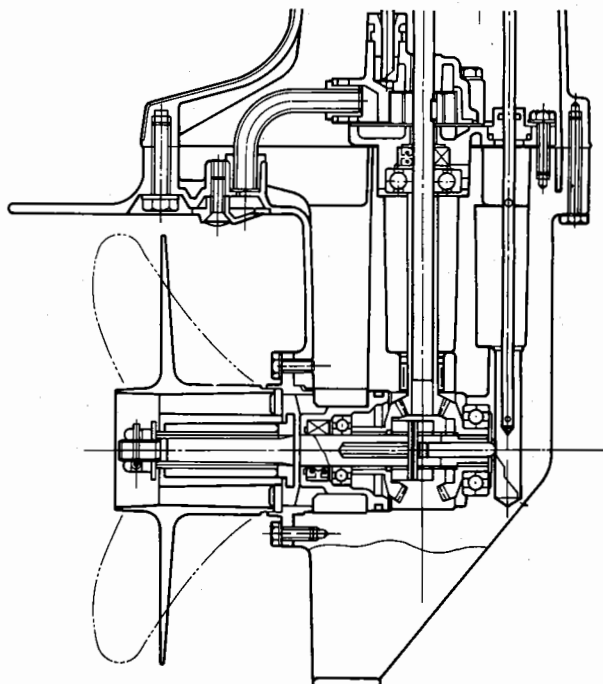


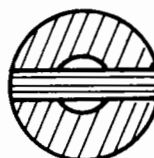
Fig. 11-1 Gear case sectional view

12. Assembling the gear case

Assembling shall be carried out in the reverse order of dismantling paying due attention to the following matters:

(1) Clutch

- 1) Install the clutch and the propeller shaft and confirm that the clearance is minimized and the movement is smoothly carried out.
- 2) Take care that the spring pin (3φx10mm) for connecting the clutch cam with the cam rod does not fly out from the circumference of the clutch cam. (Fig. 12-1)
- 3) Apply TOHATSU grease to the "O" rings portions inside and outside the cam rod bushing.
- 4) Confirm that the cam rod is operated smoothly when it is installed and operated upwards and downwards.



Take care that the tip of the pin does not project from the circumference.

(Fig. 12-1) Clutch cam

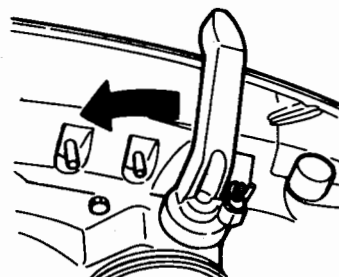


Fig. 12-1 Setting the shift lever at the REVERSE position

5) When fixing the cam rod and the shift rod with the shift rod joint do so with them arranged on the REVERSE side. (Fig. 12-2)

(2) Bevel gear

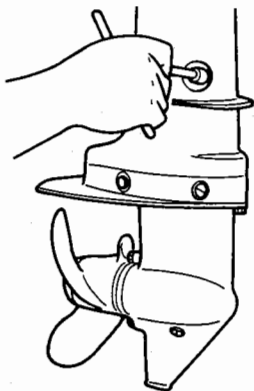
- 1) Press down the external ring when fixing the bevel gear A bearing.
- 2) Backlash between bevel gears A and B shall be measured by means of the special stool. The permissible range of backlash is between 0.05 and 0.15mm. Insert adjusting shim between the pump case lower and drive shaft bearing upper as required.
- 3) Insert the internal ring of the drive shaft bearing lower into the drive shaft and the bearing portion into the gear case respectively by means of the special tool. (referring to

(3) Propeller shaft housing

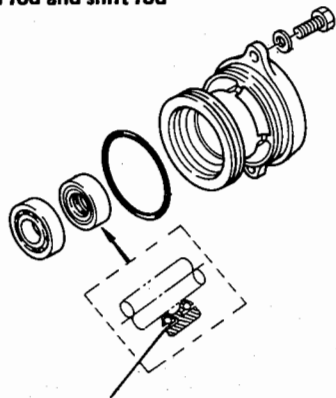
- 1) Press fit the propeller shaft bearing to the propeller shaft housing after having inserted the propeller shaft oil seal into it. (Fig. 12-3)
- 2) Apply TOHATSU grease to the oil seal lip portion.
- 3) Install it so that the oil seal steel plate side is on the gear case side. (Fig. 12-3)
- 4) When inserting the propeller shaft housing into the gear case be sure to apply TOHATSU grease to the "O" ring and the inlow portion.

(4) Propeller

When inserting the propeller into the propeller shaft be sure to apply TOHATSU grease to the propeller shaft spline portion.



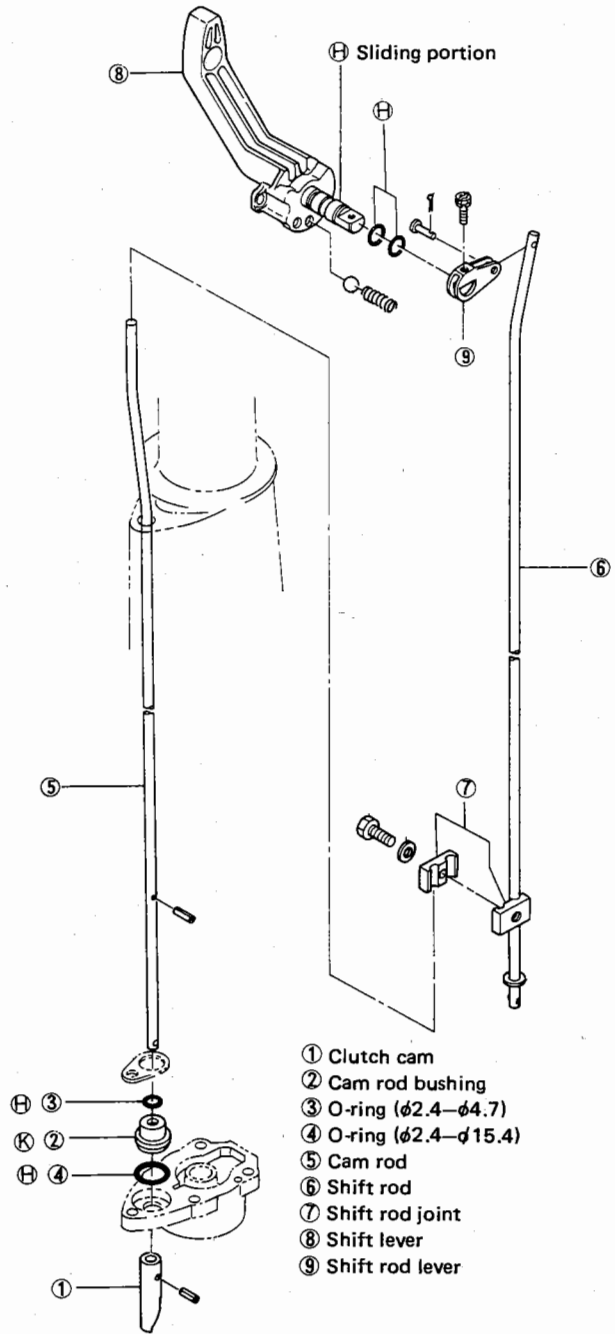
(Fig. 12-2) Installing the cam rod and shift rod



Steel plate side

(Fig. 12-3) Installing the propeller shaft housing

GEAR SHIFT



- ① Clutch cam
- ② Cam rod bushing
- ③ O-ring (φ2.4—φ4.7)
- ④ O-ring (φ2.4—φ15.4)
- ⑤ Cam rod
- ⑥ Shift rod
- ⑦ Shift rod joint
- ⑧ Shift lever
- ⑨ Shift rod lever

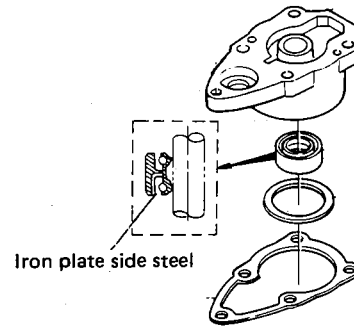
Adhesive agent, sealant and lubricating oil applying point	
(H)	marking: TOHATSU grease
(K)	marking: TOHATSU gear oil

(5) Water pump

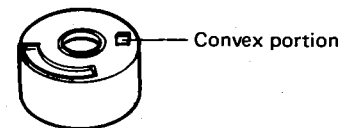
- 1) Press fit the oil seal to the pump case lower. Be sure to apply TOHATSU grease to the oil seal lip portion.
- 2) Take care that the oil seal steel plate side is arranged to be on the gear case side when installing. (Fig. 12-4)
- 3) When installing the pump case liner on the pump case make sure that the convex portion is correctly fitted. (Fig. 12-5)
- 4) Fit tightly the pump impeller into the impeller key. In installing the pump case, push it into position while the drive shaft is made to rotate clockwise. (Fig. 12-6)
- 5) Take care that the knock holes of the water pump guide plate, pump guide plate gasket and pump case gasket coincide with each other.
- 6) Install the water pipe lower on the pump case so as to assemble the pump case.
- 7) Install the water pipe lower as shown in Fig. 12-7.
- 8) Install the water pipe lower seal rubber (on the gear case side) after applying Three Bond G-17 to the inner and outer surfaces.
- 9) Install the water pipe guide on the water pipe as shown in Fig. 12-8.

(6) The quantity of gear oil

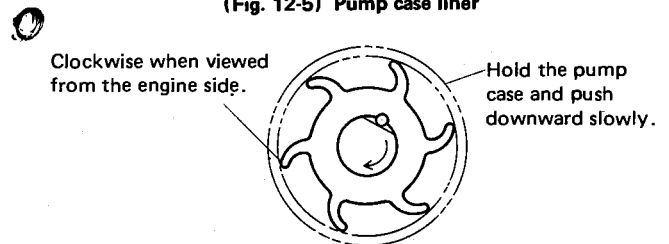
Approx 195cc (TOHATSU gear oil)



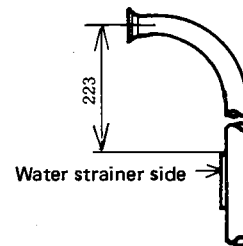
(Fig. 12-4) Assembling the pump case lower



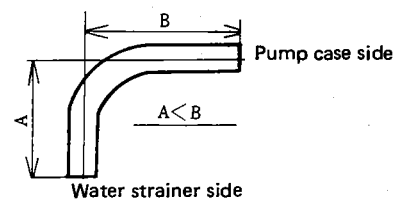
(Fig. 12-5) Pump case liner



(Fig. 12-6) Pump impeller



(Fig. 12-7) Water pipe lower



(Fig. 12-8) Assembling the water pipe

13. Stripping the motor cover lower and drive shaft housing

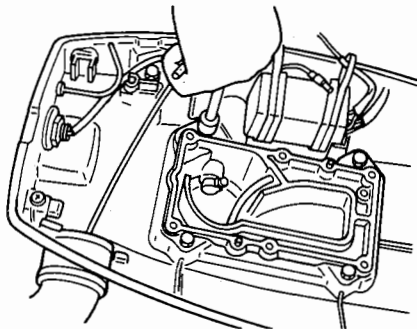
(1) Removing the motor cover lower

Remove the motor cover lower installing bolts (H-614-2) and lift the motor cover lower upwards straight with its both ends securely held. (Fig. 13-1)

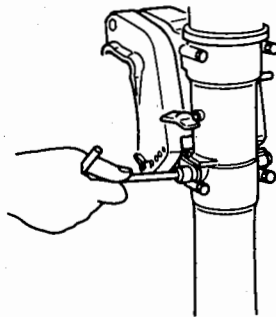
(2) Stripping the swivel bracket and stern bracket

- 1) Remove the reverse lock arm bolts (H614-2) so as to remove the reverse lock arm and springs R and L. (Fig. 13-2)
- 2) Remove the swivel bracket installing bolts (H632-4) so as to remove the drive shaft housing, thrust plate and bushings upper and lower. (Fig. 13-3)
- 3) Draw out the thrust rod. (Fig. 13-4)

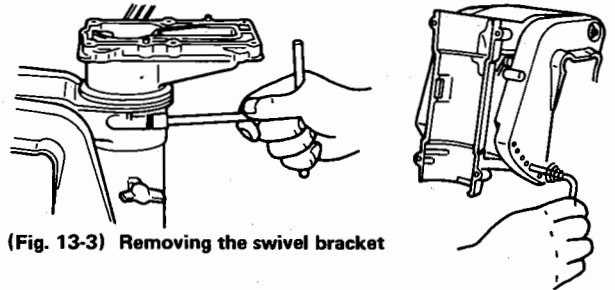
- 4) Remove the bracket distance piece installing screws so as to remove the distance piece.
- 5) Remove the stern bracket installing nuts so as to remove the bracket bolts. (Fig. 13-5)



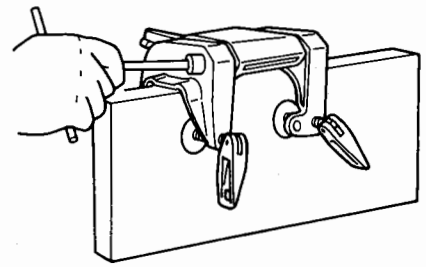
(Fig. 13-1) Removing the motor cover lower



(Fig. 13-2) Removing the reverse lock arm

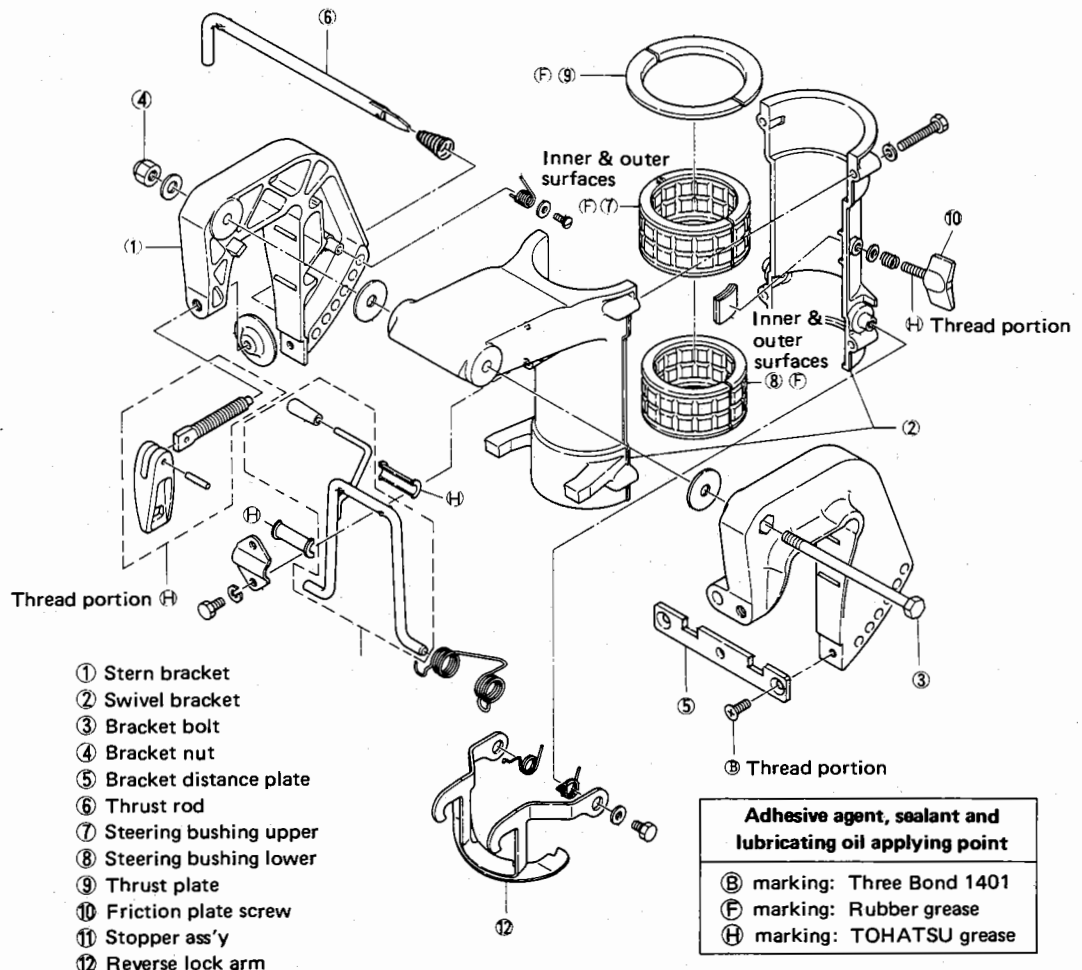


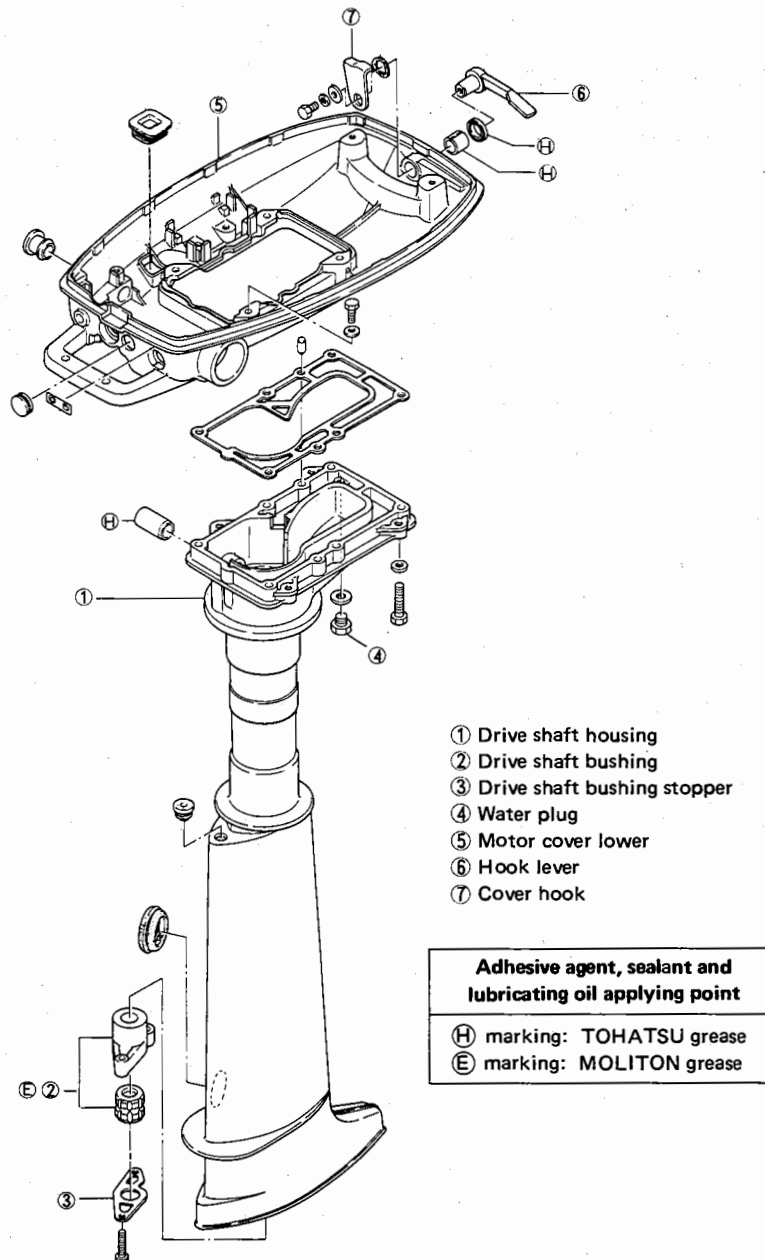
(Fig. 13-3) Removing the swivel bracket



(Fig. 13-4) Removing the thrust rod

(Fig. 13-5) Removing the stern bracket

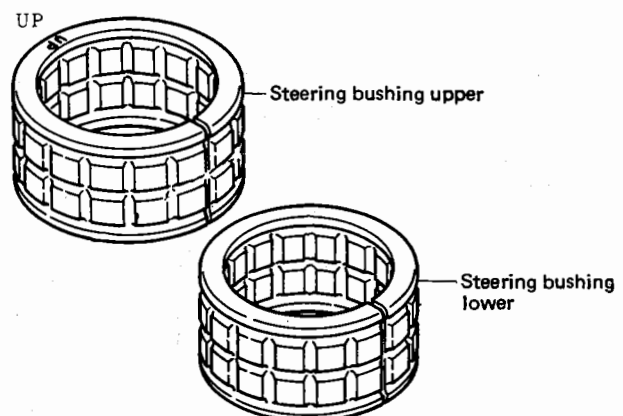




14. Assembling the motor cover lower and drive shaft housing

Assembling shall be carried out in the reverse order of dismantling giving due attention to the following matters:

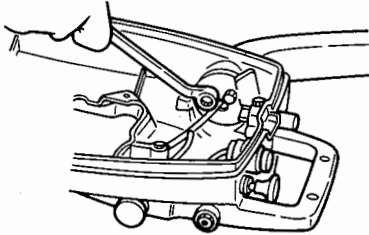
- 1) Tighten the bracket installing bolts to the specified torque.
(Specified torque: 1.14 to 1.54kg-m)
- 2) Apply TOHATSU grease to the clamp screw thread portion and tilt stopper bushing portion.
- 3) Apply the rubber grease to the steering bushing upper and lower and install them correctly without confusing the upper with the lower. (Fig. 14-1)
- 4) Take care that the rubber side of the bracket friction plate and the drive shaft housing portion to be connected with it are free of oils.



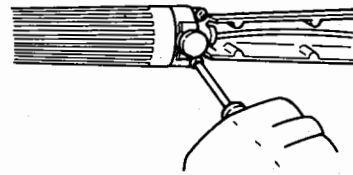
(Fig. 14-1) Installing the steering bushings upper and lower

15. Stripping the handle

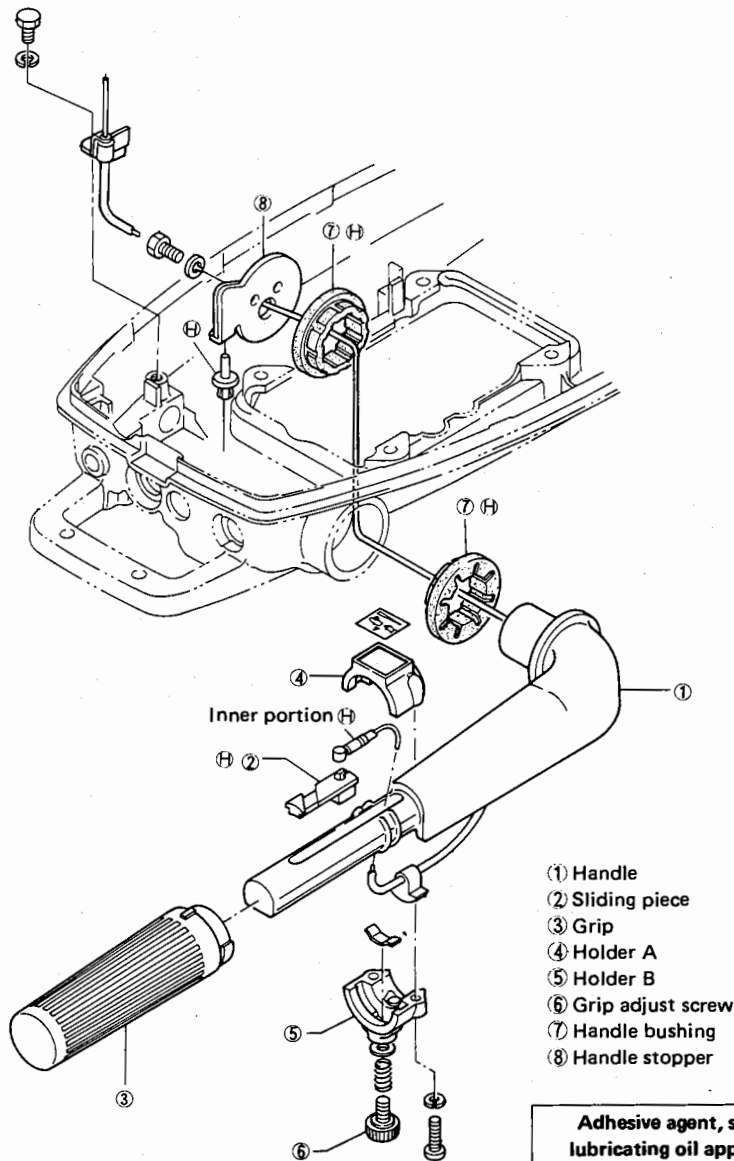
- 1) Remove the handle stopper installing bolts (H616-2) so as to remove the handle. (Fig. 15-1)
- 2) Remove the grip holders A and B installing screws and the grip will also be able to be removed. (Fig. 15-2)



(Fig. 15-1) Removing the handle stopper installing bolts



(Fig. 15-2) Removing the grip holders A and B



- ① Handle
- ② Sliding piece
- ③ Grip
- ④ Holder A
- ⑤ Holder B
- ⑥ Grip adjust screw
- ⑦ Handle bushing
- ⑧ Handle stopper

Adhesive agent, sealant and lubricating oil applying point
 (H) marking: TOHATSU grease

16. Assembling the steering handle

Assembling shall be carried out in the reverse order of the stripping paying attention to the following matters:

- 1) Apply TOHATSU grease to the handle grip portion.
- 2) Apply TOHATSU grease to the handle bushing.
- 3) Apply TOHATSU grease to the sliding piece and throttle wire inner portion.
- 4) Operate the grip so as to confirm that the carburetor and throttle valve are fully closed and they fully open after the assembly have been completed.

17. General construction of the auxiliary equipment and stripping and assembling it

(1) The recoil starter and starter lock (optional)

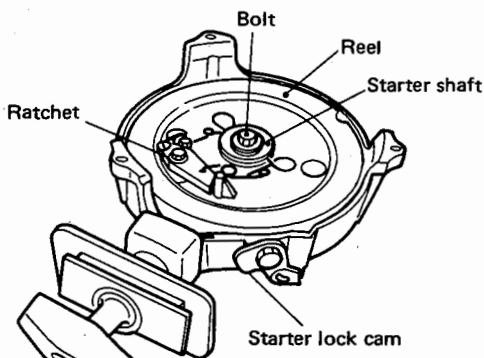
The recoil starter provided for this machine is an automatic recoil starter which automatically rewinds the starter rope using the reaction force of the power spring.

When the starter handle is pulled the ratchet comes out from the reel which is then fitted to the flywheel so as to rotate the crankshaft and start the engine.

When the engine starts or the rope is rewound this fitting is automatically released. Moreover, when the starter lock mechanism is installed it is interlocked with the clutch lever so that the starter is locked at positions other than "NEUTRAL" thus preventing the starting operation.

● Stripping

- 1) Remove the starter lock cam shaft so as to remove the starter lock rod.
- 2) Remove the rope from the starter handle and loosen the recoil starter spring by slowly turning the reel with the starter case securely held to it.
- 3) When removing the ratchet remove the ratchet snap ring (E ring) so as to remove the ratchet guide A together with the B from the starter shaft.
- 4) Loosen the central nut of the starter shaft and then the installing bolts (H635-1) so as to remove the starter shaft. (Fig. 17-1)
- 5) Remove making sure that the starter spring inside is not removed with the rope wound around the reel.

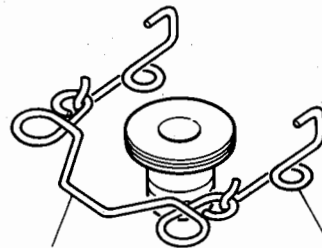


(Fig. 17-1) Recoil starter

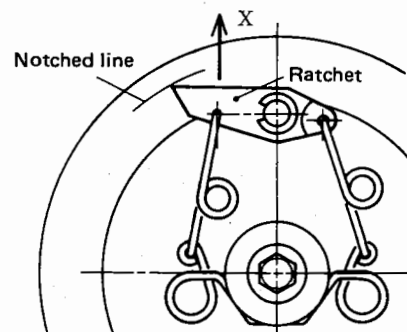
● Assembling

Assembling shall be carried out in the reverse order of stripping paying the attention to the following matters:

- 1) Install the ratchet guides A and B making sure that their installing direction is not mistaken. (Fig. 17-2)
- 2) Do not install by force the ratchet E ring taking note of the tension.
- 3) Apply the cold service grease to the starter shaft, spring guide plate, starter spring, spring slide plate, ratchet and ratchet guides A and B.
- 4) Confirm that the ratchet operates at the initial load of 600 to 800g in the L direction after greasing under the conditions as shown in Fig. 17-3 (in which the ratchet is facing upwards after re-coiling).
- 5) Confirm that the tip of the ratchet comes into contact with the marking when operating the starter handle after having assembled the recoil starter.



(Fig. 17-2) Installing the ratchet guides A and B



(Fig. 17-3) Installing the ratchet

(2) Carburetor

The carburetor (manufactured by Keihin Seiki Co., Ltd.) is combined with the fuel pump and installed on the crankcase as a unit. The throttle is operated (engine rotation. Low speed ↔ High speed) by operating the handle grip or remote control lever. The choke valve is opened and closed through the choke lever by the operation of the choke rod (which closes the valve when pulled) positioned on the left and side near the center of the motor cover lower front.

The fuel pump is a diaphragm type in which the fuel is fed taking advantage of the pressure inside the crankcase.

Outlined construction

The flow of the fuel and the air is divided into the pilot system and the main system.

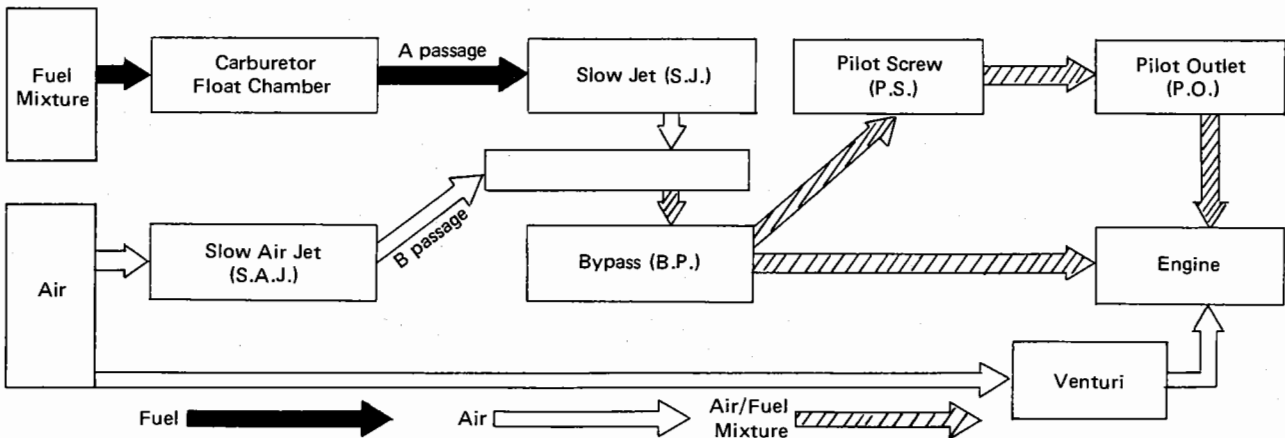
1) Pilot system (Fig. 17-6)

The pilot system consists of the Slow Jet (S.J.), Slow Air Jet (S.A.J.), Pilot Outlet (P.O.), Bypass (B.P.) and Pilot Adjust Screw (P.S.)

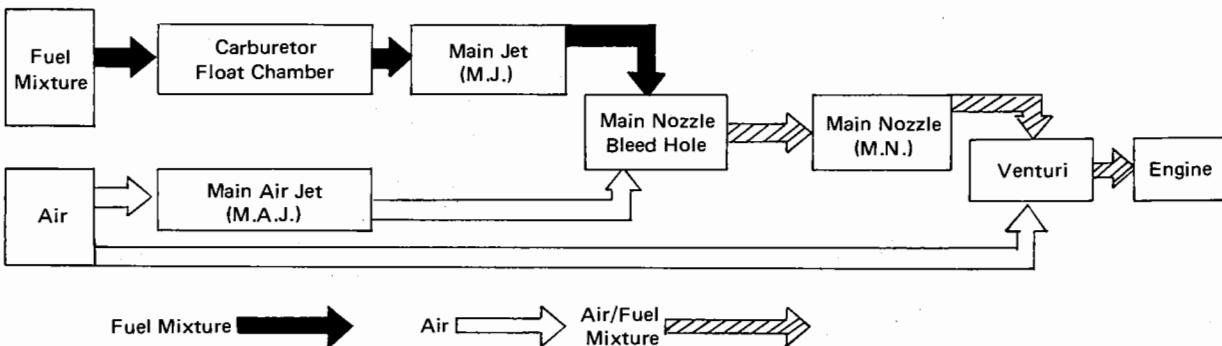
When the opening of the throttle valve is small the fuel and the air are jetted from the B.P. or P.O. after the fuel passing through the (A) passage measured at S.J. has been mixed at (B) passage with the air measured at S.A.J. before being fed to the engine.

Under idling conditions the mixture fed with the air also from B.P. is mainly jetted from P.O.. However, when the throttle valve is opened the negative pressure on the pilot system increases, so allowing the mixture to be jetted also from the B.P.

When the throttle is further opened the air increases in quantity so causing the pressure drop to be intensified and the fuel to be taken from M.J. thus allowing the mixture to be jetted also from the M.N.



(Fig. 17-6) Pilot system flow chart



(Fig. 17-7) Main system flow chart

2) Main system (Fig. 17-7)

The main system consists of the Main Jet (M.J.), Main Nozzle (M.N.) and Main Air Jet (M.A.J.)

When the opening of the throttle valve is large the pilot system hardly operates. When the throttle valve is widely opened the air increases in quantity so quickening the air flow in venturi so as to intensify the pressure drop near the tip of the M.N. which increases the amount of fuel jetted.

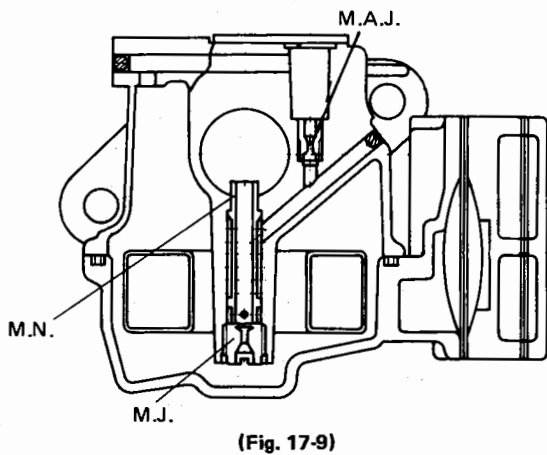
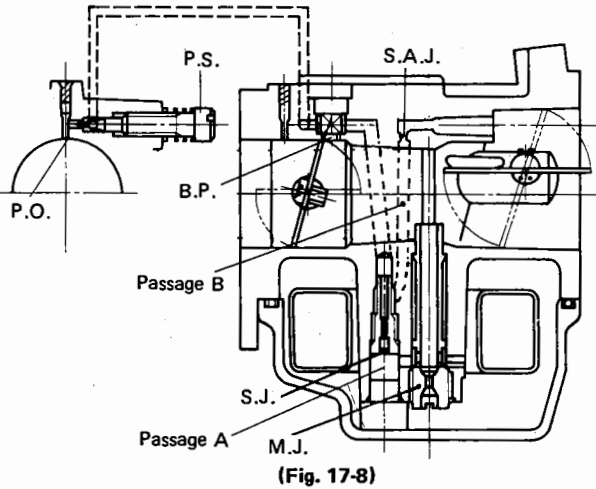
The fuel measured at the M.J. is mixed with the high pressure air taken into the bleed hole provided for the M.N. after being taken in from the M.A.J. provided for the air inlet of the carburetor, Thus the mixture having

a proper mixing ratio is jetted from the M.N. and further this is mixed with the main air before being fed to the engine.

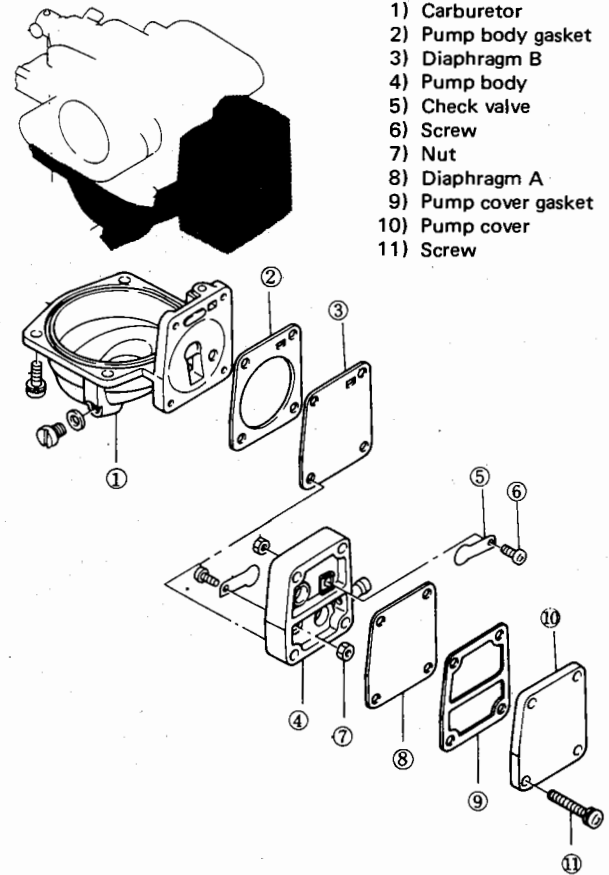
3) Float

This consists of the float, float valve, special clip and valve seat which is designed to keep the oil level constant so as to produce the air fuel mixture required for the engine. When the fuel which has been poured into the float chamber through the valve seat reaches the certain level, the float is raised which then pushes the needle valve upwards. The raised float valve is adhered tightly to the valve seat which cuts the fuel flow. As the fuel being consumed, the oil level is lowered and the lowered

float subsequently causes the lowering of the needle valve, by parting from the valve seat, the fuel is poured into the float chamber over again. The oil level is kept constant by repeating this procedure automatically.



4) Fuel pump



- 1) Carburetor
- 2) Pump body gasket
- 3) Diaphragm B
- 4) Pump body
- 5) Check valve
- 6) Screw
- 7) Nut
- 8) Diaphragm A
- 9) Pump cover gasket
- 10) Pump cover
- 11) Screw

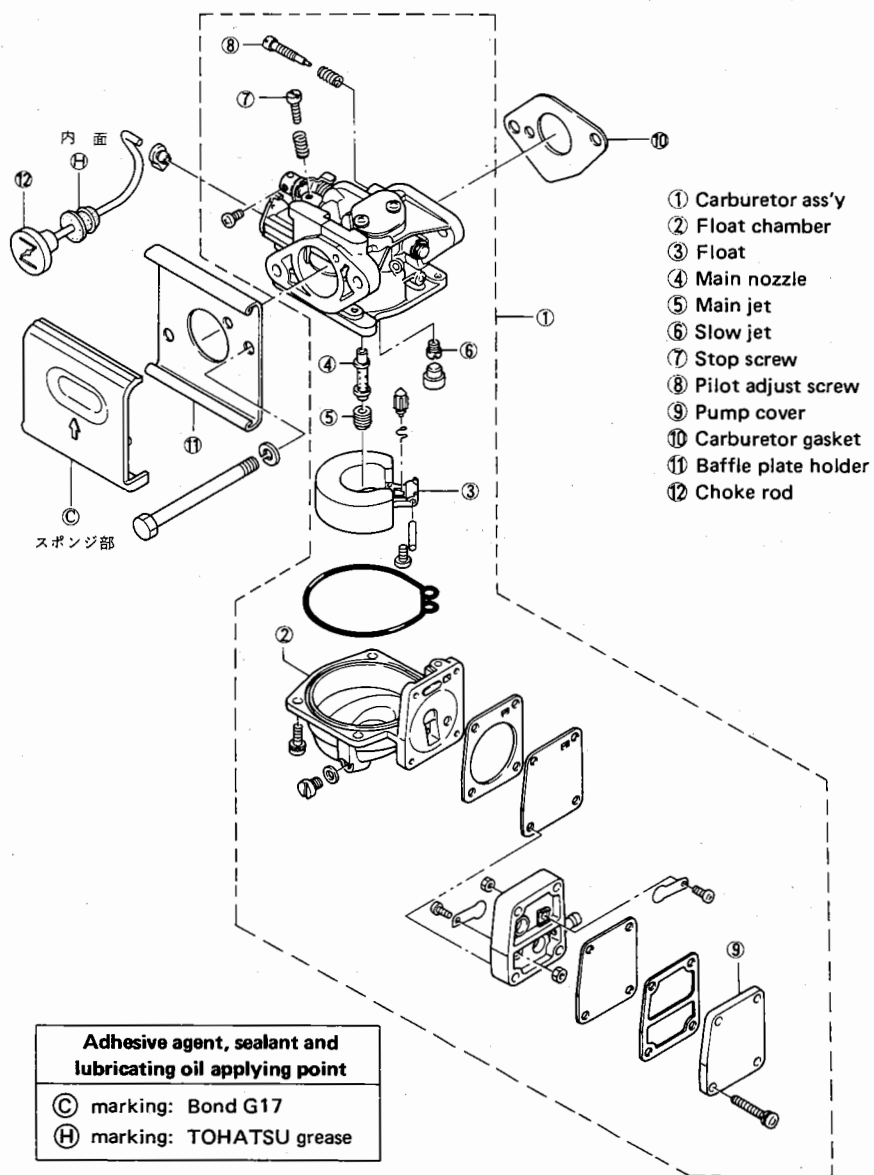
(Fig. 17-10) Fuel pump component parts

5) Carburetor setting

For details please refer to the Service Data.

6) Checking each part

Item to be checked	Action
1. Fuel leakage from fuel pipe joint	<ul style="list-style-type: none"> ○ Replace the pipe with new.
2. Play on the throttle valve shaft and choke valve shaft	<ul style="list-style-type: none"> ○ Replace if required.
3. Idling rpm <ul style="list-style-type: none"> ○ Adjust after worn up running. Clutch off: Approx. 1000 to 1050rpm Clutch in: Approx. 850 to 900rpm 	<ul style="list-style-type: none"> ○ Slightly tighten the pilot screw (P.S.) and operate the throttle and stop screw so as to obtain the specified engine rpm checking the tachometer. The, operate the pilot screw (P.S.) so that it is set at the optimum position within $\pm 1/4$ turn where the maximum engine rpm is reached and again operate the throttle stop screw so that the specified rpm is set. ○ When the abrasion of the tip of the pilot screw (P.S.) is excessive replace it with new.
4. Fuel pump <ul style="list-style-type: none"> ○ Sagging and damage to the diaphragm and deformation of installing holes 	<ul style="list-style-type: none"> ○ Replace if required.
5. Damage to the packings and leakage of gas from them	<ul style="list-style-type: none"> ○ Replace if required. (Carburetor and fuel pump)
6. Standing water or foreign matters	<ul style="list-style-type: none"> ○ Drain the fuel filter and float chamber and remove the dusts.

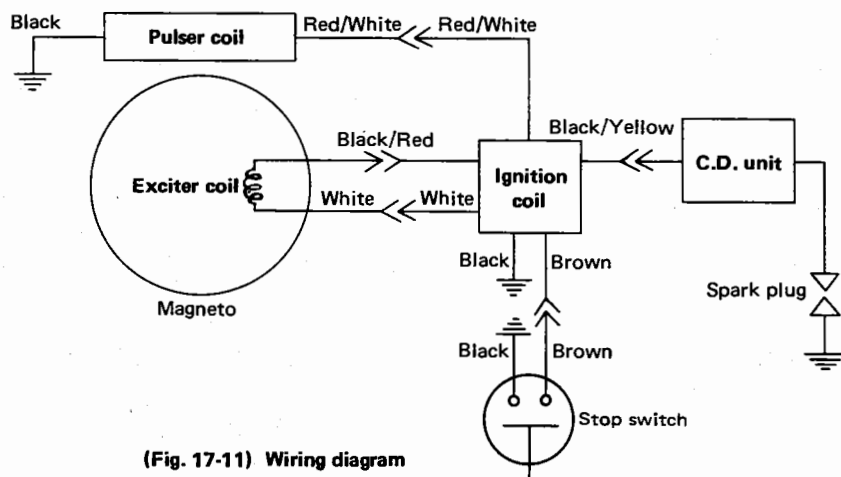


(3) Checking and servicing electrical equipment

1) Component parts (For details please refer to the illustration at page 34.)

- Flywheel coil
- Pulser coil
- C.D. unit
- Ignition coil
- Stop switch

2) Wiring diagram (Fig. 17-11)



(Fig. 17-11) Wiring diagram

3) Checking and servicing

Flywheel

Although checking and servicing are not necessary for normal running take note of the following matters:

- a. Since the magnet for the flywheel is fixed by the adhesive pay due attention to the following instructions:
 - Never give any shock due to hammers when installing on or removing from the engine.
 - When removing from the engine make sure that the specified tools are used but never use commercially available pulley pullers.
 - Make sure that the flywheel is never allowed to fall. Should it fall and be deformed or cracked never use it again but replace with new.
- b. Take care that the circumference of the flywheel is free of scars, since a pulser coil is provided for it and so scars on it can cause engine troubles.

Exciter coil, pulser coil and ignition coil

Checking and servicing these coils are not required for normal running. However, when troubles related with magneto occur so causing the sparks to fail check the following matters:

- a. Confirm that the wire harness is free of discontinuity and nothing wrong is discovered of the connections at the terminals.

- b. Check the resistance values of the exciter coil and pulser coil. When the values at approx. 20°C are as follows these coils are normal. (Measure the resistance values after having removing each connecting terminal.)

* Exciter coil: Between red/white cord and the black earth (93 to 140Ω)

* Pulser coil: Between red/white cord and the black earth (80 to 117Ω)

(Note)

(Since the pulser coil is provided with a built-in magnet take care that iron powders do not adhere to it.)

* Ignition coil

Primary coil: Between the black/yellow cord and core (0.02 to 0.38Ω)

Secondary coil: Between the secondary cord and core (3000 to 4400Ω)

C.D. unit

When sparks are generated but the ignition timing is wrong or no lead is presented and it is considered that those troubles are caused by the C.D. unit please check the following matters:

- 1) Confirm that the wire harness is free of discontinuities and the terminals are correctly connected.
- 2) Check referring to the table below.

		Tester (-) terminal					
		Red/white pulser cord	White exciter cord	Black/red exciter cord	Black Earth	Black/yellow ignition coil	Blown stop cord
Tester (+) terminal	Red/white			OFF	ON	ON	OFF
	White	ON		CON	ON	ON	CON
	Black/red	ON	Approx. 18kΩ after CON		ON	ON	ON
	Black	ON	Approx. 10kΩ after CON	Approx. 1000kΩ after CON		ON	Approx. 1000kΩ after CON
	Black/yellow	CON	CON	CON	CON		CON
	Blown	ON	Approx. 18kΩ after CON	ON	ON	ON	

(Notes)

- The resistance values indicated vary according to the changes in the tester range or the tester voltage since the indication of the resistance represents that the resistance is applied in the direction of easy how flow for the diode or in the reverse direction. When the measured values greatly differ from those indicated it is judged that those tested are defective.
- CON indicates the capacitor characteristics in which the pointer deflects once and recovers soon.

- Make sure that testers for transmitter are used which are provided with built-in batteries having a capacity of 3V or less.
- Measure with testers having a multiplying factor of 1k.
- When checking those having CON indication first short the black/yellow leads for the ignition coil with the ignition coil with the black earth.
- In the case of CON indication note that the pointer does not deflect where paragraph 5 is not carried out or the range of measurement described in paragraph 4 is lower.

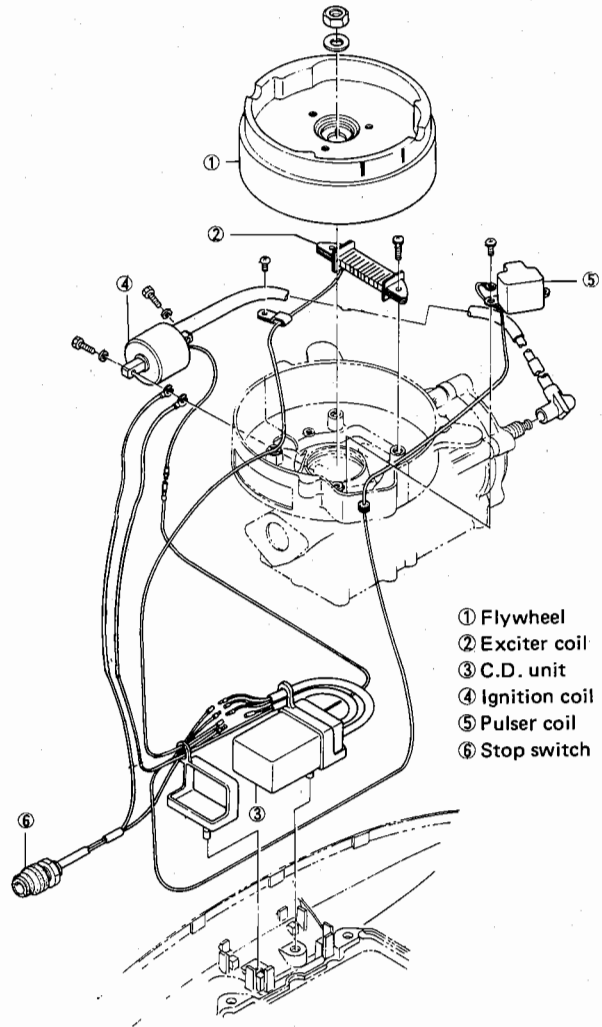
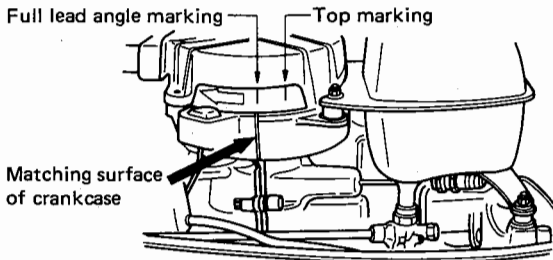
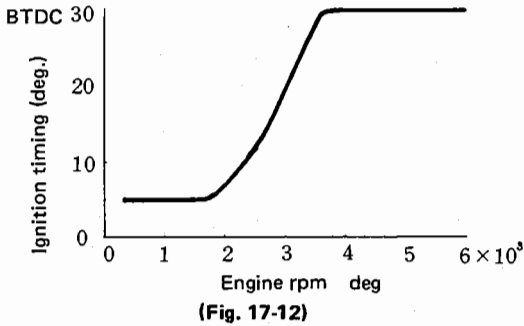
The method of checking the ignition timing

The magneto employs "an electrical lead angle method" in which the ignition timing is advanced as the engine rpm increases. (Fig. 17-12)

Start the engine and check the ignition timing by means of the timing lamp.

There are two lines of markings engraved on the side of the flywheel—top and lead angle: BTDC 30°

Check on the basis of the matching surface of the crankcase. (Fig. 17-13)



(4) Propeller

The propeller gives the motive force to boats and is available in variety of types to suit purposes.

1) Selecting the propeller

When selecting the propeller select those which closely match with boat. If otherwise the efficiency is reduced and engine troubles are experienced.

Moreover, propellers should be selected so that the recommended engine rpm's are obtained so as to ensure a highly efficient running.

If propellers are selected otherwise the running efficiency and rpm reduce and if selected so that the recommended rpm's are exceeded the vibration noises increase and damage to parts can be expected. This can also result in caviations or other serious troubles.

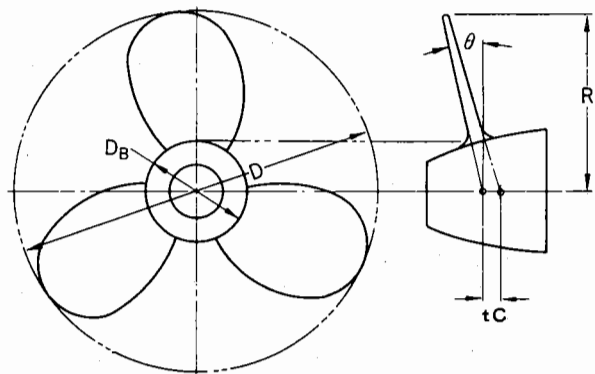


Fig. 17-14

- D = Diameter
- R = Radius
- D_B = Boss diameter
- H = Pitch
- θ = Tilt angle of rake
- tC = Imaginary thickness on center line
- Z = Number of blades
- Pitch ratio = H/D
- Boss ratio = D_B/D
- Blade Thickness Ratio (B.T.R.) = tC/D

Moreover, if propellers are selected so that the recommended rpm's do not reach the overload can be expected which results in damage to the parts.

- 2) The recommended rpm range: 4,500 to 5,500rpm
- 3) Propeller selection table (Fig. 17-15)

(5) The method of running (the method of running and adjusting after reassembling in the water tank simulating running condition)

1) The water tank simulating running condition and the test propeller

When carrying out trial run in a water tank it is necessary that the test propeller (Murine) is worked in the tank so as to apply appropriate load to the engine and so to absorb the Power.

a. The test propeller are used for the purposes as follows: (Fig. 17-17)

- For running-in of new outboard motors.
- For confirming that the outboard motors work normally after servicing.

b. The water tank in which the test propeller are used

- Be sure that the dimensions of the water tank (Fig. 17-16) are minimized.
- Even when installing two or more engines on the water tank fix the partition wall so that the dimensions specified in the minimum diagram are ensured for each of engines.
- When continuously using the water tank the water temperature in the tank rises so that the engine siesure can be expected. So, take care that the water temperature does not 25°C, it is desirable that a cooling system or an overflow device using flowing water is installed.

- Be sure to use fresh water at all times.
- When the dirty water is used without replacing after several tests it can be expected that carbons in the water adhere the inner wall of the cooling water passage thus deteriorating the performance of the cooling system.
- Continuous running results in exhaust gases entering the carburetor air intake, so affecting the mixture. It is, therefore, necessary to install exhaust fans or similar devices to remove exhaust fumes from the testing area.

c. Testing propeller (Murine) is available in dimensions as follows:

Outer diameter: ϕ 164
Width: 9.5mm

2) Installing on the water tank simulating running operation

- a. Install on the center of the mounting plate and securely fix by means of the clamp screw handles.
- b. Take care that the outboard motor is installed in a vertical position against the water level by adjusting at the thrust rod position.
- c. The water level should be set so that no cavitation can be expected during the maximum speed running.

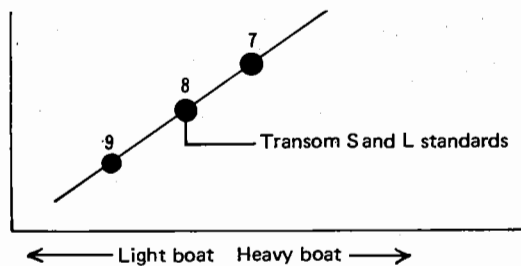


Fig. 17-15

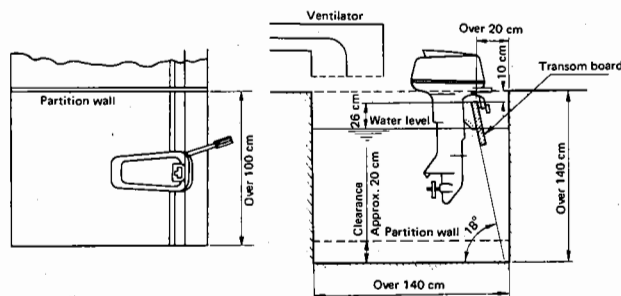
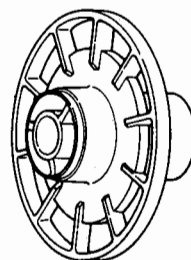


Fig. 17-16 Water tank



(Fig. 17-17) Testing propeller (Murine)

It should be 26cm from the outboard motor installing board in the case of Transom S and 39cm in the case of transom L.

- d. Use the specified testing propeller (Murine) for absorbing the power. When a motor is worked in a water tank simulating running condition with the testing propeller installed on it, it is judged to be normal if the rpm exceeds 4500 with the carburetor throttle valve fully opened.

3) Fuel

- a. Use the fuel tank installed on the outboard motor.
- b. The fuel for breaking-in should be a gasoline-TOHATSU engine oil mixture (20:1) (when replacing the engine parts).

4) Checking and adjusting after reassembling

Check the following matters after reassembling the engine and the lower unit.

- Items to be checked before test runs
 - Piping of the fuel system
 - Adjusting of clutch
 - Electric wiring, connections and clamps
 - Performance of the reverse lock and the operation

- Items to be checked during test runs

Start the engine and carry out idling so as to check the following items.

- Oil leakage from the fitting faces of the crankcase
- Cooling water leakage from the fitting faces of the cylinder head
- Cooling water leakage from the engine installing surfaces
- Abnormal sounds
- RPM during idling and stability (Clutch in 850 to 900rpm)
- Stop switch operation
- Clutch operation
- The engine conditioning during acceleration and deceleration.
- Delivering conditions of a cooling water (the cooling water should be delivered from the water checking port.)

5) Break-in

Carry out the running in after having replaced parts such as piston, piston ring, piston pin, crankshaft, cylinder and bevel gear bearing so as to give an appropriate rub to the sliding surfaces.

- Adjust using the carburetor slow stop screw so that the minimum engine rpm is 850 to 900 with the clutch thrown in (FORWARD).
- The minimum engine rpm is 1000 to 1050 when the clutch is disengaged (NEUTRAL).
- Carry out the breaking-in at low and medium engine rpm's for about 10 hours with a load applied.

(Note) Check the following matters during the breaking in:

- Abnormal sounds and vibrations
- Water or gas leakage from the fitting surfaces
- Discharging of the cooling water from the water checking port

6) After breaking-in

- When the engine has adequately warmed up set again using the carburetor slow stop screw so that the minimum engine rpm is 850 to 900 with the clutch thrown in (FORWARD).

Under these conditions carry out the adjustment of the carburetor adjust screw (P.S.) so that the optimum condition is obtained at the maximum

rpm by 1-3/4 to 2-1/4 turn (counterclockwise). Adjust the stop screw again so that the minimum engine rpm is 850 to 900 with the clutch thrown in (FORWARD) after the adjust screw (P.S.) setting has been completed.

- Measure the engine rpm when the throttle is fully opened by means of the handle grip with the clutch thrown in (FORWARD). (The measured values are acceptable if they exceeds 4500rpm).

7) Stopping the engine

- Keep pressing the stop switch until the engine completely stops after having placed the handle grip on the low speed side and set the shift lever at its neutral (N) position.
- Close the fuel cock and the air vent cap

9) Removing the outboard motor from the water tank

- When removing the outboard motor lift it upwards straight and never lay it down on its side until the water inside is completely removed.
- When carrying take care that the engine portion is not placed lower than the propeller.
- When laying on its side be sure to place the propeller on the lower side. When the engine portion is lower than the propeller the water can be expected to flow into the cylinder. Never place the engine portion on the lower side.

10) The method of checking after removing

- Check the gear case, propeller shaft housing (oil seal "O" ring portion), oil plug for gear oil leakage or bolts.
- Check the fitting faces of the cylinder, crankcase, cylinder head, spark plug and carburetor for gas or water leakage.
- Check the bolts and nuts for looseness or falling off.
- Check the painting for peeling.
- Check the following parts for tightens and tighten if required.
 - Cylinder head installing bolts
 - Carburetor installing bolts
 - Drive shaft housing installing bolts
 - Other portions where looseness is experienced.

18. Periodical checks

Check item	Maintenance frequency	Item and action to be taken	Remarks
Tightening of bolts and nuts	Every 10 hrs in the case of new products	Cylinder head, carburetor and drive shaft housing	Refer to "List of tightening torques"
Spark plug	Every 30hrs	Correct, clean or replace if the gap is widened due to the abrasion of the pole or the carbons adhere to it.	NGK BP 7HS 10 (Gap: 1.0) CHAMPION L82YC10 (gap: 1.0)
Fuel system	Every 50hrs	Clean the fuel tank, fuel cock, fuel pipe, fuel filter, fuel pump and carburetor and check them for damage.	Remove dirt and dusts, take note of leakage of fuel and inhaling of air.
Decarbonizing	Every 100hrs	Remove carbon from the combustion chamber, exhaust passage and piston ring groove.	
Carburetor	Every 100hrs	Strip and remove dirt inside, and wash with gasoline and clean with air blast.	Symptoms: Poor idling, low and medium speed operations
Propeller	In every case	Correct or replace if damaged or deformed.	
Starter rope	Before cruising	Check for wear or breakage.	
Cooling water passage	Every 100hrs	Remove fur and sediment from the water pump, water pipe and cylinder head passage.	Symptom: Overheating due to the shortage of cooling water
Cooling water check	Before running	Check the delivery of cooling water from the water checking port.	
Gear oil	Change oil 20hrs after initial run, supply oil in every 50hrs run and change oil in every 200hrs run.	Change or supply oil as specified on the left and check the propeller shaft oil seal for cracks, sign of wear or water seepage.	TOHATSU gear oil (#80 approx. 195cc)
Grease up	Every 50hrs	Propeller shaft, bracket installing bolts, clamp screw, recoil starter, shift lever shaft, hook lever shaft, throttle lever, choke lever, choke rod, throttle wire, reverse lock mechanism, tilt stopper mechanism, starter lock mechanism (optional), steering pushing upper and lower and other sliding parts.	
Anode	Every 3 to 6 months	Check sign of wear.	Replace if required.
Reverse lock operation	In every use	Check for correct operation.	
Handle	In every use	Check steering and throttle operations for smoothness and adjust the sliding as required.	
Compression pressure	Every 100hrs	Measure the compressive stress of cylinder (Be sure to measure with the throttle fully opened after warm up).	Reference value: 5.5kg/cm ² /500rpm
All the parts	Every 500hrs	Overhaul.	Replace if required.

19. Trouble shooting

Engine does not start.	Engine starts but stops soon.	Poor idling	Poor acceleration	Engine rpm is abnormally high.	Engine rpm is abnormally low.	Speed is low.	Engine is overheated.	Possible causes
•	•							Fuel tank is empty.
•	•	•	•		•	•	•	Fuel system connection is not correct.
•	•	•	•		•	•	•	Air is inhaled from the fuel system.
•	•	•	•		•	•	•	Fuel pipe is distorted.
•	•	•	•		•	•	•	Fuel cock and tank cap air vent are not opened.
•	•	•	•		•	•	•	Fuel strainer, fuel pump or carburetor is clogged with trushes.
		•	•		•	•	•	Improper engine oils are used.
•		•	•			•	•	Improper gasolines are used.
•	•	•	•		•	•		Oil is excessive in gasoline/oil mixture.
							•	Oil is inadequate in gasoline/oil mixture.
•			•					Fuel supply is excessive.
•	•	•	•			•	•	Carburetor adjustment is poor.
•	•	•	•			•	•	Plugs used are not specified.
•	•	•	•			•		Spark plug fouls, bridge increases and gap is widened.
•	•	•	•			•		Sparks do not fly or they are too weak.
				•		•	•	Cooling water flow is insufficient.
			•	•		•	•	Cavitation.
			•	•	•	•	•	Propeller is not proper.
		•	•	•	•	•	•	Propeller is damaged or deformed.
			•	•		•	•	Thrust rod is not properly positioned.
			•	•	•	•	•	Loads do not balance on the boat.
			•	•	•	•	•	Transom is too high or too low.
•								Stop switch shorts.

4. FITTING THE OPTIONAL PARTS

1. Remote controls

(1) Installing the remote control box

Install the remote control box on locations which do not interfere with the operation with the remote control lever and confirm that the passage of the remote control cable is not obstructed. (Fig. 1-1)

(2) The length of the remote control cable

The cable lengths vary according to the types of boat. Therefore, set up the standards for the cable length required by adding 300mm to the distance measured between (A) and (B). (Fig. 1-2).

(Note)

Take care that the remote control cables are not bent so that the diameter is 406mm or less. If bent further their life expectancy is much reduced and the heavier control lever operation results.

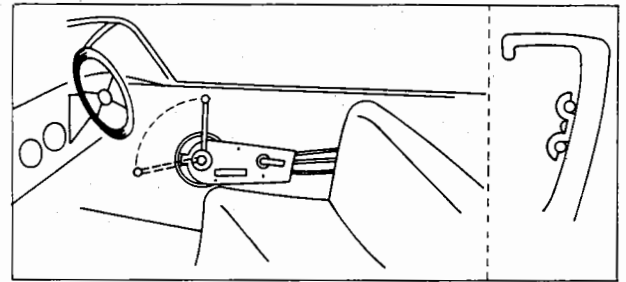


Fig. 1-1

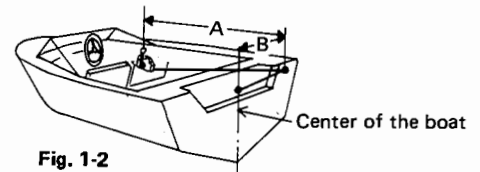


Fig. 1-2

The standards of cable lengths = (A + B) + 300mm

Cable lengths	Part number
2.0 m	332-83702-0
2.5 m	332-83703-0
3.0 m	332-83704-0
3.5 m	332-83705-0
4.0 m	332-83706-0
4.5 m	332-83707-0
5.0 m	332-83708-0
5.5 m	332-83708-0
6.0 m	332-83709-0

(3) The method of operating the remote control box

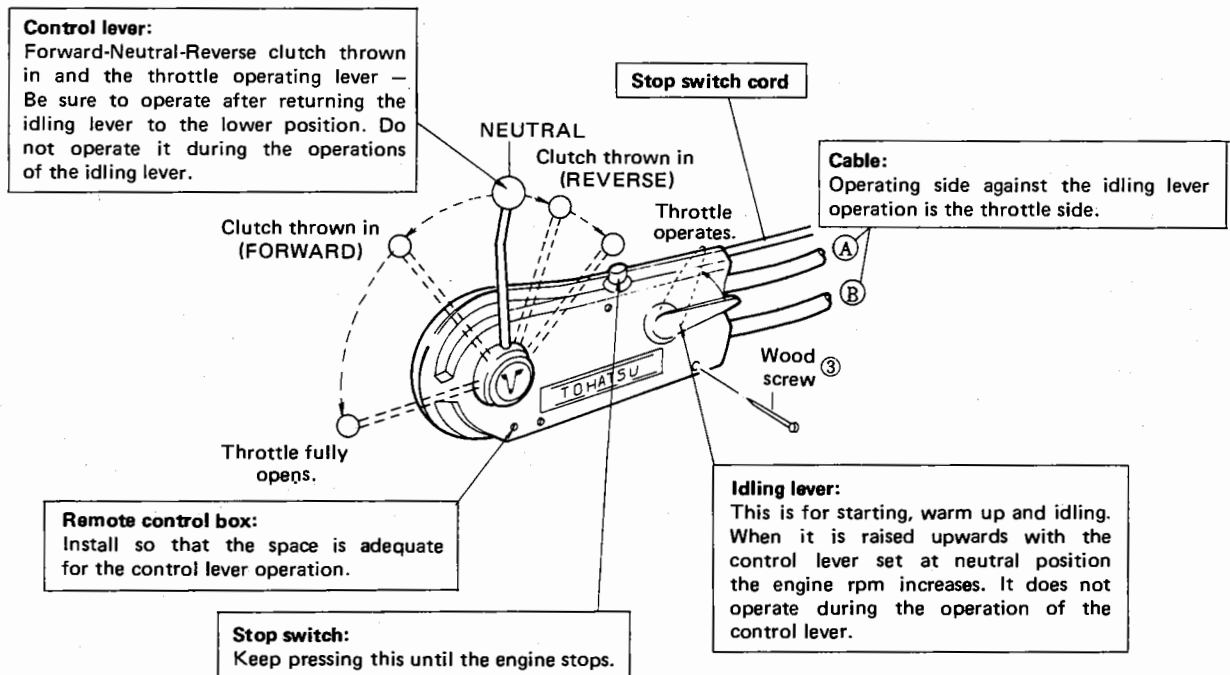
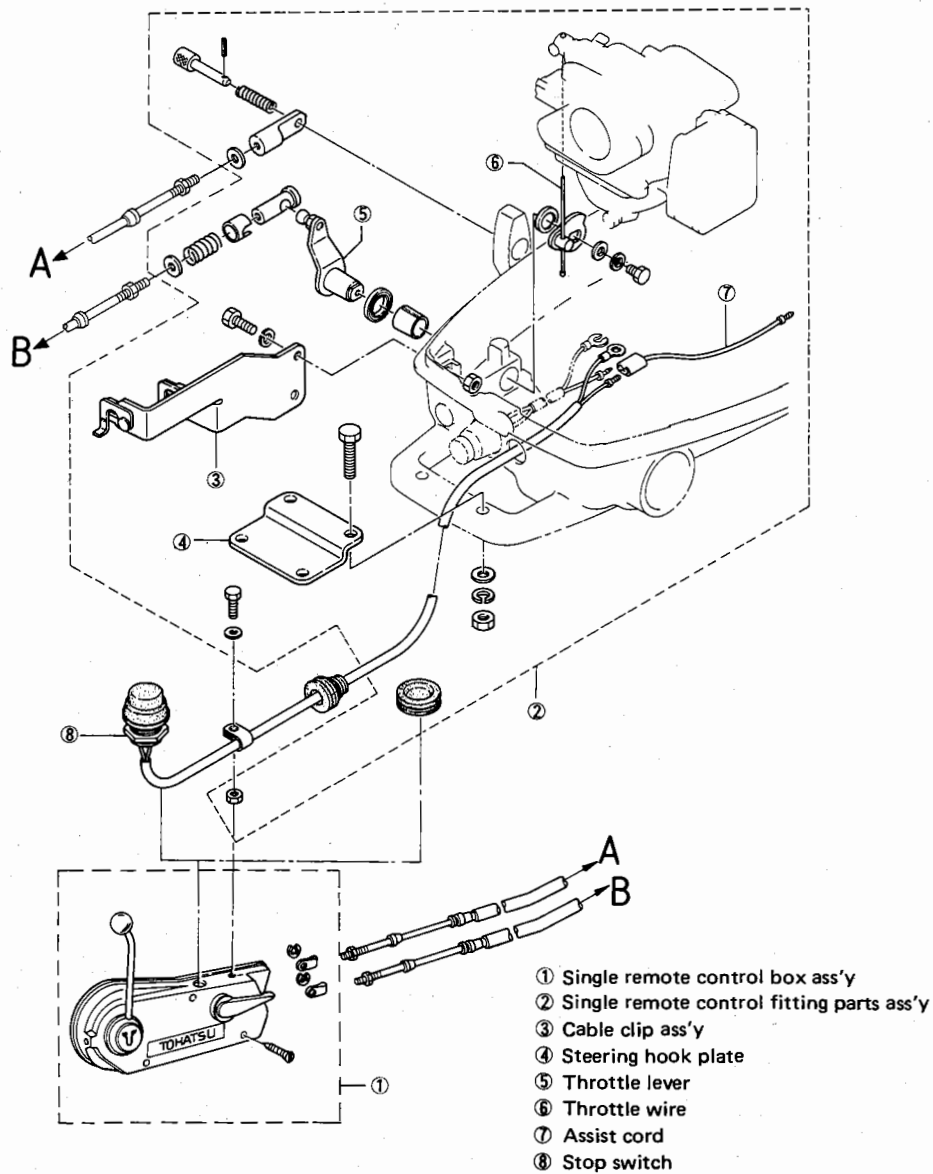


Fig. 1-3



2. Lighting coils

- (1) Fit the lighting coil on the crankcase as shown in the diagram. When fitting make sure that the burring portion is fitted on the hole of the crankcase referring to the sectional drawing.
- (2) Fix by means of the cord clamp so that the lead wires do not obstruct.

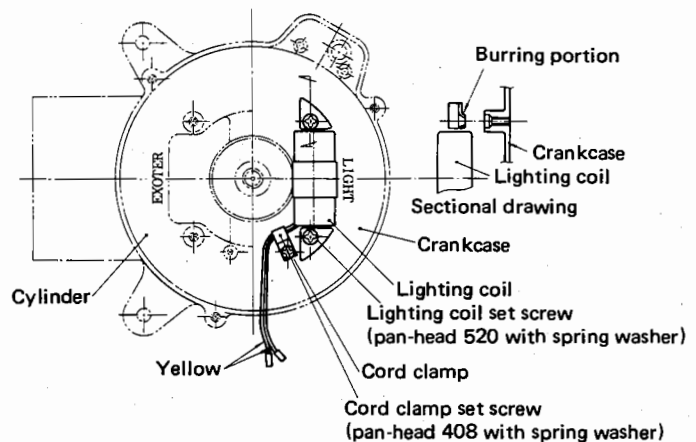


Fig. 2-1 Fitting lighting coil

3. Light extension cord

- When passing a current across the electric bulb for lighting without installing batteries connect wires to the electric bulb directly from the lighting output terminal (yellow lead wires).

Note: The bulb capacity: 12V 40W

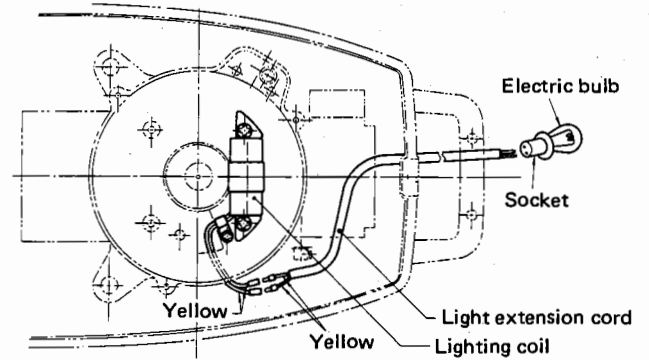
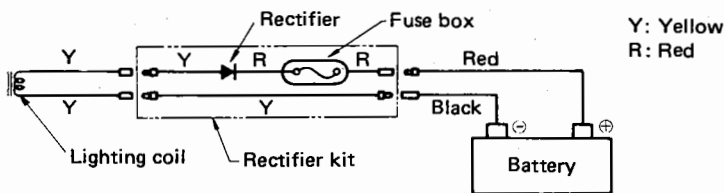


Fig. 3-1 Fitting light extension cord

4. Rectifier kit

When using batteries for power supplies for the lights for ships and other facilities install a rectifier kit on them which allow the charging of the batteries to be carried out during running of the outboard motor.

(1) Wiring diagram of the rectifier kit



(2) The method of installing the rectifier kit

Install the rectifier kit and lead wire clamp on the boss portion of the crankcase in the direction as shown in the diagram. Then arrange so that the fuse box is as if it is embraced with the clamp installed earlier. Then connect terminals.

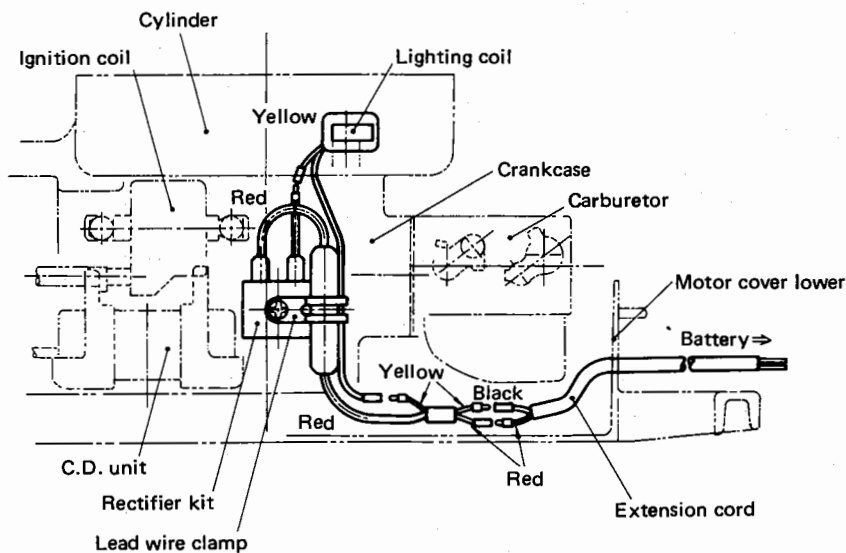


Fig. 4-1 Fitting rectifier kit

(3) Method of inspecting the rectifier kit

1 Inspecting the fuse

The fuse is rated as 10A. The fuse is provided for preventing damage to the machinery and equipment due to wrong wire connections of the battery terminals or short-circuit faults occurring in the circuit. Open the fuse box and confirm visually that the fuse inside it is not gone. If it is difficult to confirm visually check the continuity by means of the tester put on the both ends. Check the fuse holder for rust or deformation and correct or replace if required.

	The method of testing (1) (tester terminal)	The method of testing (2)
Male knob terminal (yellow) on the magneto side	-	+
Female knob terminal (red) on the output side	+	-

When carrying out the method of testing(1) the rectifier is normal if the pointer deflects to a small extent thus indicating that the resistance is high and when carrying out the method of testing(2) it is also normal if the pointer deflects to a great extent thus signifying that the resistance is low.

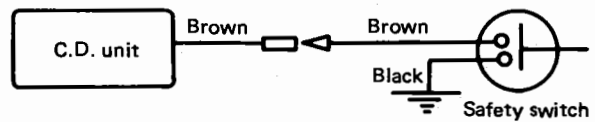
2 Inspecting the rectifier

First check the fuse and if normal, then measure the resistance by means of the circuit tester for radio with its terminals connected between the male knob terminal (yellow cord) on the magneto side and the female knob terminal (red cord) on the output side respectively of the lead wires on the both sides of the rectifier after switching over to the resistance measuring range referring to the table below.

Although the deflections in the case of the method of testing(2) vary according to the types of the testers or working ranges the unit is normal if the difference between the deflection of the pointer in the method of testing(1) and that in the method(2) is large.

5. Safety switch

Remove the stop switch provided for this machine and install the safety switch on the portion from which the stop switch was removed. Cords should be connected to the same locations as in the stop switch.



6. Vertical starting accessories

- Tighten to the starter case at 4 portions with pan-head machine screws. In this case it is necessary that the installing screw portions of the starter case are processed. (Over 7mm M6P 1.0 screw depth)

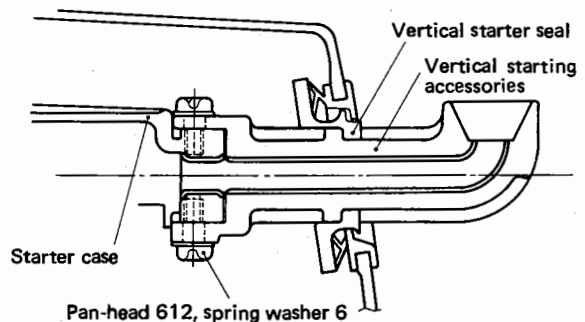


Fig. 6-1

7. Flashing plug

Remove the washing plug provided for this machine and install the flushing plug instead and insert the rubber hose from the water supply into it so as to wash it with water.

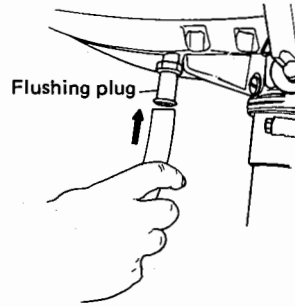
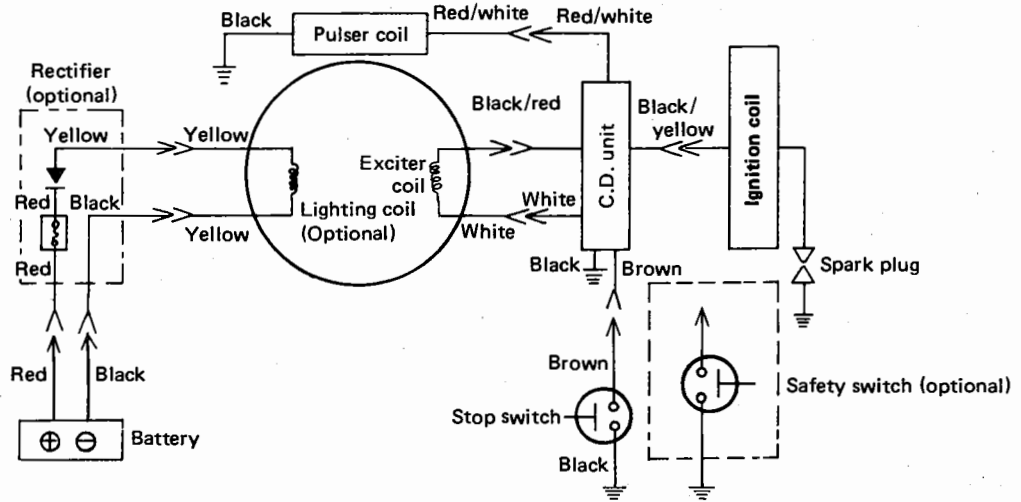


Fig. 7-1

●Wiring diagrams





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