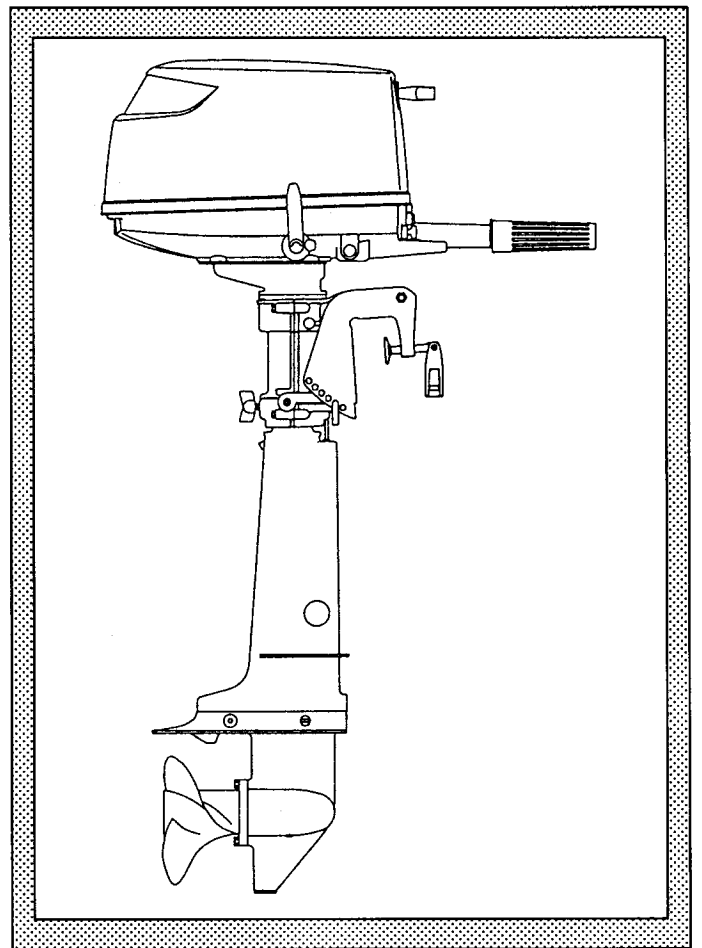


TOHATSU
OUTBOARD



**SERVICE
MANUAL**

4-Stroke

**4
5
6**



TOHATSU CORPORATION

MFS 4A2/5A2/6A2

SERVICE MANUAL

TOHATSU CORPORATION

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CHAPTER 1 SPECIFICATIONS

1. Specifications

Item	4A2	5A2S	6A2S
------	-----	------	------

Dimensions

Overall length	mm (in) approx.	680 (26.8) Handle is horizontally positioned.		
Overall width	mm (in) approx.	325 (12.8) Handle is horizontally positioned.		
Overall height	mm (in) approx.	S	1,073 (42.2)	1,020 (40.2)
		L	1,200 (47.2)	1,147 (45.2)
Transom height	mm (in) approx.	S : 435 (17.1) L : 562 (22.1)		
Weight	Kg (lb) approx.	S	26 (57)	25 (55)
		L	27 (59)	26 (57)

Performance

Maximum output	Kw (Hp)	2.9 (4)	3.7 (5)	4.4 (6)
Maximum operating range	rpm	4,500 – 5,500		5,000 – 6,000
Idling (Clutch off)	rpm	1,300		
Trolling (Clutch in)	rpm	1,100		
Fuel consumption at W.O.T.	L/hr	1.5/5,000 rpm	1.7/5,000 rpm	2.0/5,500 rpm

Engine

Engine type	4-Stroke		
Number of cylinder	1		
Bore and stroke	mm (in)	59.0 × 45.0 (2.32 × 1.77)	
Displacement	mL (Cu in)	123 (7.5)	
Valve system	OHV, Cross flow		
Cooling system	Water cooling		
Engine lubrication system	Trochoid pump		
Starting system	Manual starter		
Ignition system	Flywheel magneto C.D. ignition		
Spark plug	NGK DCPR6E		
Ignition timing	BTDC 25°		
Carburetor	Horizontal butterfly valve type		
Fuel pump	Mechanical plunger type		
Direction of engine rotation	Clockwise		
Engine oil	API SF or SG or SH, SAE 10W-30/40		
Volume of engine oil	mL (fl. oz.) approx.	450 (15.2)	
Fuel tank capacity	L (US gal)	* 1.3 (0.34)	12 (3.17)
		Integral	Separate
Speed control	Twist grip type (Option: Remote control)		

* In case of dual fuel tank system, use it together with 12L separate tank.

CHAPTER 1 SPECIFICATIONS

Item	4A2	5A2S	6A2S
------	-----	------	------

Lower unit

Maximum tilt-up angle	75°		
Trim angle	4° – 24°		
Trim position	6		
Tilt angle for the shallows	32.5°		
Steering angle	150°		
Allowable thickness of transom board	30 – 55 mm (1.18 – 2.16 in)		
Exhaust system	Through hub exhaust		
Clutch	Dog clutch system		
Gear reduction ratio	1.25 (13 : 28)		
Gear oil	Genuine gear Oil API GL5, SAE #80 – 90.		
Capacity of gear oil	mL (fl. oz.) approx.	195 (6.6)	
Propeller mark (Standard)	7	8	

Warning systems

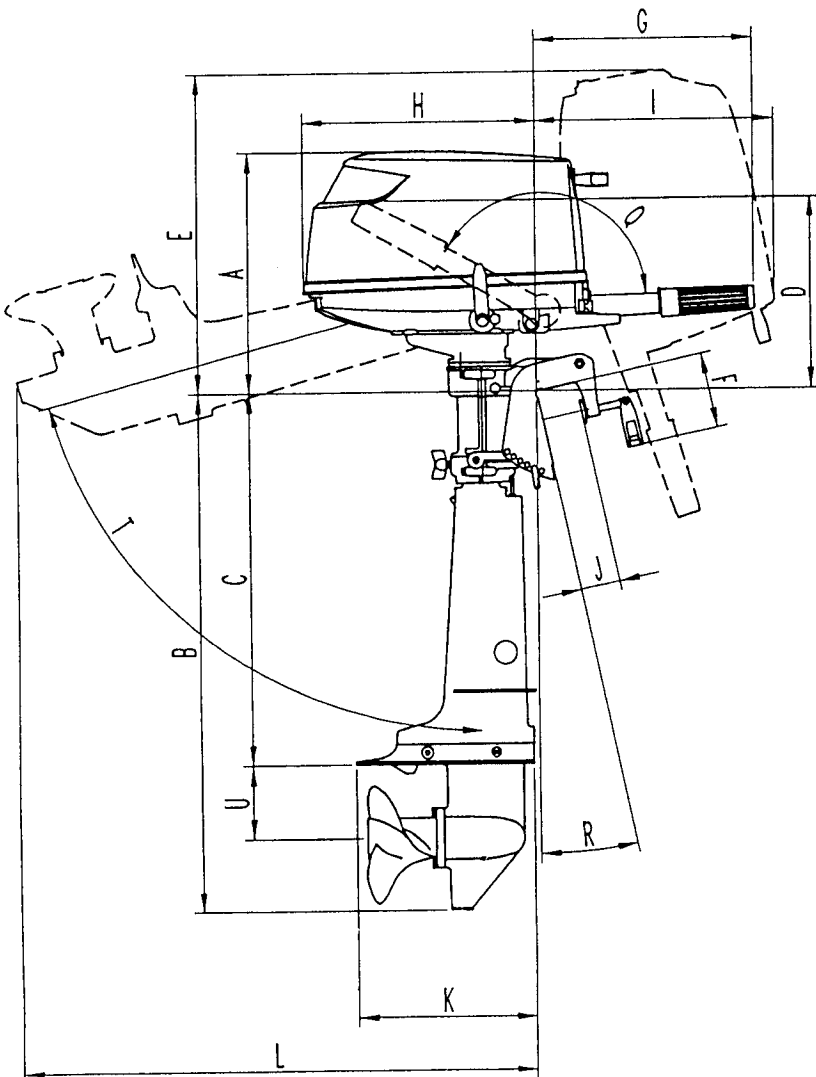
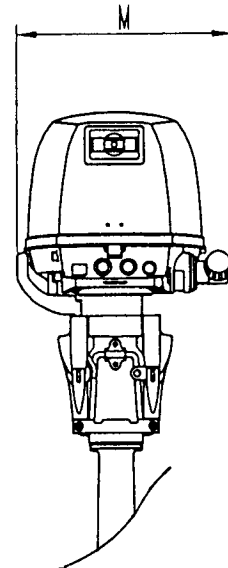
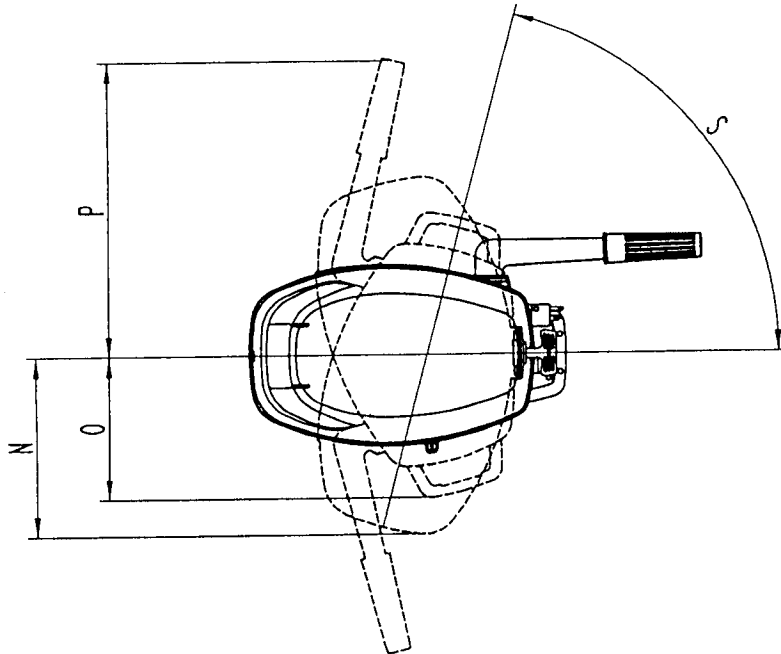
Engine revolution limiter	rpm	6,300 ± 200	
Engine oil pressure warning indicator	Engine oil pressure warning lamp (Red lamp)		

Optional parts

Propeller No. of blades × diameter × pitch mm (in)	7	3 × 200 × 178 (3 × 7.9 × 7.0)	
	8	3 × 200 × 186 (3 × 7.9 × 7.3)	
	9	3 × 200 × 229 (3 × 7.9 × 9.0)	
Alternator	12V 60W		
Rectifier	For charging		
Vertical starter			
Remote control	Cable length: 6 – 20 ft		

CHAPTER 1 SPECIFICATIONS

2. Outline Dimensions



A	4A2		
	418	16.5	
B	5A2S • 6A2S		
	365	14.4	
B	S	655	25.8
	L	782	30.8
C	S	435	17.1
	L	562	22.1
D	400	15.7	
E	510	20.1	
F	110	4.3	
G	330	13.0	
H	350	13.8	
I	335	13.2	
J	55	2.1	
K	275	10.8	
L	S	658	25.9
	L	758	29.8
M	325	12.8	
N	265	10.4	
O	210	8.3	
P	445	17.5	
Q	120°		
R	12°		
S	75°		
T	75°		
U	110	4.3	

(mm) (in)

CHAPTER 2 SERVICE DATA AND TOOLS

1. Service Data and Maintenance Standards

	Description	Check Item	Standard value	
Engine-related Items	Cylinder head	Carbon deposit on the combustion chamber		
		Distortion of the mounting surface		
		Corrosion in the mated surface		
		Clogging cooling water passage		
	Cylinder	Deposit in the water jacket		
		Wear-out of the inside diameter: Measure the bore with a cylinder gauge.	59.00 mm (2.323 in)	
		Seizure		
		Scratch and wearing down in the cylinder liner		
		Mating surfaces of the cylinder and cylinder headPiston		
	Piston	Outside diameter ● Measure the diameter at a point 7 mm above the lower end of the piston skirt. ● Piston clearanc	Diameter: 58.960 mm (2.3213 in) Piston clearance: 0.020 – 0.055 mm (0.0008 – 0.0022 in)	
		Carbon deposit on the piston crown and in the piston ring groove.		
		Scratch on the sliding surface.		
		Measurement of clearance between the piston ring and ring groove	Top: 0.04 – 0.08 mm (0.0016 – 0.031 in) Second: 0.03 – 0.07 mm (0.0012 – 0.0028 in) Oil: 0.01 – 0.18 mm (0.0004 – 0.0071 in)	
		Measurement of diameter of the piston pin hole	Clearance between pin and hole Loose: 0.002 – 0.012 mm (0.00008 – 0.00047 in)	
	Piston ring	● End gap	Note: Measurement of the end gap: When no ring gauge is available, measure the lower part of the cylinder bore that is not so worn down.	
		Top		Top: 0.15 – 0.35 mm (0.0059 – 0.0138 in)
		Second		Second: 0.30 – 0.50 mm (0.0118 – 0.0197 in)
		Oil		Oil: 0.20 – 0.40 mm (0.0079 – 0.0157 in)
	Piston pin	Outer diameter	16.00 mm (0.63 in)	
	Crank shaft	Deflection of the crank shaft: Both the main bearings of the crank shaft should be supported on V-blocks.		Less than 0.05 mm (0.002 in) (Both ends)
		Outer diameter of the crank pin.		29.94 mm (1.1787 in)
		Outer diameter of the oil pan bearing.		24.98 mm (0.9835 in)
	Connecting rod	Inner diameter of the small end		16.010 mm (0.6303 in)
Oil clearance of the big end			0.053 – 0.079 mm (0.0021 – 0.0031 in)	
Side clearance of the big end			0.20 – 0.40 mm (0.008 – 0.016 in)	
Oil pan	Clearance between the cam shaft and bearing		0.02 – 0.05 mm (0.0008 – 0.002 in)	
	Clearance between the crank shaft and bearing		0.015 – 0.040 mm (0.0006 – 0.0016 in)	

CHAPTER 2 SERVICE DATA AND TOOLS

	Repair Limit	Measure
Engine-related items		Remove carbon deposit and clean.
	Scratch depth or distortion is 0.03 mm or more (0.0012 in).	Repair. (Set #240 – #400 sandpaper on the surface plate and polish the surface for repair. Use #600 sandpaper for finishing.)
		Repair or replace depending on the situation.
		Clean and remove foreign matters.
		Remove foreign matters and clean.
	59.07 mm or more (2.3256 in)	If wear is exceeding the repair limit, replace or bore the cylinder and finish by honing. Over-sized piston is 0.5 mm. (Refer to the item 4.)
		Replace or use an over-sized piston after boring the cylinder.
	When the liner cannot be repaired by means of #400 – #600 sandpaper because it is extremely scratched or scarfed, or the difference between the maximum wear and minimum wear is 0.06 mm or more. (0.0024 in)	Bore and hone to $\varnothing 59.5 \pm 0.01$ mm. ($\varnothing 2.343 \pm 0.0004$ in)
		To be use over size piston and ringe.
	When the depth of scratch or distortion in/of the mating surface is 0.03 mm or more. (0.0012 in)	Set #240–#400 sandpaper on the surface plate and polish the surface. Use #600 sandpaper for finishing.
	Outer diameter: 58.90 mm or more (2.3189 in) Piston clearance: 0.15 mm or more (0.0059 in)	Replace if out of the repair limit.
		Remove carbon residuum and clean.
		Repair with #400 – #600 sandpaper depending on the situation.
	Top: 0.10 mm or more (0.0039 in) Second: 0.09 mm or more (0.0035 in) Oil: 0.21 mm or more (0.0083 in)	Replace if out of the repair limit. *
	0.04 mm or more (0.0016 in)	Replace if out of the repair limit.
	Top: 0.5 mm or more (0.020 in) Second: 0.7 mm or more (0.026 in) Oil	Replace with new piston ring if wear of the cylinder liner is within the repair limit. *
	15.97 mm or less (0.629 in)	Replace if out of the repair limit.
	0.05 mm or more (0.002 in)	Replace if out of the repair limit.
	29.91 mm or less (1.1776 in)	Replace if out of the repair limit.
	24.96 mm or less (0.9827 in)	Replace if out of the repair limit.
	16.040 mm or more (0.6315 in)	Replace if out of the repair limit.
	0.090 mm or more (0.0035 in)	Replace if out of the repair limit.
0.70 mm or more (0.0276 in)	Replace if out of the repair limit.	
0.07 mm or more (0.0028 in)	Replace if out of the repair limit.	
0.06 mm or more (0.0024 in)	Replace if out of the repair limit.	

*: To be replaced with a new oil ring when replacing with new top and/or second rings.

CHAPTER 2 SERVICE DATA AND TOOLS

	Description	Check Item	Standard value		
			4A2	5A2S	6A2S
Engine-related	Intake valve Exhaust valve	Valve clearance	IN 0.06 – 0.14 mm (0.0024 – 0.0055 in)		
			EX 0.11 – 0.19 mm (0.0043 – 0.0075 in)		
		Outer diameter of valve stem	IN 5.48 mm (0.2157 in)		
			EX 5.44 mm (0.2142 in)		
		Inner diameter of valve guide	IN 5.48 mm (0.2157 in)		
			EX 5.44 mm (0.2142 in)		
	Clearance to valve stem	IN 0.020–0.044 mm (0.0008–0.0017 in)			
		EX 0.045–0.072 mm (0.0018–0.0028 in)			
	Contact width of valve seat	IN 0.8 mm (0.0315 in)			
		EX 0.8 mm (0.315 in)			
	Valve spring	Free length	35.0 mm (1.378 in)		
	Cam shaft	Height of cam (both IN & EX) *1	25.24 mm (0.994 in)	26.59 mm (1.047 in)	28.33 mm (1.115 in)
Outer diameter of bearing		13.98 mm (0.5504 in)			
Engine block	Compression pressure at 500 rpm				
	With de-compressor	M Pa	0.29 ± 0.1	0.29 ± 0.1	0.34 ± 0.1
		Kg/cm ²	3.0 ± 1	3.0 ± 1	3.5 ± 1
		ft – lb	22 ± 7	22 ± 7	25 ± 7
	Without de-compressor (Rocker arm in EX side is removed)	M Pa	0.78 ± 0.1	0.78 ± 0.1	0.93 ± 0.1
		Kg/cm ²	8.0 ± 1	8.0 ± 1	9.5 ± 1
ft – lb		58 ± 7	58 ± 7	69 ± 7	
Fuel-related	Carburetor	● Setting mark	3H9C	3R1C	3R4A
		● Venturi/Throttle diameter	10/19 mm	13/19 mm	15/21 mm
		● Main jet (MJ)	#60	#65	#75
		● Main air jet (MAJ)	#120	#115	#140
		● Inner diameter of main nozzle *2	1.6 mm	1.8 mm	1.8 mm
		● Pilot jet (PJ)	#35	#38	#45
		● Pilot air jet (PAJ)	#120	#110	#140
		● Opening angle of throttle (at W.O.T.)	75°	75°	74°
		● Pilot screw (PS)	–	–	–
		● Oil level (from flange surface to float bottom)	10 mm	10 mm	10 mm
	● Idle speed	1,300 rpm	1,300 rpm	1,300 rpm	
Oil pump	Inner diameter of pump body	23.09 mm (0.91 in)			
	Clearance between outer rotor and body	0.12–0.20 mm (0.0047–0.0079 in)			
	Height of outer rotor	5.99 mm (0.236 in)			
	Clearance between rotor and body side	0.02–0.07 mm (0.0008–0.0028 in)			

* 1: Differ between serial numbers.

* 2: Bleed hole is different between models. Refer to page 37.

CHAPTER 2 SERVICE DATA AND TOOLS

	Repair Limit			Measure
	4A2	5A2S	6A2S	
Engine-related				Repair out of the limit.
	5.45 mm (0.215 in) or less			
	5.41 mm (0.213 in) or less			
	5.54 mm (0.218 in) or less			
	5.57 mm (0.219 in) or less			
	0.07 mm (0.0028 in) or less			
	0.10 mm (0.0039 in) or less			
	1.8 mm (0.07 in) or less			
	1.8 mm (0.07 in) or less			
	33.2 mm (1.31 in) or less			Repair out of the limit.
24.98 mm (0.983 in) less			Repair out of the limit.	
26.33 mm (1.037 in) less		28.07 mm (1.105 in) less		
13.95 mm (0.549 in) or less			Pay heed to pressure leak in compression from the rotation, sliding and sealing parts.	
Fuel-related				Repair out of the limit.
	23.13 mm (0.91 in) or more			
	0.25 mm (0.01 in) or more			
	59.5 mm (2.34 in) or more			
	0.10 mm (0.004 in) or more			

CHAPTER 2 SERVICE DATA AND TOOLS

	Description	Check Item	Standard value		
			4A2	5A2S	6A2S
Electrical items	Magneto	Ignition timing	BTDC 25°		
		Spark performance	10 mm (0.39 in) or more/500 rpm (Measured by genuine spark tester)		
		Spark plug	NGK DCPR-6E		
		Plug gap	0.8 – 0.9 mm (0.031 – 0.035 in)		
		Alternator output (OP)	12V 60W		
		Resistance of alternator coil Between yellow-yellow wire	0.39 Ω ± 20%		
		Resistance of Pulser coil Between red-white wire and black wire	166 Ω ± 20%		
	Resistance of exciter coil Between black-red wire and white wire	119 Ω ± 20%			
	Ignition coil	Resistance of primary coil Between black-yellow wire and core	0.2 – 0.38 Ω		
		Resistance of secondary coil Between high tension cord and core	3,000 – 4,400 Ω		
C.D. unit	Refer to Chapter 8.				
Rectifier (OP)	Refer to Chapter 10.				
Cooling items	Thermostat	Operation of thermostat	<ul style="list-style-type: none"> ● Start to open: 52 °C ± 2 °C (125 °F ± 4 °F) ● Temperature at which valve opens full: 65 °C ± 2 °C (150 °F ± 4 °F) ● Valve lift stroke when it fully opens: 3 mm (0.12 in) or more 		
		Pump impeller	Wear-out, crack		
		Pump case liner	Wear-out		
	Guide plate	Wear-out			
Lower Unit items	Anode	Gear case anode			
	Propeller shaft	● Damaged at bearing portion			
		● Damaged at oil seal portion			
	Bevel gear	● Backlash between bevel gears A and B (0.16 – 0.49 mm, 0.0063 – 0.0193 in)* 0.05 – 0.15 mm (0.0020 – 0.0059 in)			
		● Clearance between bushing of bevel gear A and propeller shaft 0.030 – 0.058 mm (0.0012 – 0.0023 in)			
		● Clearance between bushing of bevel gear C and propeller shaft 0.040 – 0.070 mm (0.0016 – 0.0028 in)			
	Drive shaft bushing	● Clearance between drive shaft and bushing 0.016 – 0.073 mm (0.0006 – 0.0029 in)			
	Propeller (7)	Outer diameter × pitch 200 × 178 mm (7.9 × 7 in)			
Propeller (8)	Outer diameter × pitch 200 × 186 mm (7.9 × 7.3 in)				
Propeller (9)	Outer diameter × pitch 200 × 229 mm (7.9 × 9 in)				
Other items	Oil seals	Wear-out, damage			

* Values in parentheses are dial readings of a backlash gauge.

CHAPTER 2 SERVICE DATA AND TOOLS

	Repair Limit			Measure
	4A2	5A2S	6A2S	
Electrical Items				
				Adjust the side electrode. However, if the electrode is excessively worn out, replace the spark plug.
		Spark gap : 1.2 mm (0.047 in) or more		
Cooling Items	<p>If the valve opens at the room temperature, replace the thermostat.</p> <p>While immersing the thermostat in water, raise the water temperature and check the temperature at which the valve opens.</p> <p>Since there is a time lag in operation of the thermostat, keep the water temperature at 65 °C for about 5 minutes and measure the valve lift stroke.</p>			
		When the blade periphery or upper/lower lip is worn, cracked or damaged.		Replace in a set.
Lower Unit Items				Replace when it is excessively worn out.
				Replace
		(0.98 mm, 0.039 in or more)*		
		0.3 mm (0.012 in) or more		
		0.1 mm (0.004 in) or more		
		0.1mm (0.004 in) or more		
		0.5 mm (0.02 in) or more		
	Replace depending on wear, bent or damage in the circumference.			
Other Items	When the lips have been deteriorated, degraded, damaged, or the interference has worn down to 0.5 mm (0.02 in) or less.			Replace

CHAPTER 2 SERVICE DATA AND TOOLS

2. Table of Points to Apply Sealants, Adhesives and Lubricants

Parts Name	Symbols	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	Remarks
Items		Instantaneous Adhesive "Three Bond 1741"	"Three Bond 1107"	"Bond G - 103"	"Three Bond 1342"	"Moliton Grease"	Rubber grease	Cold - & Heat - resistant lithium grease	Genuine grease		Engine oil	Gear oil	
Piston											●		Ring groove, Skirt
Piston ring											●		
Piston pin											●		
Connecting small end											●		Bearing portion
Connecting big end											●		Bearing portion
Main bearing											●		Bearing portion
Cylinder liner											●		Inner wall
Crank shaft oil seal								●					Lip
Crank case head oil seal								●					Lip
Choke rod grommet									●				Inner surface
Starter shaft					●								Screw
Starter spring								●					
Friction plate								●					
Ratchet								●					
Starter lock									●				Sliding portion
Starter lock cam									●				Sliding portion
Engine block											●		450 ml in oil pan
Gear case												●	195 ml in gear case
Gear case bolt, front									●				Screw
Gear case bolt, rear									●				Screw
Propeller shaft housing									●				Fit joint
Cam shaft											●		Bearing, cam
Oil pump											●		Outer & inner rotor
Oil pressure switch					●								Screw
Oil strainer					●								Screw

CHAPTER 2 SERVICE DATA AND TOOLS

Symbols	A	B	C	D	E	F	G	H	I	J	K	
Items Parts Name	Instantaneous Adhesive "Three Bond 1741"	"Three Bond 1107"	"Bond G - 103"	"Three Bond 1342"	"Moliton Grease"	Rubber grease	Cold - & Heat - resistant lithium grease	Genuine grease		Engine oil	Gear oil	Remarks
Oil strainer pipe			●									To be glued to grommet
Propeller shaft housing O-ring								●				
Propeller shaft oil seal								●				Lip
Drive shaft housing bolt								●				Screw
Stern bracket plate								●				Washer, 8.5 - 28 - 1.0
Clamp screw								●				Screw
Propeller shaft housing bolt								●				
Thrust plate						●						Upper and lower plates
Steering bushing, upper						●						Inside, outside
Steering bushing, lower						●						Inside, outside
Tilt stopper bushing								●				
Steering handle						●						Grip sliding portion
Steering handle bushing						●						
Throttle bowden								●				Inner
Steering handle damper								●				Head
Starter seal rubber	●											
Hook lever bushing								●				
Hook lever seal ring								●				
Propeller shaft								●				Spline
Drive shaft					●							Spline in crank shaft side
Drive shaft bushing					●							L & UL only
Cam shaft bushing											●	For shift
Cam shaft O-ring A								●				For shift
Cam shaft O-ring B								●				For shift
Shift lever shaft								●				Sliding portion

CHAPTER 2 SERVICE DATA AND TOOLS

3. Table of Tightening Torque

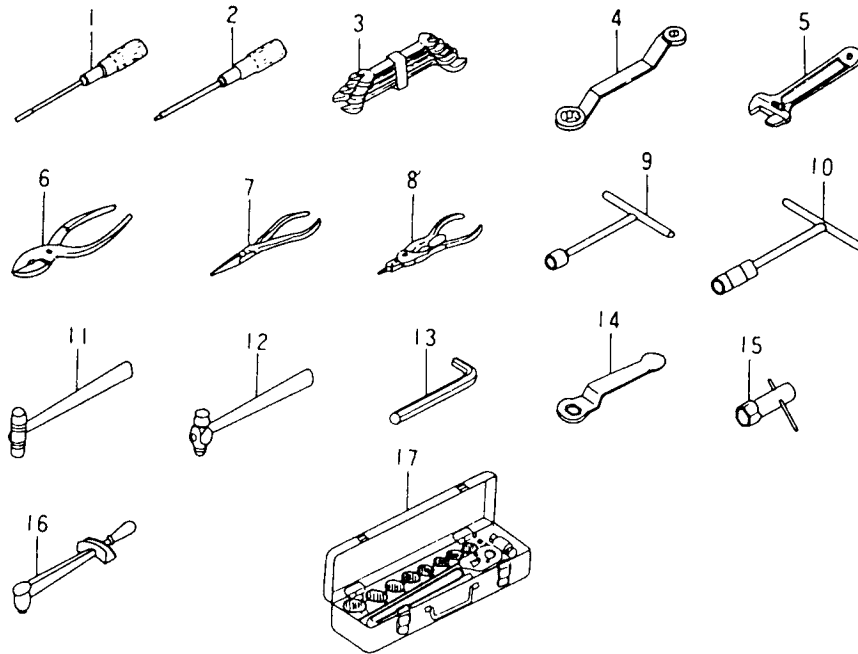
Item	Thread size	Bolt & Nut	Tightening Torque		
			N – m	Kg – m	ft – lb
Connecting rod	M7 × 1.0	Bolt	11 – 13	1.1 – 1.3	8 – 9.4
Engine oil drain plug	M10 × 1.25	Bolt	15 – 20	1.5 – 2.0	11 – 14.5
Oil pan	M8 × 1.25	Bolt	24 – 26	2.4 – 2.6	17 – 19
	M6 × 1.0	Bolt	8 – 10	0.8 – 1.0	5.8 – 7.2
Cylinder head	M8 × 1.25	Bolt	24 – 26	2.4 – 2.6	17 – 19
Pivot bolt	M8 × 1.25	Bolt	24 – 26	2.4 – 2.6	17 – 19
Pivot adjusting nut	M6 × 1.5	Nut	9 – 11	0.9 – 1.1	6.5 – 8
Pressure switch	PT1/8	Bolt	7 – 10	0.7 – 1.0	5 – 7.2
Flywheel	M12 × 1.25	Nut	45 – 55	4.5 – 5.5	33 – 40
Spark plug	M12 × 1.25	–	15 – 20	1.5 – 2.0	11 – 14
Starter shaft	M5 × 0.8	Bolt	3.5 – 4	0.35 – 0.4	2.5 – 2.9
Stern bracket bolt	M8 × 1.25	Nylon nut	11 – 15	1.1 – 1.5	8 – 11
Engine mounting	M6 × 1.0	Bolt	6 – 8	0.6 – 0.8	4.3 – 5.8

General Standards	M4 × 0.7	Bolt, Nut	1 – 2	0.1 – 0.2	0.7 – 1.4
	M5 × 0.8	Bolt, Nut	3 – 4	0.3 – 0.4	2.2 – 2.9
	M6 × 1.0	Bolt, Nut	5 – 6	0.5 – 0.6	3.6 – 4.3
	M8 × 1.25	Bolt, Nut	11 – 15	1.1 – 1.5	8 – 11
	M10 × 1.25	Bolt, Nut	23 – 31	2.3 – 3.1	17 – 22

CHAPTER 2 SERVICE DATA AND TOOLS

4. Tools and Instruments Required for Disassembly and Repair

(1) General tools



1. Straight-point screwdriver (200 mm)
 - do – (150 mm)
 - do – (100 mm)

2. Phillips screwdriver (200 mm)
 - do – (150 mm)
 - do – (100 mm)

3. Set of wrenches (6 pieces)

4. Box wrenches (10 × 13)
 - do – (17 × 21)
 - do – (21 × 23)

5. Adjustable wrench (300 mm)

6. Pliers

7. Needle-nose pliers

8. Snap ring pliers

9. T-bar socket wrench (10 mm)
 - do – (13 mm)
 - do – (17 mm)

10. T-bar universal wrench (10 mm)
 - do – (13 mm)

11. Plastic hammer

12. Hammer

13. L-shape hexagon wrench (8 mm)
 - do – (10 mm)

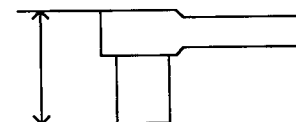
14. Box wrench (16 mm)

15. Socket wrench (16 mm)

16. Torque wrench (100 N – m)

17. Socket wrench set (6 N – m) (20 N – m*)

* If this tool is used for tightening the big end of the connecting rod, the height of the tool head is limited to 32 mm.



32 mm or less

CHAPTER 2 SERVICE DATA AND TOOLS

(2) Compression gauge

(3) Test propeller

(4) Measuring instruments

The following instruments are for general use and available on the market.

Tachometer: 600 – 6,000 rpm

Universal tester: 1 Ω • 10 Ω • 10 k Ω 30 – 300 AC V, 30 DC V, Battery 3 V or less

Vernier calipers: JIS B7507, M1 type, 300 mm

Micrometer: JIS B7502, 0.01 mm scale unit, outside micrometer 0 – 25 mm, 25 – 50 mm, 50 – 75 mm

Cylinder gauge: JIS B7515, 4 – 6 mm, 10 – 25 mm, 25 – 50 mm, 50 – 75 mm

Ring gauge: JIS B7420, 5.5, 16, 25, 30, 59 mm \varnothing

Dial gauge: JIS B7503, 0.01 mm scale unit

Feeler gauge: JIS B7524, 0.03 – 0.3 mm measurable (Part No. 353 – 72251 – 0)

V-block: JIS B7540

Surface plate: JIS B7513, 500 × 500 mm

Dial gauge magnet base or dial gauge stand:

CHAPTER 2 SERVICE DATA AND TOOLS

5. How to Use Special Tools

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

① When disassembling

Fasten the tools **A** and **B** to the flywheel cup of the magneto with the bolts **D**, and remove the magneto nut (right-hand screw) with the socket wrench of the nominal size 17.

(Fig. 5-1)

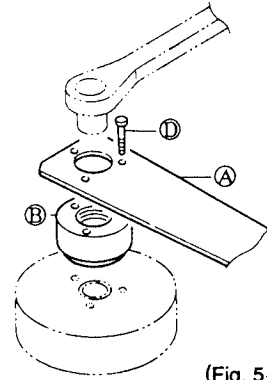
Next, screw the tool **C** into the tool **B** and then tighten the tool **C** with the socket wrench of the nominal size 24. The flywheel can be removed.

(Fig. 5-2) Be sure to use three bolts (D).

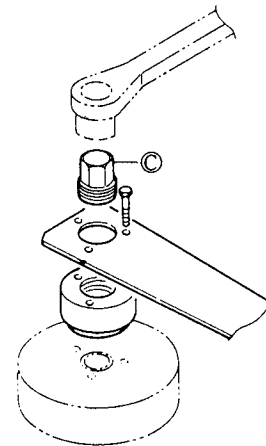
② When reassembling

Before replacing the flywheel cup to the original place, make sure that the magneto key has properly been set. After setting the washer and nut on the crank shaft, fasten the tools **A** and **B** to the flywheel and tighten the nut.

Tightening torque: 45 – 55 N – m (4.5 – 5.5 kg – m) (33 – 40 ft – lb)
--



(Fig. 5-1)

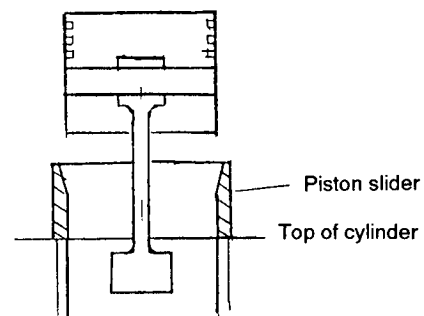


(Fig. 5-2)

2. Piston slider (3H6-72871-0)

This tool is to be used for inserting the piston into the cylinder. After inserting the piston into the tapered end of the piston slider, set the piston slider together with the piston tightly on the top of the cylinder and insert the piston into the cylinder by pushing the piston crown with fingers. (Fig. 5-4)

Note: Don't stop inserting the piston into the cylinder until all the piston rings enter the cylinder.



(Fig. 5-4)

CHAPTER 2 SERVICE DATA AND TOOLS

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

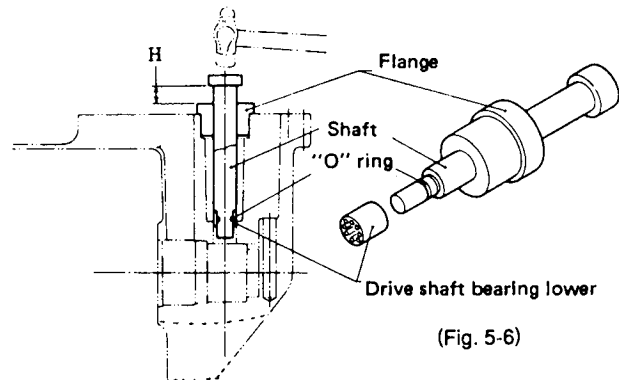
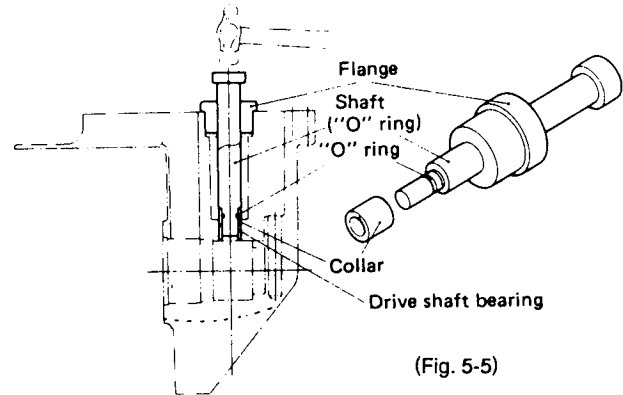
① When disassembling

Set the drive shaft bearing tool as shown in Fig. 5-5 and tap it with a hammer until the drive shaft bearing falls down.

② When reassembling

Set the drive shaft bearing (lower) on the shaft as shown in Fig. 5-6 and tap the tool with a hammer until the clearance H is eliminated.

Note: To avoid denting the gear case surface, don't tap the hammer excessively.



CHAPTER 2 SERVICE DATA AND TOOLS

5. Backlash measuring tool

① Measuring

● Set up the backlash measuring tool as shown in Fig. 5-7.

● Pull up the drive shaft by hand in the direction of ⊗.

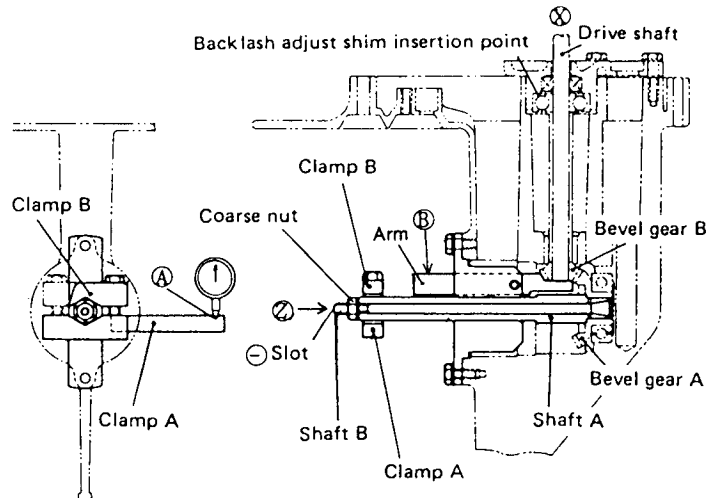
● Insert the edge of a screwdriver into the slot of the shaft B and tighten the hexagon nut. (The shaft A and the bevel gear A are locked by tightening the nut.)

Set the dial gauge at the part ①.

● While pushing the arm and shaft B in the direction of ② and in the direction of ③ respectively, move the clamp A and read the dial gauge.

● If the dial gauge reads a value between 0.16 mm and 0.49 mm, the backlash is normal. If not, adjust the backlash with an adjusting shim.

Thickness of adjusting shim: Two types of 0.1 mm and 0.15 mm



(Fig. 5-7)

Backlash on Dial gauge		Thickness of adjusting shim	
inch.	mm	inch.	mm
0 - 0.0063	0 - 0.15	- 0.0039	- 0.1
0.0063 - 0.0192	0.16 - 0.49	0	0
0.0193 - 0.0208	0.50 - 0.52	+ 0.0098	+ 0.25
0.0209 - 0.0236	0.53 - 0.59	+ 0.0118	+ 0.3
0.0237 - 0.0259	0.60 - 0.65	+ 0.0138	+ 0.35
0.0260 - 0.0283	0.66 - 0.71	+ 0.0157	+ 0.4
0.0284 - 0.0307	0.72 - 0.77	+ 0.0177	+ 0.45

- : Reduce shim

+ : Add shim

② When disassembling

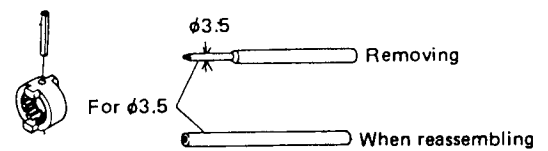
Loosen the hexagon nut and lightly tap the slot of the shaft B in the direction of ④. Then, the bevel gear B and shaft are released from lock.

6. Spring pin tool

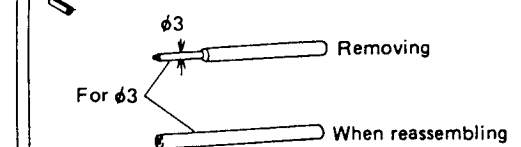
Spring pins are used as the clutch pin and clutch cam pin.

● For removing and resetting the clutch pin, use the tools shown in Fig. 5-8.

● For removing and resetting the clutch cam pin, use the tools shown in Fig. 5-9.



(Fig. 5-8)



(Fig. 5-9)

CHAPTER 3 INSPECTION AND MAINTENANCE

1. Periodical Inspections

Classification	Part name	Inspection frequency						Check and maintenance	Remarks
		20 hours or 1 month after the first operation	Every 50 hours or 3 months	Every 100 hours or 6 months	Every 200 hours or 12 months	Every 300 hours or 18 months	Every 400 hours or 24 months		
Fuel system	Carburetor			○	○	○	○	Overhaul and adjust.	
	Fuel filter	○	○	○	○	○	○	Check and clean filter.	
	Piping	○	○	○	○	○	○	Check any damage to pipe and fuel leak from pipe joint.	
	Fuel tank	○	○	○	○	○	○	Clean.	
Ignition system	Spark plug	○		○	○	○	○	Check plug gap and remove carbon deposits or Replace.	0.8 – 0.9 mm 0.031–0.35 in
Starter system	Starter rope	○	○	○	○	○	○	Check wear.	
Engine	Engine oil	○ Replace		○ Replace	○ Replace	○ Replace	○ Replace		450ml
	Valve clearance	○			○		○	Check and adjust.	
	Compression pressure				○		○	Check.	
	Combustion chamber					○		Clean.	Including valve lapping
Lower system	Propeller	○	○	○	○	○	○	Check any bent, damage, wear in blade.	
	Gear oil	○ Replace	○	○ Replace	○ Replace	○ Replace	○ Replace	Change or replenish oil. Check water seepage into oil pan.	Genuine gear oil (GL5, SAE80 – 90), 195 ml (6.6 fl. oz.)
	Anode		○	○	○	○	○	Check corrosion and wear.	
	Water pump impeller		○	○	○	○	○	Wear or crack	
Bolts, nuts		○	○		○			Retighten	
Sliding parts, rotating parts, grease nipples		○	○	○	○	○	○	Grease up.	

Note: The owner's manual recommends the user to get the outboard motor overhauled in whole every 300-hours running.

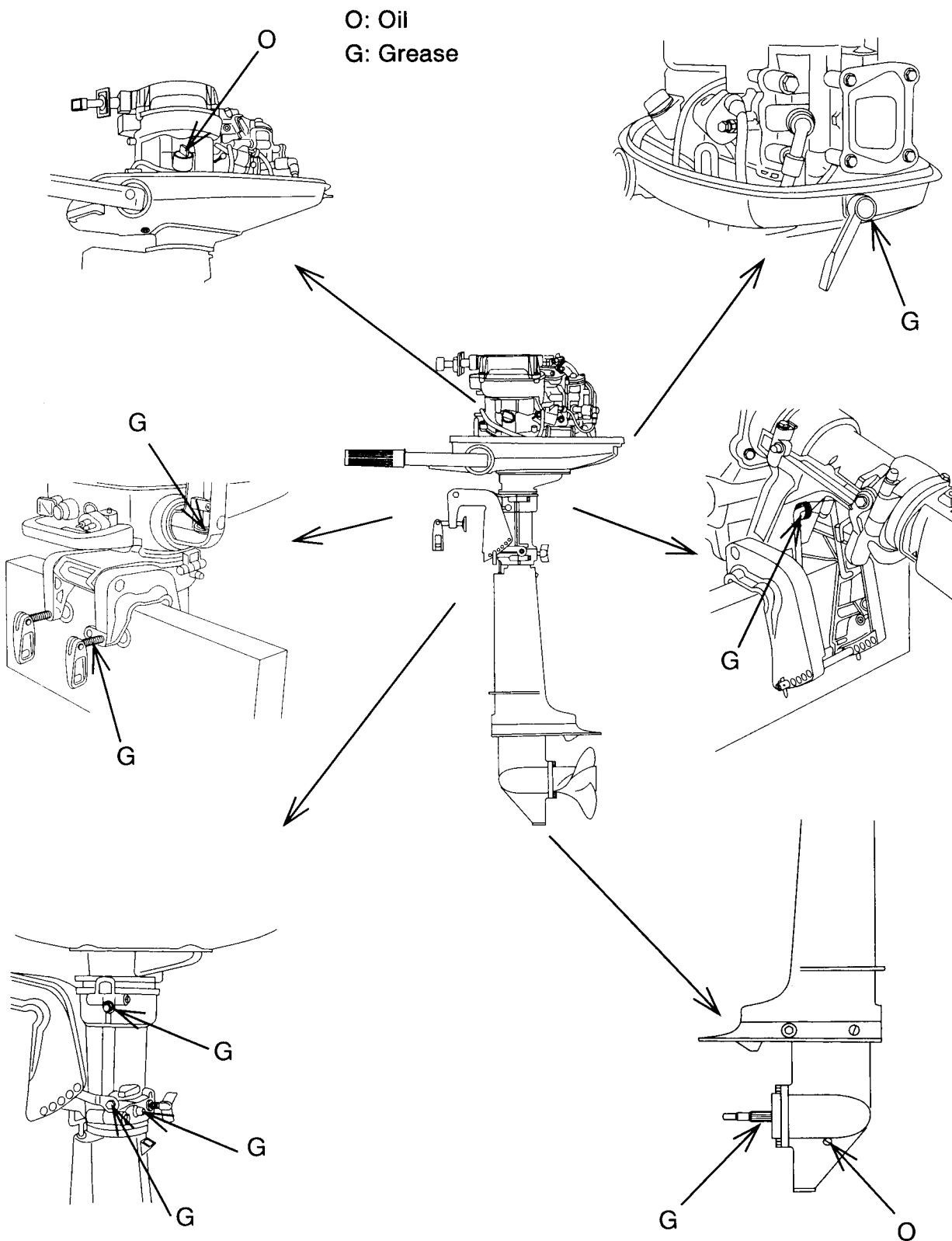
CHAPTER 3 INSPECTION AND MAINTENANCE

2. Troubleshooting

	Engine failing to start	Engine starting but stopping soon	Poor idling	Poor acceleration	Engine speed extremely high	Engine speed extremely low	Boat speed low	Overheating of engine	Possible cause
Fuel, lubrication system	●	●							Empty fuel tank
	●	●	●	●		●	●	●	Incorrect connection of fuel line
	●	●	●	●		●	●	●	Air entering fuel line
	●	●	●	●		●	●	●	Deformed or damaged fuel hose
	●	●	●	●		●	●	●	Closed air vent on fuel tank
	●	●	●	●		●	●	●	Clogged fuel filter, fuel pump, or carburetor
			●	●		●	●	●	Use of improper engine oil
	●		●	●			●	●	Use of improper gasoline
								●	Engine oil is insufficient. (Oil warning lamp goes on.)
	●			●					Excessive supply of fuel
	●	●	●	●		●	●	●	Poor carburetor adjustment
							●	Oil pump is faulty.	
Electrical system	●	●	●	●		●	●	●	Use of improper spark plug
	●	●	●	●		●	●		Spark plug gets dirty or bridged.
	●	●	●	●		●	●		No spark or weak spark
	●								Shortcircuit of stop switch
	●		●	●		●	●		Ignition timing incorrect
	●								Lock plate not fitted to stop switch
Compression system				●			●		Improper valve clearance
		●	●	●			●		Cylinder head sealing is faulty.
		●	●	●			●		Sealing of intake/exhaust valve is faulty.
			●	●			●		Piston, piston ring or cylinder excessively wears out.
			●					●	Carbon deposits in the combustion chamber.
Others							●	●	Spark plug is poorly tightened.
							●	●	Insufficient cooling water flow, clogged or defective pump
			●				●	●	Malfunction of thermostat
				●	●		●	●	Anti-ventilation plate is damaged.
				●	●	●	●	●	Use of improper propeller
			●	●	●	●	●	●	Propeller is damaged or deformed.
				●	●		●	●	Incorrect position of thrust rod
				●	●	●	●	●	Unbalanced load on boat
●		●	●	●	●	●	●	Transom is too high or low.	
								Poor adjustment of throttle link mechanism.	

CHAPTER 3 INSPECTION AND MAINTENANCE

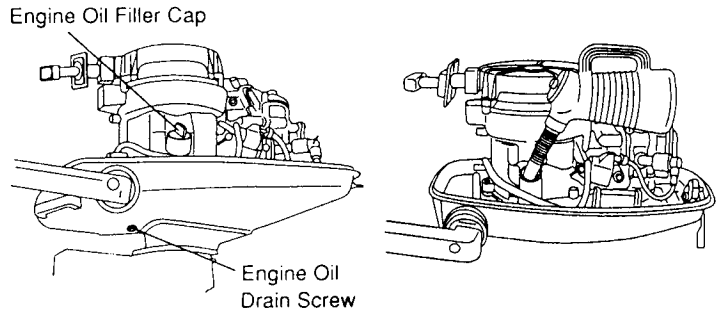
3. Points to Apply Oil or Grease



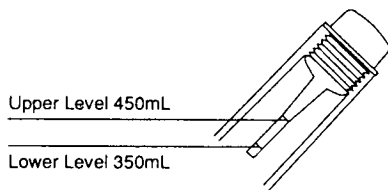
CHAPTER 3 INSPECTION AND MAINTENANCE

4. Change of Engine Oil

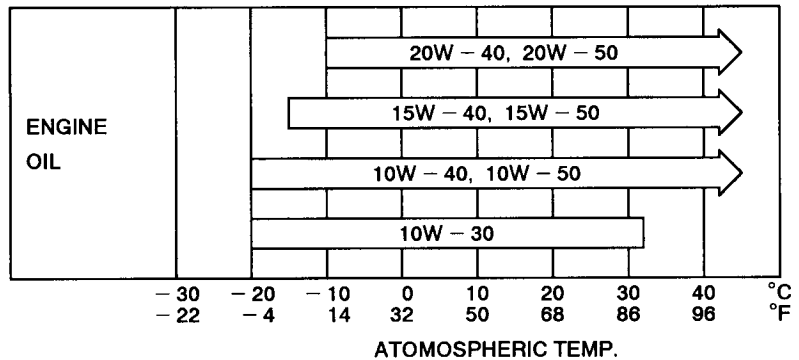
- ① Remove the oil filler cap and drain screw to drain engine oil out.
- ② After fastening the drain screw, pour new engine oil through the oil filler until it reaches the upper limit indication on the oil level gauge.
- ③ Finally, tightly fasten the oil filler cap.



Note: Specified oil: SF/SG/SH class (API classification) SAE 10W – 30/40 oil for 4-stroke gasoline engine.
Or, use other engine oil whose viscosity is proper to the atmospheric temperature in the cruising area.

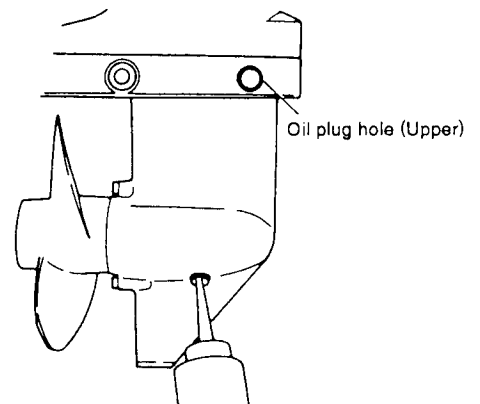
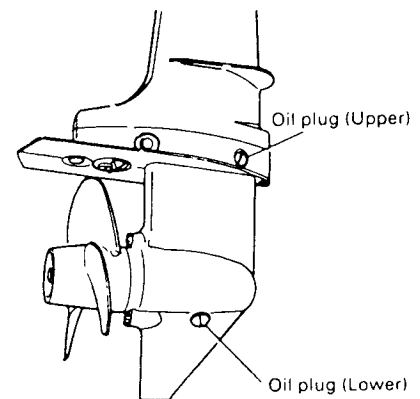


- Specified volume of engine oil: 450 ml (15.2 fl. oz.)



5. Change of Gear Oil

- ① Remove both the upper and lower oil plugs to drain out gear oil completely.
- ② While inserting the spout of the oiler into the lower oil plug hole, pour gear oil just as squeezing the oiler until it overflows from the upper oil plug hole.
- ③ After tightly fastening the upper oil plug, remove the oiler and tightly fasten the lower oil plug.



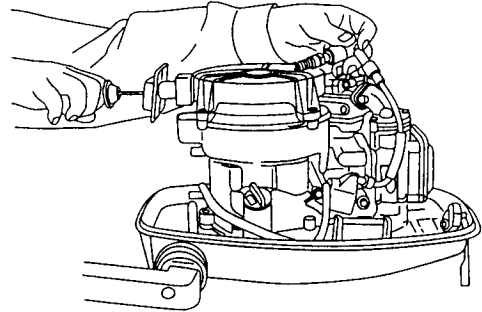
Note: Be sure to use genuine gear oil (GL5, SAE #80 – 90).
Specified volume of gear oil: 195 ml (6.6 fl. oz.) approx.

CHAPTER 3 INSPECTION AND MAINTENANCE

6. Inspection of Ignition System

(1) Check of sparking of spark plug

- ① Remove the plug cap and spark plug.
- ② Insert the spark plug to the plug cap.
- ③ While contacting the screw of the spark plug to the engine for grounding, pull the recoil starter and check sparking condition between the electrodes by eyes.



CAUTION

- Be careful of high voltage at the spark plug and high tension cord. → Securely ground the spark plug.
- Pay heed to gasoline not to fire it at sparking. Be careful not to ground the spark plug near the spark plug hole. → Before starting spark check, completely wipe out gasoline spilling on the spark plug and engine, etc.

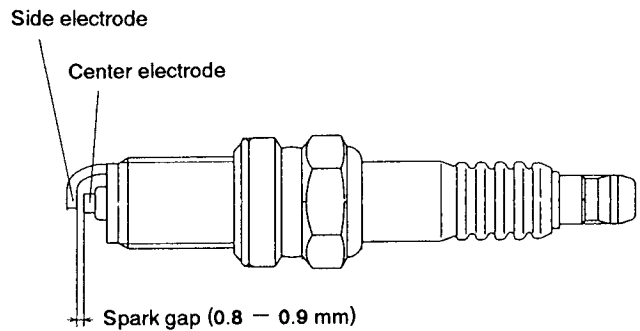
(2) Check of stain on the spark plug and spark gap

- ① Remove the spark plug.
- ② Carry out eye-check of stain on the electrodes and their peripheries.

If the electrodes are fouled or carbon deposits accumulates on them, clean the electrodes with a plug cleaner or wire brush, or replace the spark plug with new one.

- ③ Check the spark gap.

If the spark gap is 1.2 mm (0.047 in) or more, adjust the side electrode to obtain the specified gap or replace the spark plug with new one.



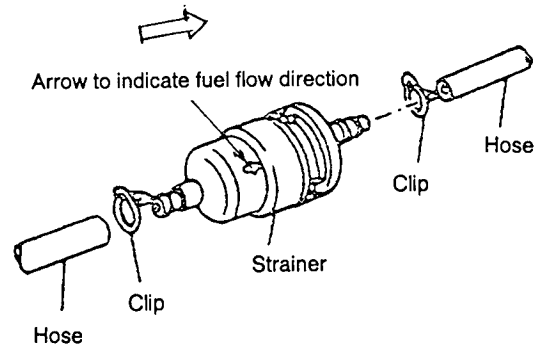
CHAPTER 3 INSPECTION AND MAINTENANCE

7. Inspection of Fuel System

(1) Replacement of fuel strainer

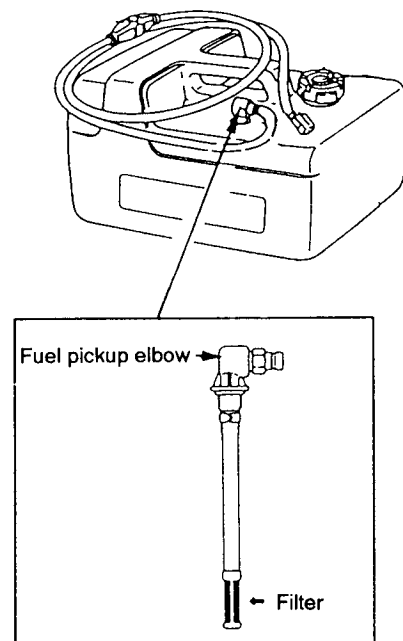
The fuel strainer in the engine side is a disposable type. If it is clogged with dust or water, replace it with new one.

- Notes:
- Remove the fuel connector for replacing the fuel strainer.
 - Be careful not to connect the fuel strainer in wrong direction.
 - Fasten the hose with the clip without fail.



(2) Cleaning of fuel filter

Remove the fuel pickup elbow of the fuel tank by turning it clockwise and clean the fuel filter.

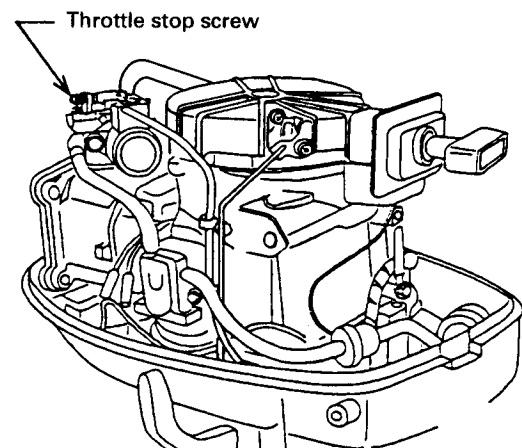


(3) Adjustment of carburetor for slow running

Turn the throttle stop screw with a screwdriver so that engine speed becomes as specified below.

- Notes:
- Adjust engine speed with a tachometer after warming up the engine.
 - Specified engine speed
 - Clutch off: 1,300 rpm
 - Clutch in: 1,100 rpm

Remarks: The pilot screw is not adjustable.

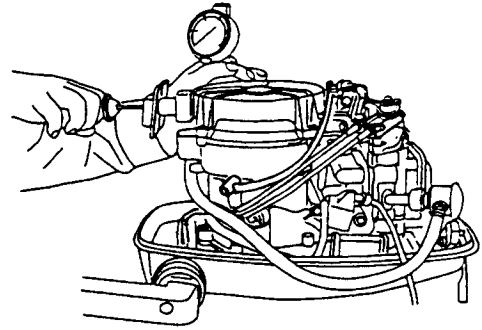


CHAPTER 3 INSPECTION AND MAINTENANCE

8. Inspection of Compression System

(1) Measurement of compression pressure

- ① Remove the spark plug.
- ② Install the compression gauge in the spark plug hole.
- ③ Open the throttle grip and choke valve.
Do not pull the choke knob.
- ④ Pull the recoil starter several times as quickly as possible so that the pointer of the compression gauge does not go furthermore.



Note: Standard compression pressure at 500 rpm

De-compressor		4A2/5A2S	6A2S
With	MPa	0.29 ± 0.1	0.34 ± 0.1
	Kg/cm ²	3.0 ± 1	3.5 ± 1
	ft - lb	22 ± 7	25 ± 7
Without *	MPa	0.78 ± 0.1	0.93 ± 0.1
	Kg/cm ²	8.0 ± 1	9.5 ± 1
	ft - lb	58 ± 7	69 ± 7

* Remove the rocker arm for EX side

CAUTION

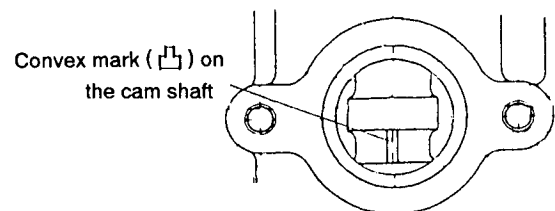
Through measurement of compression pressure, leave the lock from the stop switch.

(2) Adjustment of valve clearance

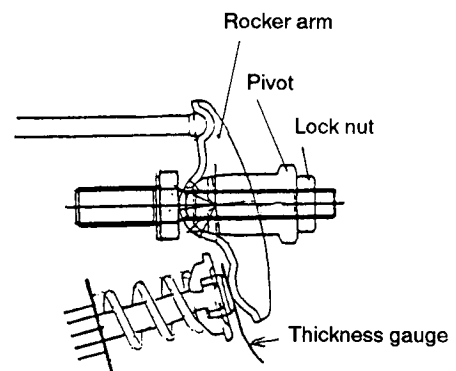
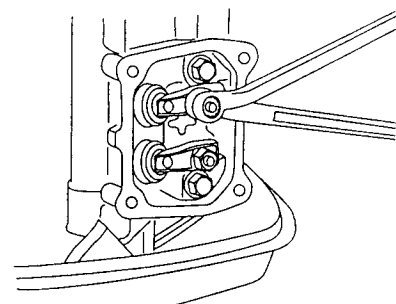
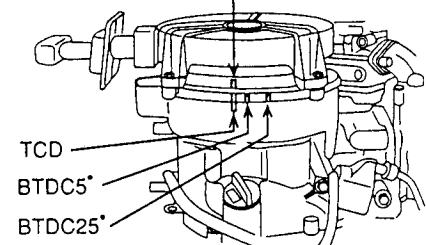
Adjustment of valve clearance must be performed as the engine is cool.

- ① Remove the cylinder head cover and spark plug.
- ② Set the piston at the top dead center.
 - Remove the fuel pump. When the convex mark (凸) on the cam shaft is revealed, the piston is positioned at the compression point.
 - The top dead center is where the notched marking on the flywheel and "TDC" mark on the cylinder meet each other.
- ③ Fix the pivot and loosen the lock nut.
- ④ Insert a feeler (thickness gauge) between the rocker arm and valve.
- ⑤ While turning the pivot, adjust the valve clearance.
- ⑥ Fix the pivot and tighten the lock nut.
- ⑦ Again check the valve clearance.

Valve clearance	IN: 0.06 – 0.14 mm (0.0024 – 0.0055 in)
	EX: 0.11 – 0.19 mm (0.0043 – 0.0075 in)



Notched marking on the flywheel



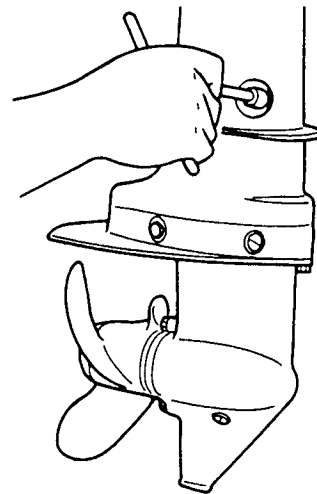
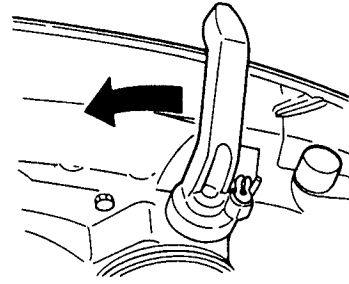
CHAPTER 3 INSPECTION AND MAINTENANCE

9. Inspection of Gear Shift and Propeller System

(1) Shifting system adjustment

If the stroke of the shifting gear is uneven between the neutral and forward positions and between the neutral and reverse positions, adjust the shifting system.

- ① Remove the spark plug cap from the spark plug.
- ② Remove the drive shaft housing grommet.
- ③ Shift the shifting lever to the reverse position.
- ④ Loosen the shift rod joint bolt and set the cam rod at the reverse position.
- ⑤ Tighten the shift rod joint bolt.
- ⑥ While operating the shifting lever, check to see if its stroke and mating with the dog clutch are correctly adjusted.
- ⑦ Set the drive shaft housing grommet as it was.



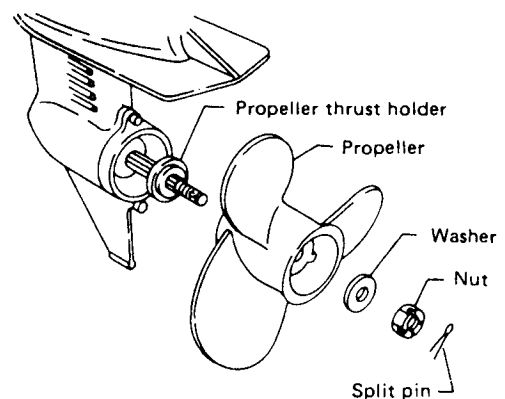
CAUTION

Through this adjustment, remove the spark plug cap.

(2) Check of propeller

If the propeller has worn out, bent, broken off, it causes not only decline in the engine performance but also water seepage into the gear case or engine failure. If the propeller is so, replace it with new one.

- ① Remove the split pin, propeller nut and propeller washer.
- ② Pull the propeller out of the shaft.
- ③ When reassembling the propeller, apply grease onto the propeller shaft.



CAUTION

Carefully handle the propeller because its edges are sharpened.

When removing or replacing the propeller,

- Stop the engine and set the shifting lever at the neutral position.
- Leave the lock from the stop switch.
- Protect hands with gloves on.

CHAPTER 3 INSPECTION AND MAINTENANCE

10. Inspection of Cooling System

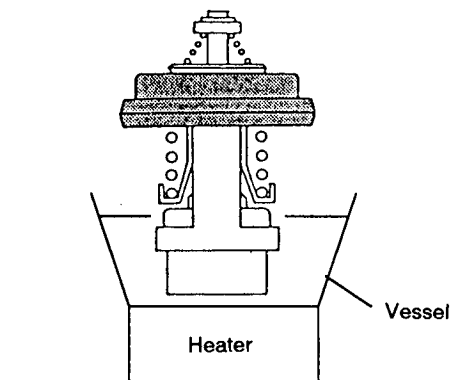
(1) Check of thermostat

- ① Put the thermostat in a proper vessel and pour water (or warm water) into it.
- ② Heat the vessel together with the thermostat inside, and check to see if the valve operates normally.

Valve operation start temperature: $52^{\circ}\text{C} \pm 2^{\circ}\text{C}$
($125^{\circ} \pm 4^{\circ}\text{F}$)

Valve full open temperature: $62^{\circ}\text{C} \pm 2^{\circ}\text{C}$
($150^{\circ} \pm 4^{\circ}\text{F}$)

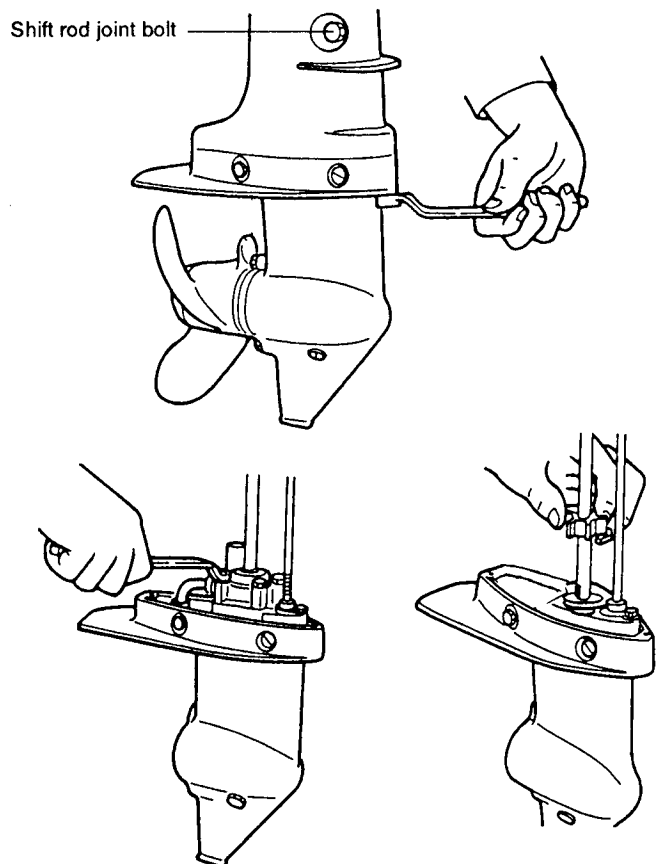
Valve full open lift: 3 mm (0.12 in) or more



(2) Replacement of pump impeller

- ① Remove the drive shaft housing grommet and loosen the shift rod joint bolt. (Don't remove the bolt but just loosen it.)
- ② Remove the two gear case bolts and pull the gear case assembly.
- ③ Remove the water pump case and pump case.
- ④ Remove the pump impeller and replace it with new one.

Note: Besides the impeller, inspect the guide plate and liner also. If they are badly worn, replace them.



CHAPTER 4 POWER UNIT

1. General Notes on Service

When servicing the engine, pay heed to the following matters that are must-follow instructions and general notes on servicing the outboard motor in whole.

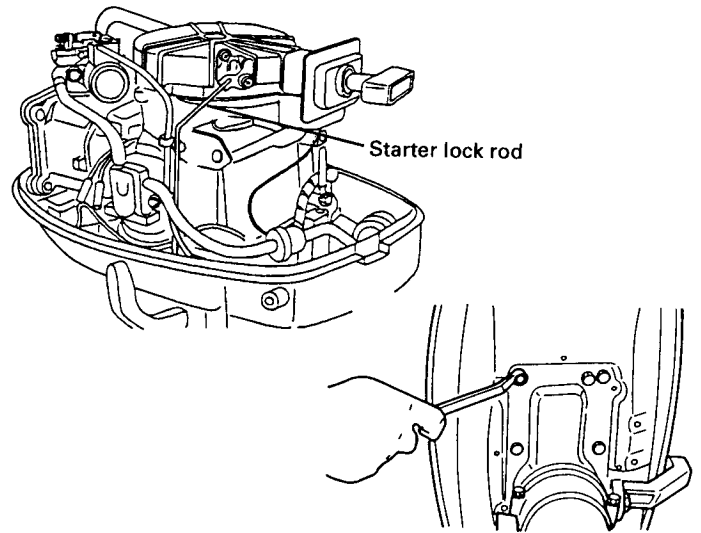
- (1) When servicing the outboard motor, be sure to securely fix it on a proper workstand.
- (2) Be careful not to scratch or damage the mating surfaces of the cylinder, cylinder head, oil pan and coated surfaces, etc. during servicing.
- (3) Don't reuse packings, gaskets, O-rings, split pins that are once removed for servicing, and replace them with new ones when reassembling. Deformed snap rings must be also replaced with new ones.
- (4) When replacing parts, be sure to use genuine parts. Regarding lubricants, use genuine or specified oil and grease without fail.
- (5) For services that require to use a special tool(s), use the specified tool(s) following the instructions to carry out the services properly.
- (6) On disassembling and removing parts, pay careful attention to mating point marks of respective parts. If no marks on it, make simple marks at those mating points for convenience for reassembling.
- (7) To avoid losing small parts, temporarily restore bolts, nuts, washers, and other small parts to their respective original positions as far as circumstances permit.
- (8) When parts are removed for disassembling, dust off them and wash them with wash liquid or white gasoline and then check to see if they are worn or damaged.
- (9) Through reassembling, pay heed to every detail such as mating, preciseness in centering, air-tightness, lubrication, grease-up, cleanliness of oil and fuel paths, packing, wiring, piping, etc.
 - 1) When fastening a part for which many bolts and nuts are used (cylinder head, oil pan, etc.), carefully tighten the bolts and nuts in order from inner ones to outer ones diagonally or circularly to avoid unevenly tightening. (When removing bolts and nuts from such a part, carefully loosen and remove them in the reverse manner.)
 - 2) When inserting an oil seal, be careful neither to make mistake in setting the wrong side up nor to scratch the mating surface (lip) to the shaft. Apply grease onto the lips.
 - 3) When applying liquid sealant, take care of its quantity and thickness. If sealant is too much applied, the excess may not only stick out and flow into the case but also cause bad influence. When using an adhesive, carefully follow the instructions.
 - 4) If a bolt or nut is hard to loosen and remove because of rust, spray liquid screw loosener to it and try to loosen and remove it five or more minutes after.
 - 5) For details of service standards, tightening torques, parts that are specified to apply sealant, glue, grease, etc., refer to the service data table.
 - 6) Bolts, nuts, and washers are indicated by the symbols below.

H820 – Hexagon headed bolt	Diameter 8 mm	Lengh 20 mm
N8 – Normal hexagon nut	Diameter 8 mm	
L8 – Hexagon lock nut	Diameter 8 mm	
W6 – Plain washer	Diameter 6 mm	
SW6 – Spring washer	Diameter 6 mm	
Screw 620 – Pan headed screw	Diameter 6 mm	Lengh 20 mm
- (10) Work carefully during maintenance and repair to avoid injuries and accidents.

CHAPTER 4 POWER UNIT

2. Removing Power Unit

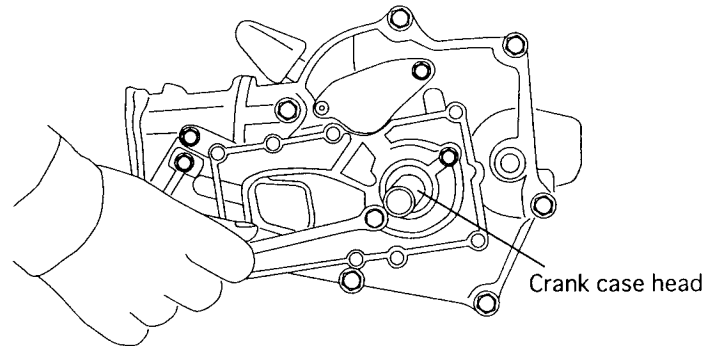
- ① Drain out the engine oil.
- ② Disconnect or remove the following connections, wires, hoses, links, etc.
 - Plug terminals of the C.D. unit
 - Ground terminals of the ignition coil, C.D. unit, stop switch, oil pressure switch
 - Plug terminals of warning lamps
 - Fuel hose
 - Starter lock rod
 - Throttle wire
 - Choke wire
- ③ Remove the engine fitting bolts (H630-6) and lift the power unit upwards.



3. Removing Parts

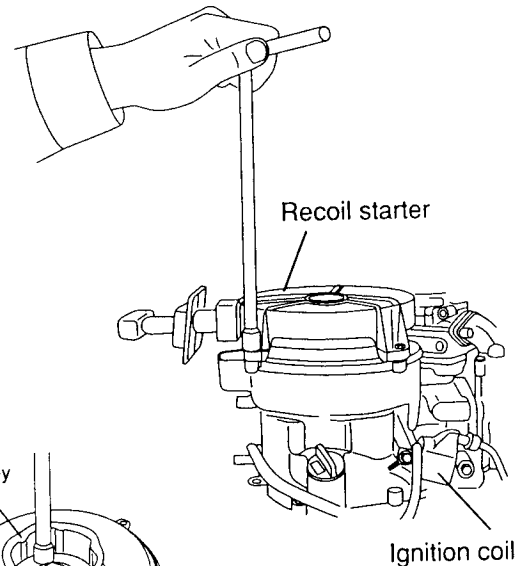
1) Crank case head

- ① Remove the crank case head fitting bolts (H620-2) and then remove the crank case head and gasket.



2) Recoil starter

- ① Remove the recoil starter fitting bolt (H623-3) and then remove the recoil starter assembly.



3) Ignition coil

- ① Remove the plug cap from the spark plug.
- ② Remove the ignition coil fitting bolt (H622-2) and then remove the ignition coil.

4) Magneto flywheel cup

- ① Remove the starter pulley fitting bolt (H612-3) and then remove the starter pulley.
- ② Remove the flywheel cup with a special tool according to the instructions of "How to Use Special Tools" (Chapter 2, 5).

CHAPTER 4 POWER UNIT

5) Exciter coil, pulsator coil

- ① Remove the exciter coil fitting screw (screw 520-2) and then remove the exciter coil.
- ② Remove the pulsator coil fitting screw (screw 512-2) and then remove the pulsator coil.

6) Alternator (optional)

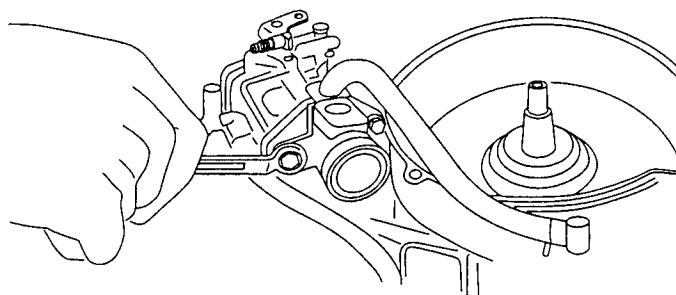
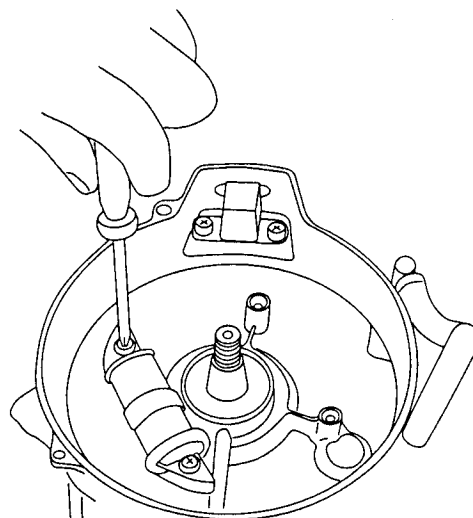
- ① Remove the alternator fitting screw (screw 520-2) and then remove the alternator.

7) Carburetor, inlet manifold

- ① Remove the carburetor fitting bolt (H685-2) and then remove the carburetor together with the air silencer and insulator.
- ② Remove the inlet manifold fitting bolt (H625-2) and then remove the inlet manifold together with the O-ring.

8) Fuel pump

- ① Remove the fuel pump fitting bolt (screw 630-2) and then remove the fuel pump.



CHAPTER 4 POWER UNIT

4. Disassembling Engine

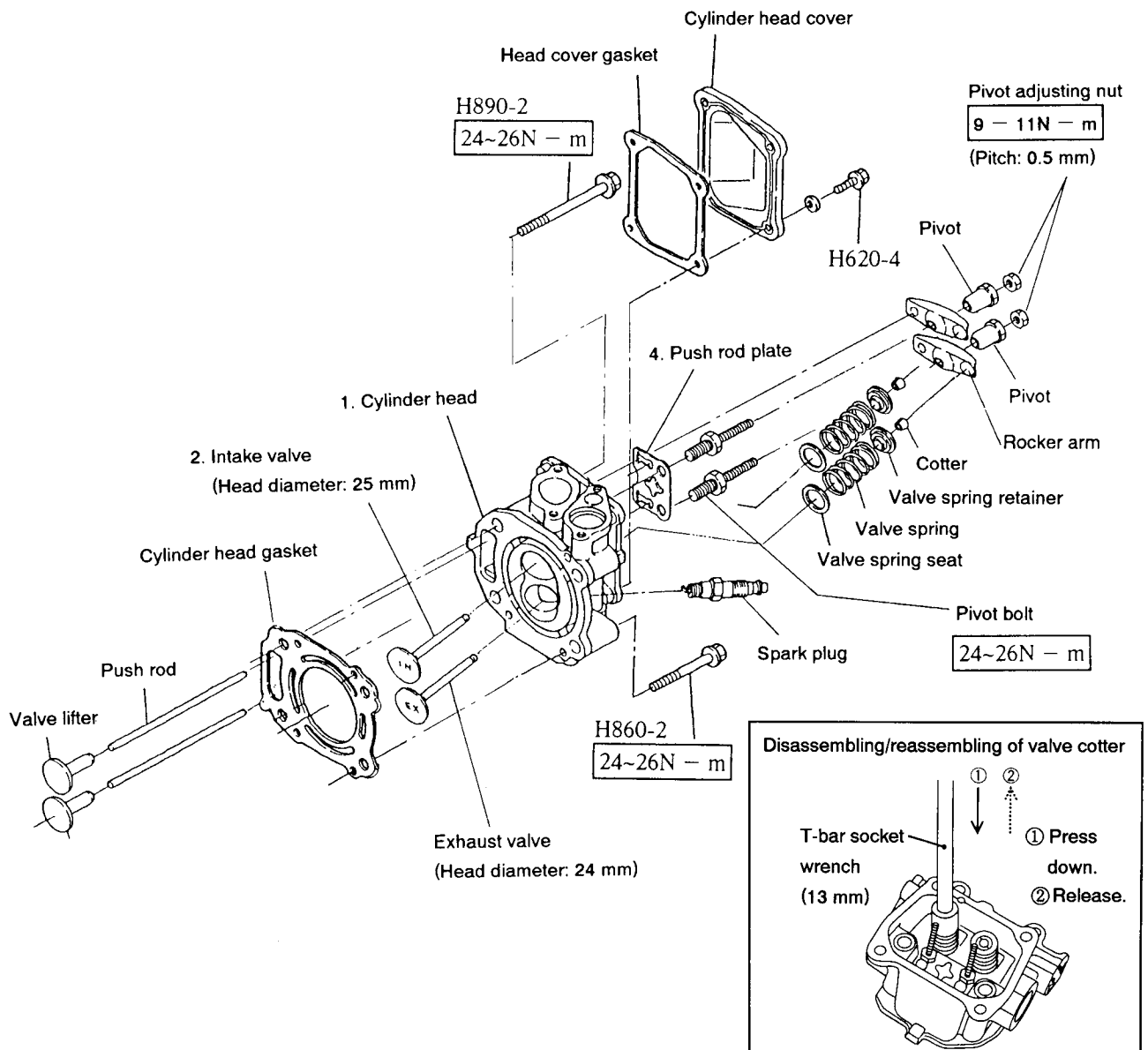
Disassemble the engine according to the illustrations provided by mechanisms.

- 1) Cylinder head, valves and relating parts
- 2) Oil pan, oil pump and relating parts
- 3) Crank shaft, cam shaft, piston, cylinder and related parts

CHAPTER 4 POWER UNIT

1) Cylinder head, valves and relating parts

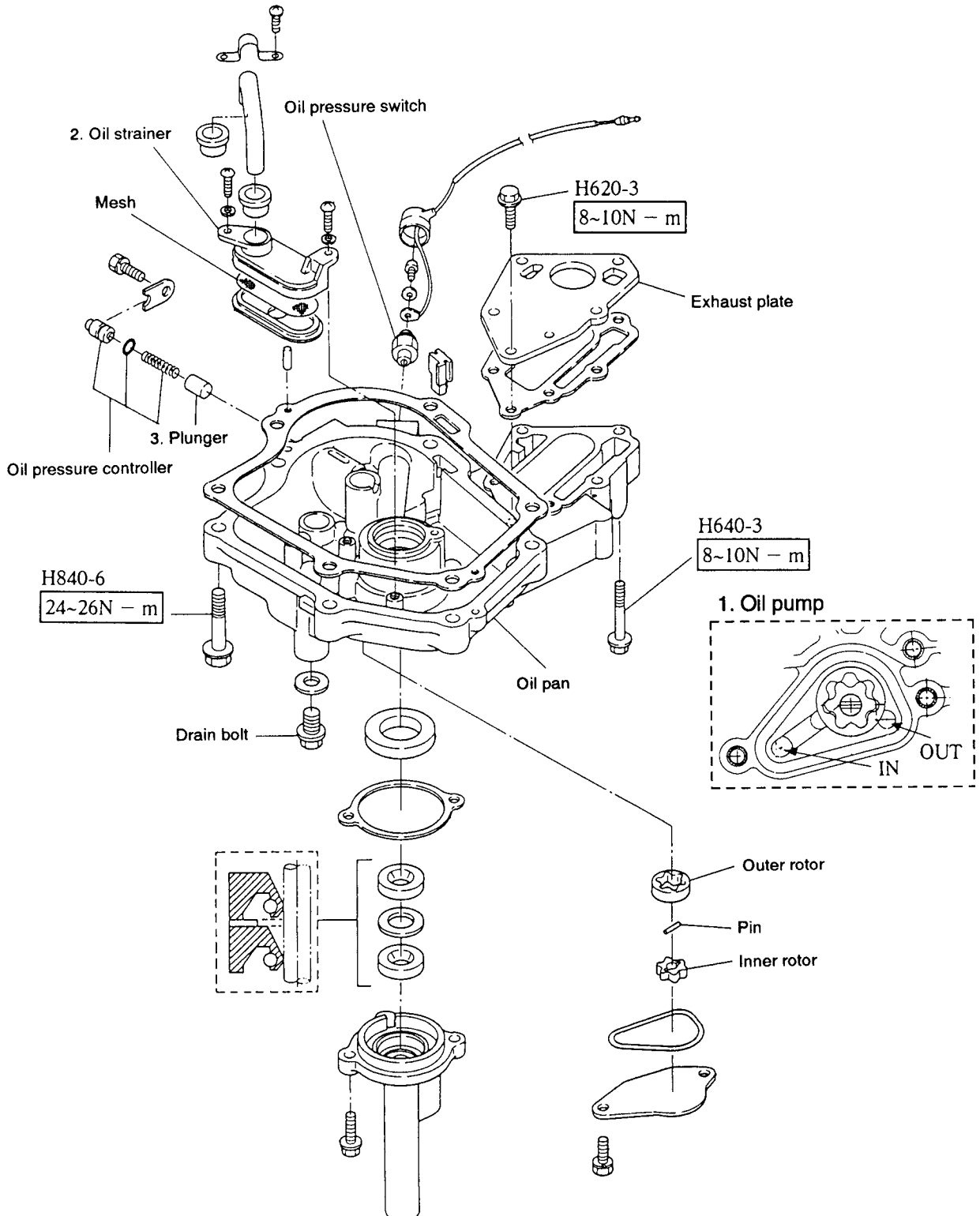
No.	Part name	Check point, etc.
	Gasket, O-ring	Note: Must be replaced by new parts whenever they are once removed for disassembling.
1	Cylinder head	<ul style="list-style-type: none"> ● Carbon deposit in combustion chamber ● Surface width and roughness between valve seat and valve
2	Intake valve, Exhaust valve	<ul style="list-style-type: none"> ● Surface width and roughness between seat and intake/exhaust valve ● Carbon deposit
3	Push rod	● Wear of both ends and straightness
4	Push rod plate	● Wear of guide
5	Rocker arm	● Wear of four contact points: contact surface with push rod, valve stem, pivot and center hole
6	Valve lifter	Note: Must be fitted to the push rod just before reassembling cam shaft in order to prevent it from falling down.



CHAPTER 4 POWER UNIT

2) Oil pan (exhaust manifold), oil pump and relating parts

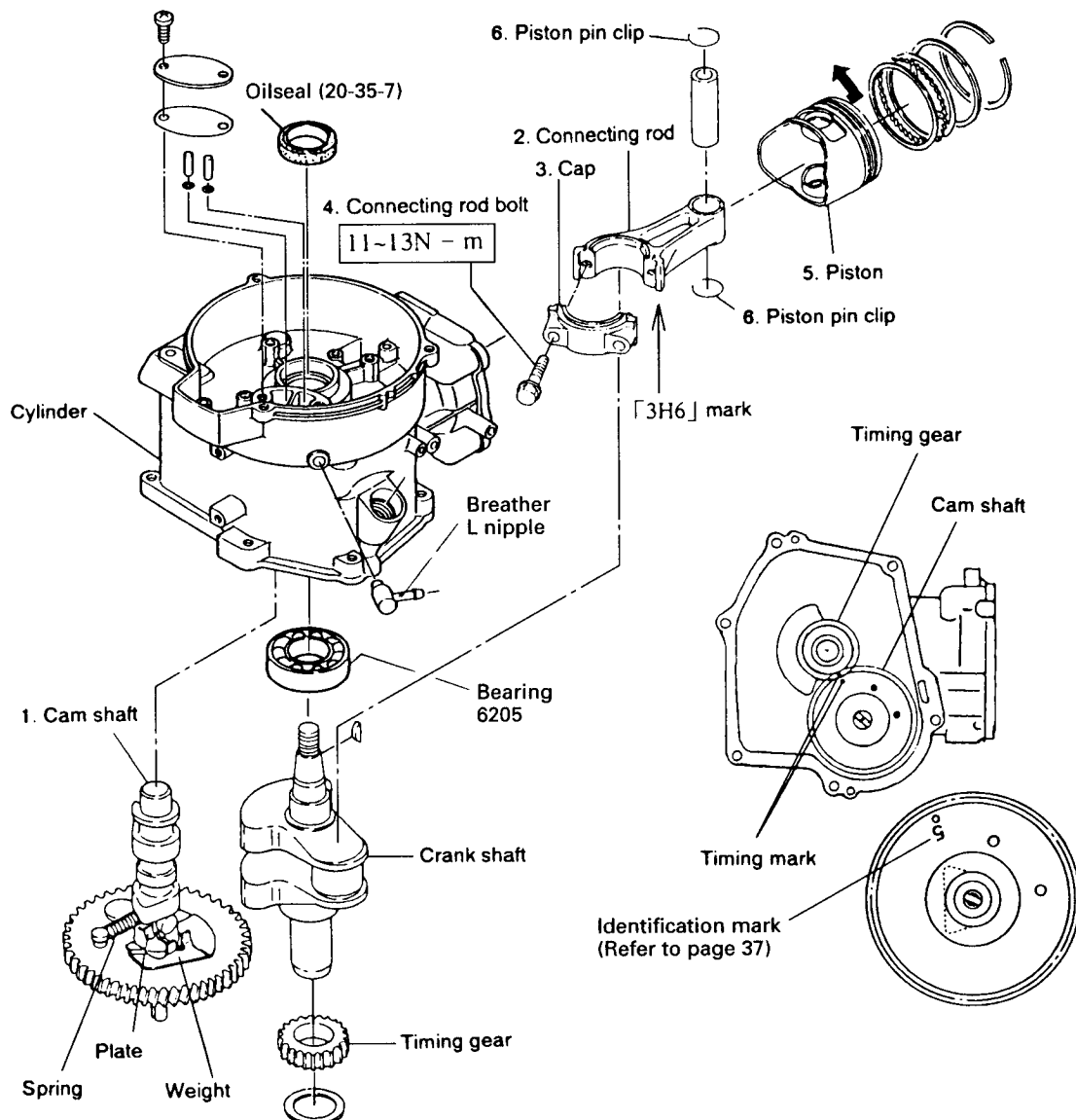
No.	Part name	Check point, etc.
1	Oil pump	Note: When reassembling, replenish the oil pump with new engine oil of 20 ml approx. from the oil inlet side.
2	Oil strainer	● Damage and clogging in the mesh
3	Plunger	Note: Pay heed to the plunger direction for reassembling (Hole must be located towards the spring).



CHAPTER 4 POWER UNIT

3) Crank shaft, cam shaft, piston, cylinder and related parts

No.	Part name	Check point, etc.
1	Cam shaft	<ul style="list-style-type: none"> ● Wear and deformation of decompression spring ● Smooth movement of decompression weight Note: When reassembling, mate the timing marks of crank shaft and cam shaft with each other.
2	Connecting rod	Note: Pay heed to the connecting rod orientation for reassembling ("3H6" mark must face the oil pan).
3	Connecting rod cap	Note: Mate the markings of the cap and connecting rod with each other.
4	Connecting rod bolt	Note: Tighten the bolts in careful manner: Gradually tighten the two bolts alternately several times so that they are evenly tightened.
5	Piston	Note: Pay heed to the piston direction (arrow mark faces the cam shaft and 「UP」 mark faces the magneto).
6	Piston pin clip	Note: Don't use the clip that is once removed. Be sure to use a new part for reassembling.



CHAPTER 4 POWER UNIT

5. Inspection and Measurement of Engine Parts

1) Measurement with vernier calipers

● Valve seat width

Standard value	Out of the limit to use
0.8 mm 0.0315 in	If 1.8 mm (0.071 in) or more, it needs replacement or repair.

● Valve spring free length

Standard value	Out of the limit to use
35.0 mm 1.38 in	If 33.2 mm (1.307 in) or less, it needs replacement.

● Inner diameter of oil pump body

Standard value	Out of the limit to use
23.09 mm 0.909 in	If 23.13 mm (0.911 in) or more, it needs replacement.

2) Measurement with depth gauge or calipers

● Depth of oil pump body

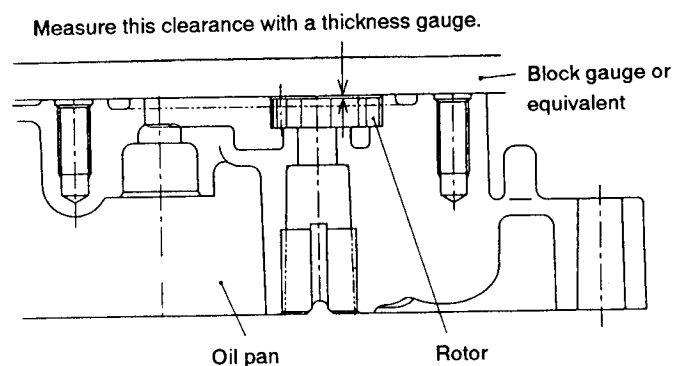
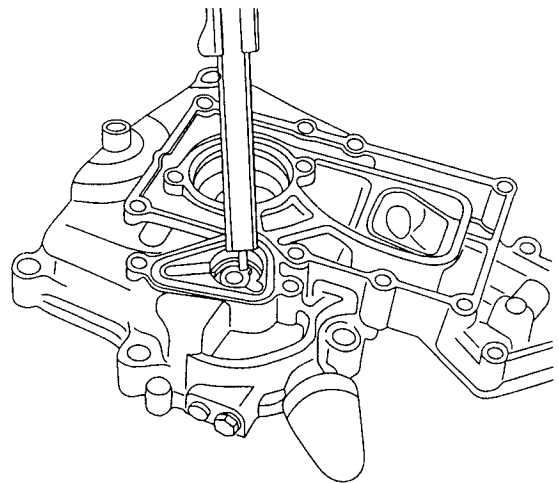
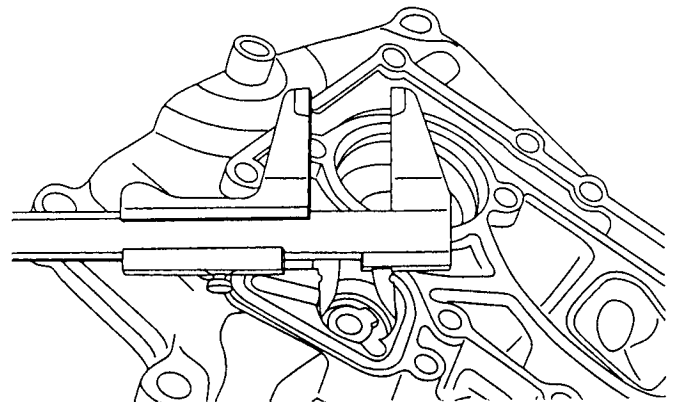
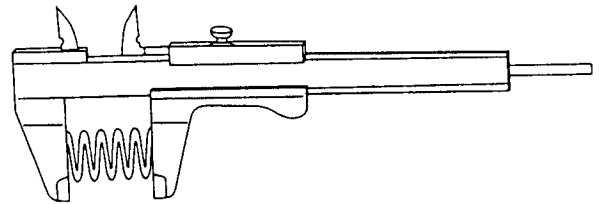
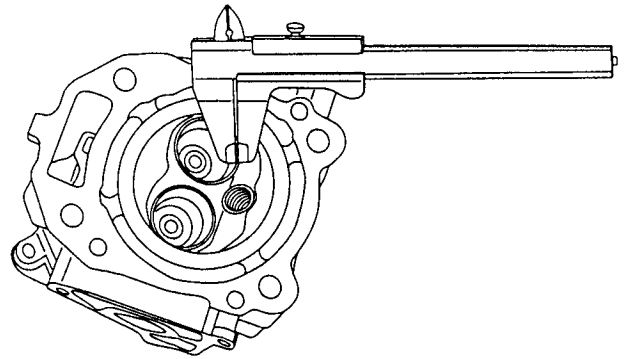
Standard value	Out of the limit to use
6.0 mm 0.236 in	6.06 mm (0.239 in)

● Clearance between oil pump rotor and body

Standard value	Out of the limit to use *
0.02 – 0.07 mm 0.0008 – 0.0028 in	If 0.10 mm (0.004 in) or more, it needs replacement.

Note: A thickness gauge can be used for this measurement.

* : Including wear of the pump cover.

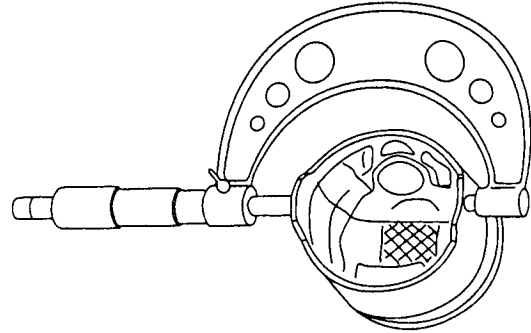


CHAPTER 4 POWER UNIT

3) Measurement with micrometer

● Outer diameter of piston skirt

Standard value	Out of the limit to use
58.960 mm 2.3213 in	If 58.90 mm (2.3189 in) or less, it needs replacement.

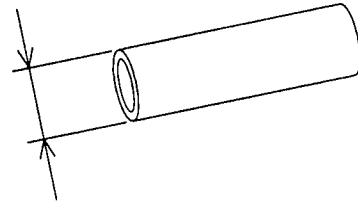


● Piston clearance (Clearance between piston and cylinder)

Standard value	Out of the limit to use
0.020 – 0.055 mm 0.0008 – 0.0022 in	If 0.15 mm (0.0059 in) or more, it needs replacement.

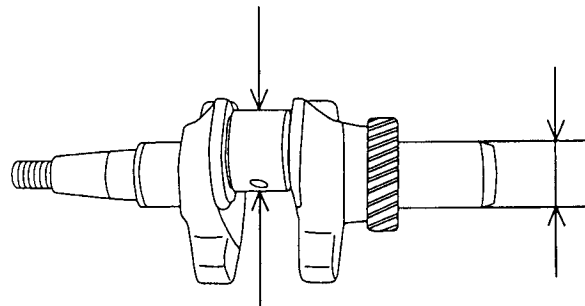
● Outer diameter of piston pin

Standard value	Out of the limit to use
16.00 mm 0.630 in	If 15.97 mm (0.629 in) or less, it needs replacement.



● Outer diameter of crank pin

Standard value	Out of the limit to use
29.94 mm 1.1787 in	If 29.91 mm (1.1776 in) or less, it needs replacement.



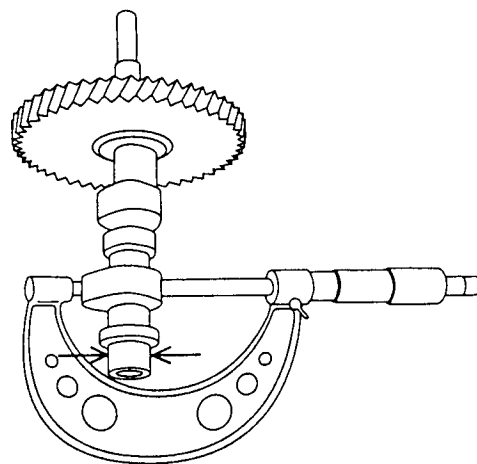
● Outer diameter of crank shaft in oil pan bearing

Standard value	Out of the limit to use
24.98 mm 0.9835 in	If 24.96 mm (0.9827 in) or less, it needs replacement.

CHAPTER 4 POWER UNIT

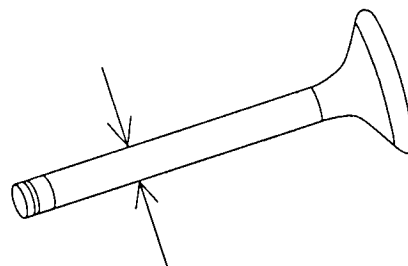
● Cam shaft

		Standard value	Out of the limit to use	Serial number
Outer dia. in bearing		13.980 mm 0.5504 in	If 13.950 mm (0.5492 in) or less, it needs replacement.	
Cam height IN & EX	4A	25.24 mm 0.9937 in	If 24.98 mm (0.9835 in) or less, it needs replacement.	~11594
	5A	26.59 mm 1.0469 in	If 26.33 mm (1.0366 in) or less, it needs replacement.	~17908
	6A	28.33 mm 1.1154 in	If 28.07 mm (1.1051 in) or less, it needs replacement.	4A2: 11595~ 5A2: 17910~ 6A2: First one~



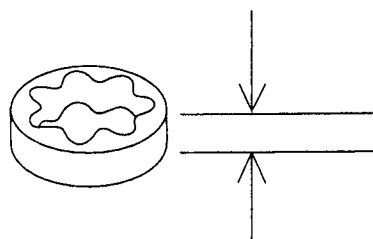
● Valve stem

	Standard value	Out of the limit to use
IN	5.47 mm 0.2154 in	If 5.45 mm (0.2146 in) or less, it needs replacement.
EX	5.44 mm 0.2142 in	If 5.41 mm (0.2130 in) or less, it needs replacement.



● Clearance between valve guide and valve stem

	Standard value	Out of the limit to use
IN	0.020 – 0.044 mm 0.00079 – 0.00173 in	If 0.07 mm (0.00276 in) or more, it needs replacement.
EX	0.045 – 0.072 mm 0.00177 – 0.00283 in	If 0.10 mm (0.00394 in) or more, it needs replacement.



● Height of oil pump outer rotor

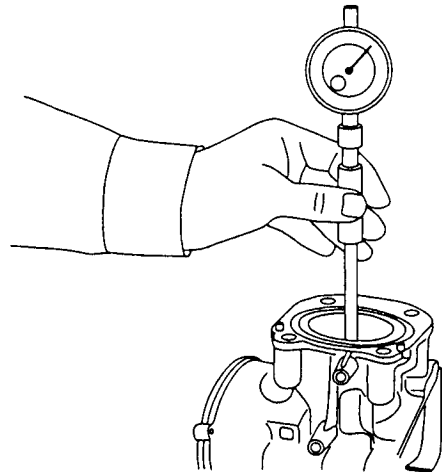
Standard value	Out of the limit to use
5.99 mm 0.2358 in	If 5.96 mm (0.2346 in) or less, it needs replacement.

CHAPTER 4 POWER UNIT

4) Measurement with cylinder gauge

● Inner diameter of cylinder

Standard value	Out of the limit to use
59.00 mm 2.3228 in	If 59.07 mm (2.3256 in) or more, it needs replacement.

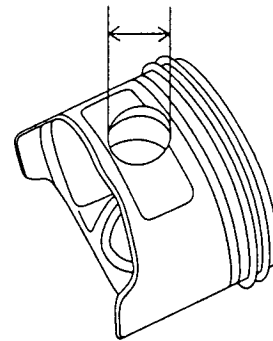


● Diameter of piston pin hole

Standard value	Out of the limit to use
16.002 mm 0.630 in	Depends on clearance between pin and hole.

● Clearance between piston pin and piston pin hole

Standard value	Out of the limit to use
0.002 – 0.012 mm 0.00008 – 0.00047 in	If 0.04 mm (0.0016 in) or more, it needs replacement.

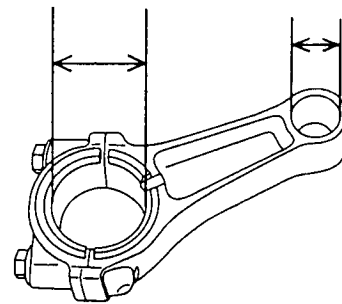


● Oil clearance at big end of connecting rod

Standard value	Out of the limit to use
0.053 – 0.079 mm 0.0021 – 0.0031 in	If 0.090 mm (0.0035 in) or more, it needs replacement.

● Inner diameter of small end of connecting rod

Standard value	Out of the limit to use
16.010 mm 0.6303 in	If 16.04 mm (0.6315 in) or more, it needs replacement.

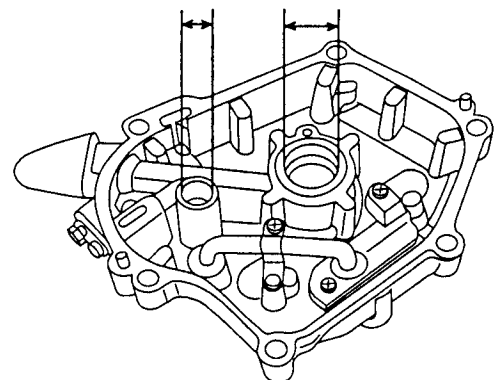


● Inner diameter of oil pan bearing

	Standard value	Out of the limit to use
Crank shaft	25.01 mm 0.985 in	Depends on the clearance appearing in the next item
Cam shaft	14.01 mm 0.5516 in	

● Clearance between oil pan bearing and crank shaft

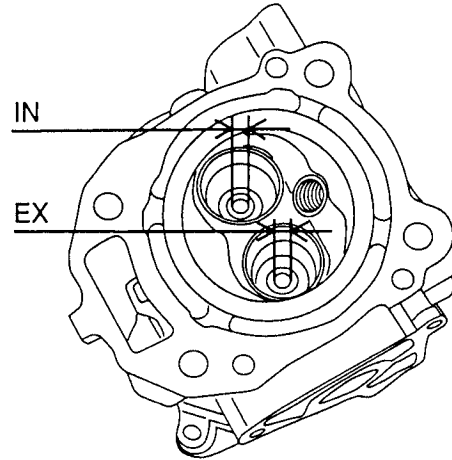
	Standard value	Out of the limit to use
Crank shaft	0.015 – 0.040 mm 0.0006 – 0.0016 in	If 0.06 mm (0.0024 in) or more, it needs replacement.
Cam shaft	0.02 – 0.05 mm 0.0008 – 0.0020 in	If 0.07 mm (0.0028 in) or more, it needs replacement.



CHAPTER 4 POWER UNIT

● Inner diameter of valve guide

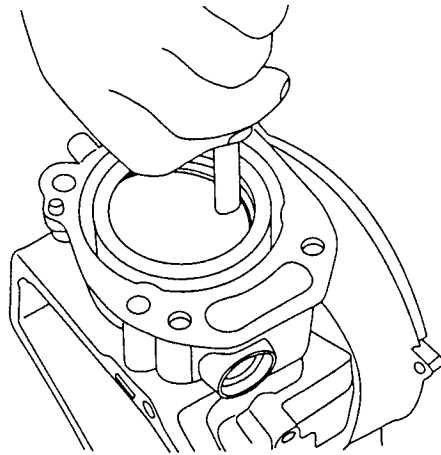
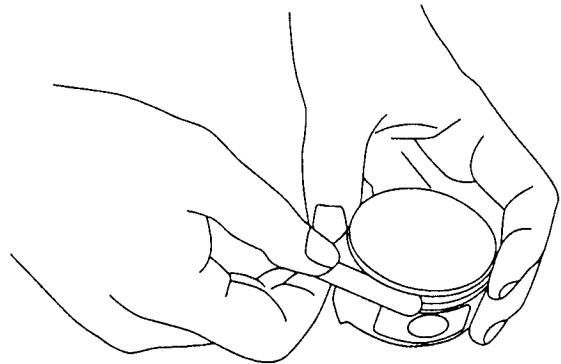
	Standard value	Out of the limit to use
IN	5.5 mm 0.2165 in	If 5.54 mm (0.2181 in) or more, it needs replacement.
EX	5.5 mm 0.2165 in	If 5.57 mm (0.2193 in) or more, it needs replacement.



5) Measurement with thickness gauge

● Clearance between piston ring and ring groove

	Standard value	Out of the limit to use
Top	0.04 – 0.08 mm 0.0016 – 0.0031 in	If 0.10 mm (0.0039 in) or more, it needs replacement.
Second	0.03 – 0.07 mm 0.0012 – 0.0028 in	If 0.09 mm (0.0035 in) or more, it needs replacement.
Oil	0.01 – 0.18 mm 0.0004 – 0.0071 in	If 0.21 mm (0.0083 in) or more, it needs replacement.



● Piston ring end gap

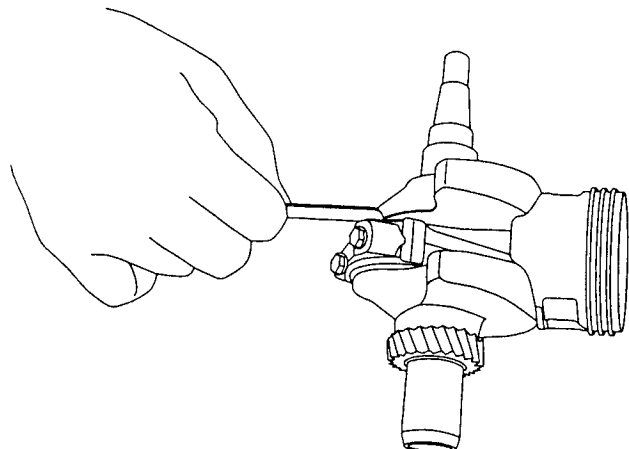
	Standard value	Out of the limit to use
Top	0.15 – 0.35 mm 0.0059 – 0.0138 in	If 0.5 mm (0.0197 in) or more, it needs replacement.
Second	0.30 – 0.50 mm 0.0118 – 0.0197 in	If 0.7 mm (0.0276 in) or more, it needs replacement.
Oil	0.20 – 0.40 mm 0.0079 – 0.0157 in	

Note: • Set the piston ring by pressing it in the piston crown side.

- To be replaced with a new oil ring when replacing with new top and/or second rings.

● Side clearance at big end of connecting rod

Standard value	Out of the limit to use
0.2 – 0.4 mm 0.0079 – 0.0157 in	If 0.7 mm (0.0276 in) or more, it needs replacement.



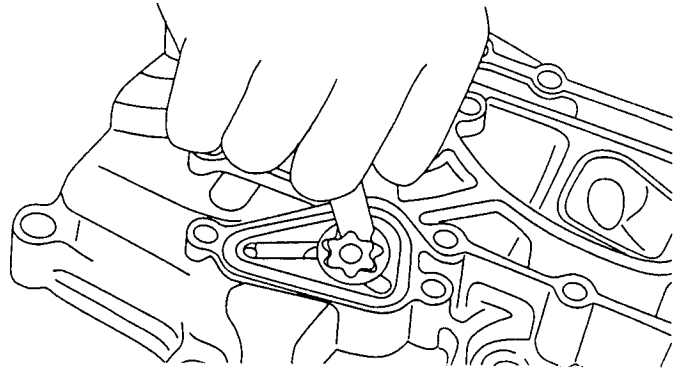
CHAPTER 4 POWER UNIT

● Clearance between inner and outer rotors

Standard value	Out of the Limit to use
0.15 mm or less 0.0059 in or less	0.20 mm (0.0078 in)

● Clearance between outer rotor and body

Standard value	Out of the Limit to use
0.12 – 0.20 mm 0.0047 – 0.0078 in	If 0.25 mm (0.0098 in) or more, it needs replacement.



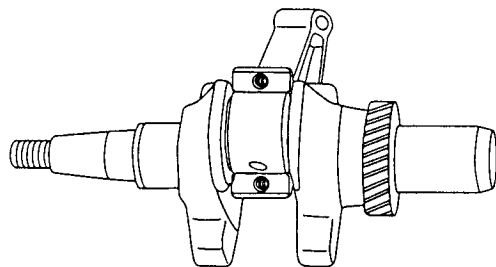
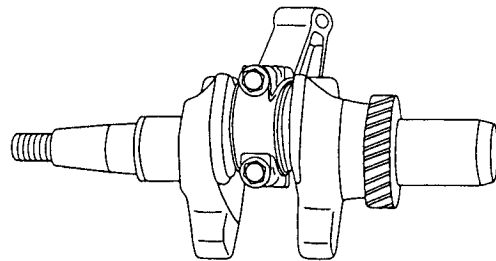
6) Measurement with Plastigage®

● Oil clearance at big end of connecting rod

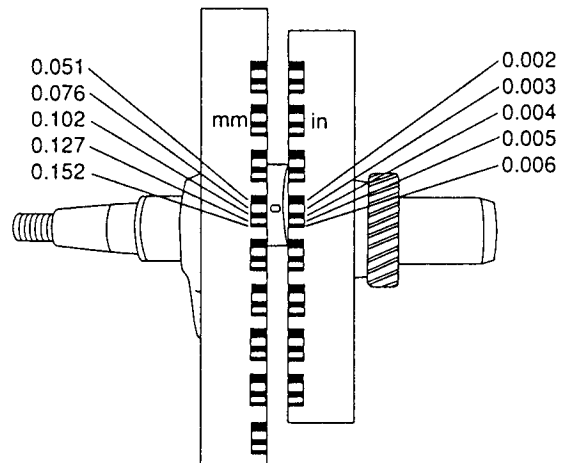
- 1) Wipe oil out of the crank pin and big end bearing of connecting rod.
- 2) Set the Plastigage to the crank pin and fit it to the connecting rod. Tighten the bolt with the specified torque.

Tightening torque: 11 – 13 N – m (1.1 – 1.3 kg – m) (8 – 9.4 ft – lb)

- 3) Remove the connecting rod and check the Plastigage reading.



Standard value	Out of the Limit to use
0.053 – 0.079 mm 0.00209 – 0.0031 in	If 0.09 mm (0.00354 in) or less, it needs replacement.



CHAPTER 4 POWER UNIT

7) Measurement with pressure gauge

● Oil pump

- 1) Remove the oil pressure switch first. Next, set a pressure gauge attachment and a pressure gauge capable of reading 0 – 1.0 MPa (0 – 10 kg/cm²). (0 – 72 ft – lb)
- 2) Start the engine and measure oil pressure at the oil temperature of 75 °C . (167 °F)

Engine speed	Oil pressure (at 75 °C of oil temperature)
1,300 rpm	0.03 MPa (0.3 kg/cm ²) (2.2 ft – lb) or more
5,000 rpm	0.15 MPa (1.5 kg/cm ²) (11 ft – lb) or more

- 3) If the oil pressure is lower than the requirement, check the oil pump system.

8) Other inspections

● Clearance of ball bearing

Wash the bearing and dry it. While turning the bearing by hand, check to see if the clearance is normal, there is neither noise nor scratch. If there is something wrong in the bearing, replace it with new one.

CHAPTER 4 POWER UNIT

6. Repair and Replacement of Engine Parts

● Repair of valve seat

- 1) Plane the valve seat face with the 45° valve seat cutter.
- 2) Depending on the situation (the contact position of the seat is too high or too low), use the 30° cutter or 60° cutter and then repair the surface area with the 45° cutter.

- 3) Apply Prussian Blue compound (or equivalent) evenly on the seat face. While turning the valve with the valve lapper, check face width between the valve and valve seat. If necessary, repair the face width with the valve seat cutter.

	Standard value	Limit that needs repair
IN	0.8 mm 0.0315 in	1.8 mm (0.0709 in) or more
EX	0.8 mm 0.0315 in	1.8 mm (0.0709 in) or more

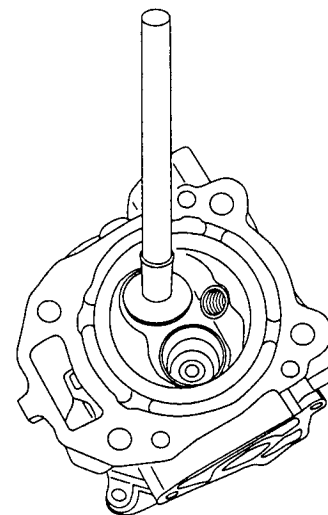
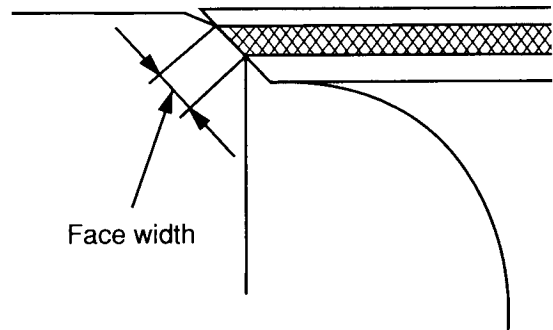
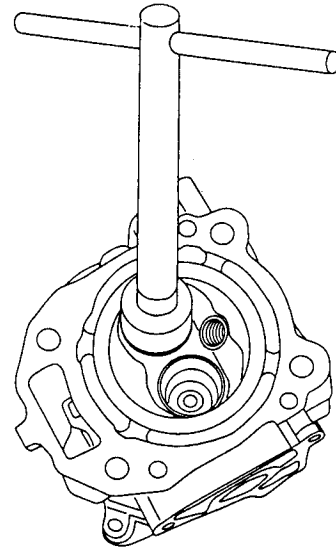
- 4) After repair of the valve seat, lap the valve for good fitting.

Apply lapping compound thinly on the seat and lap the valve while turning and tapping it with the valve lapper.

Remarks: Since the lapping compound is supplied in a set of three grades (coarse, medium and fine), lap the valve with all of them in order from coarse, medium and fine.

Notes:

- When using lapping compound of a different grade, completely wipe out the previously used compound beforehand.
- After lapping is complete, wash the valve and valve seat after completely wiping the compound out of them.



CHAPTER 4 POWER UNIT

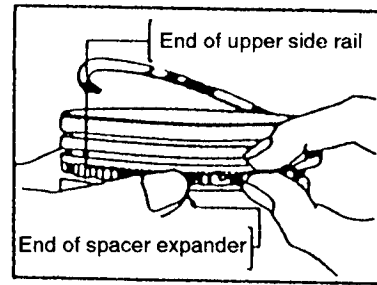
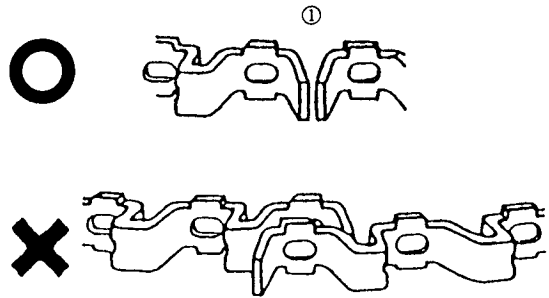
7. Reassembling Engine

Reassemble the engine in the reverse order of disassembling with careful attention to the following points.

● Piston ring

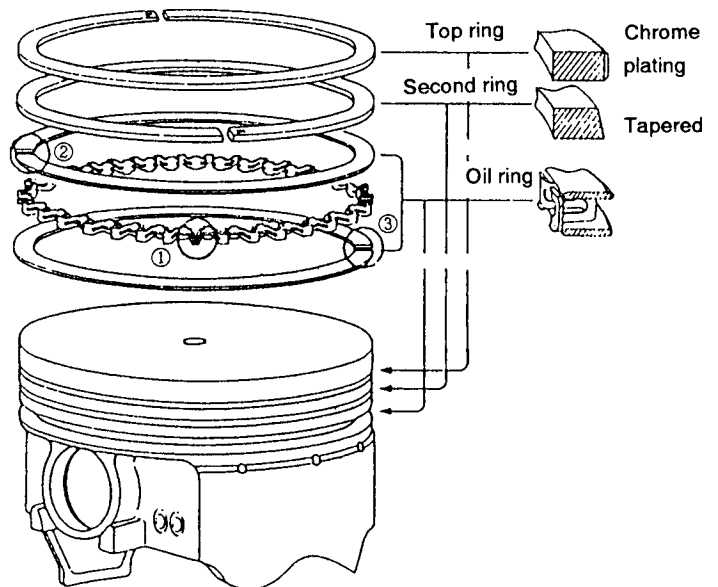
Incorporating oil rings

1. Set the expander in the oil ring groove, and check to see if its both ends correctly link with each other as shown in the figure. ... ①
2. While holding down the slit of the expander by a thumb, incorporate the upper side rail while shifting its ends to the left at angle of 90° to the slit of the expander. ... ②
3. In the same manner as the above step 2, incorporate the lower side rail while shifting its ends to the right at an angle of 90° to the slit of the expander. ... ③



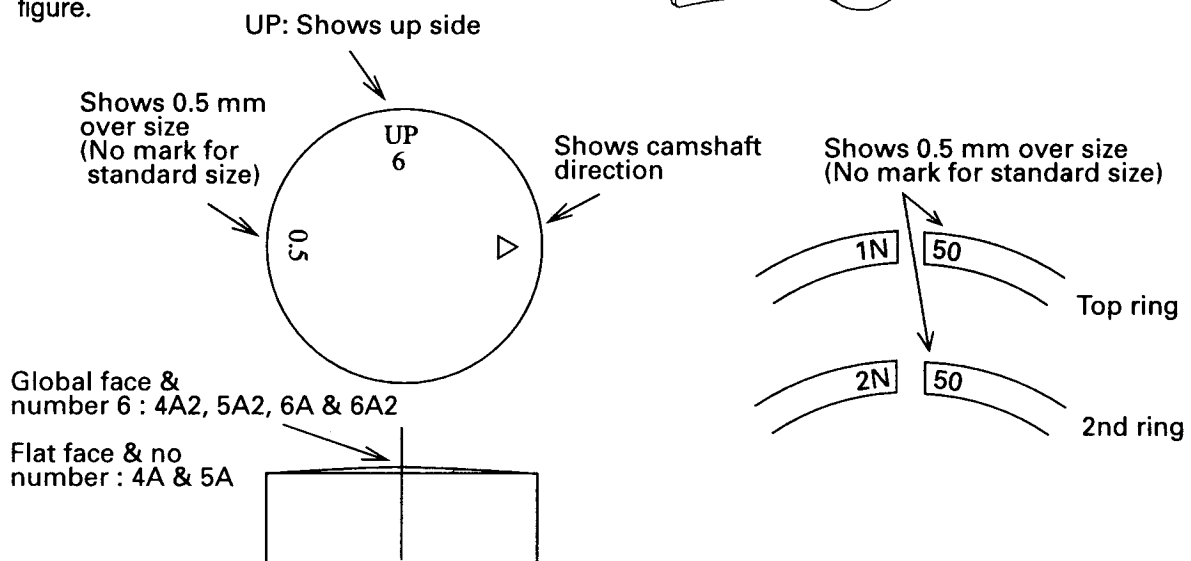
Incorporating compression rings

Incorporate compression rings with the brand and size marking side up from the bottom of the piston in the correct order.



Check of correct setting of each piston ring

1. Ensure the end gap is not located on the line of thrust side or piston pin axis.
2. After setting all rings, again check that they are correctly set on the piston as shown in the figure.

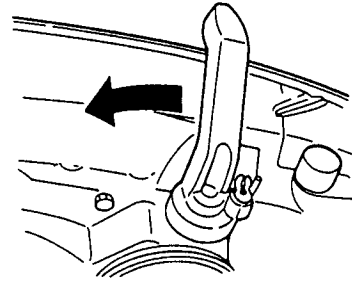


CHAPTER 5 LOWER UNIT

1. Disassembling Gear Case

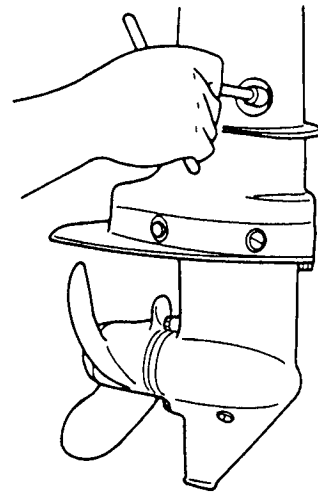
(1) Removing gear case

- ① Shift the shifting lever to the reverse side.

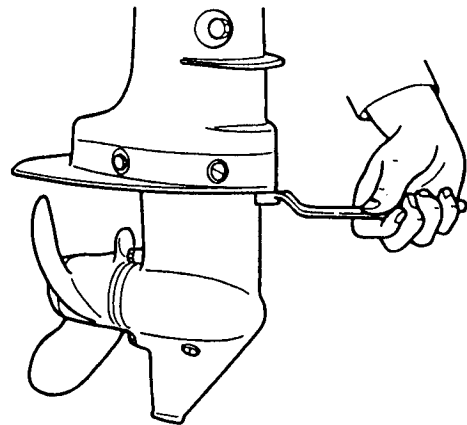


- ② Remove the drive shaft housing grommet and loosen the shift rod joint bolt (H616-1) with the T-handle wrench.

Note: Don't remove the bolt but just loosen it.

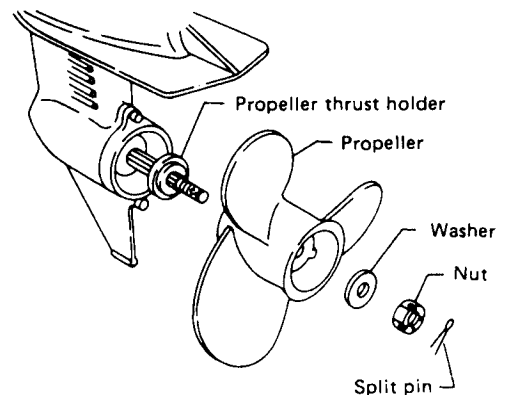


- ③ Remove the gear case fitting bolts (H645-1 in the front, H835-1 in the rear), and pull out the gear case assembly.



(2) Removing propeller

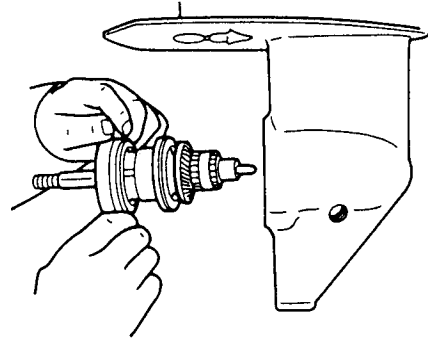
- ① Pull out the split pin from the propeller nut.
- ② Remove the propeller nut, washer, propeller, thrust holder from the propeller shaft in this order.



CHAPTER 5 LOWER UNIT

(3) Disassembling propeller shaft and clutch

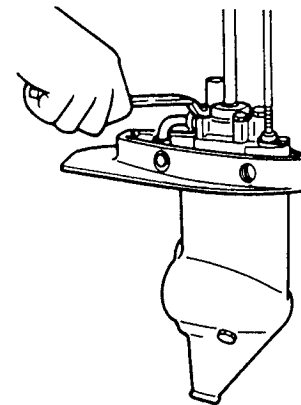
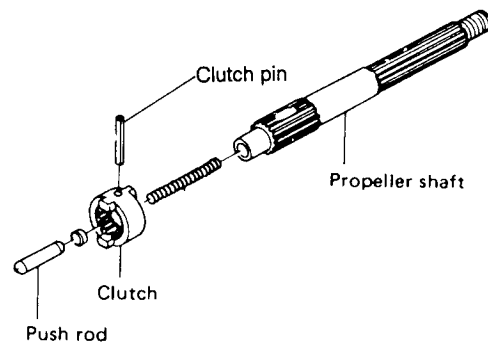
- ① Remove the oil plugs from the upper and lower sides of the gear case to drain out the gear oil.
- ② Remove the propeller shaft housing bolt (H616-2) and then remove the propeller shaft housing, propeller shaft and bevel gear C.



- ③ While pressing the push rod lightly, pull out the clutch pin.

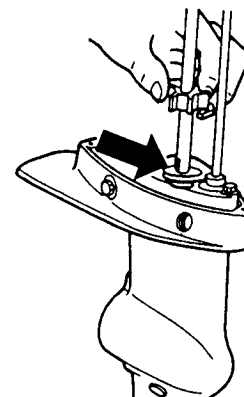
Notes:

- When pulling out the clutch pin, pay heed to the push rod and clutch spring because they break forth from the propeller shaft with disengagement of the clutch pin.
- Use the special tool to pull out the clutch pin.



(4) Disassembling water pump case

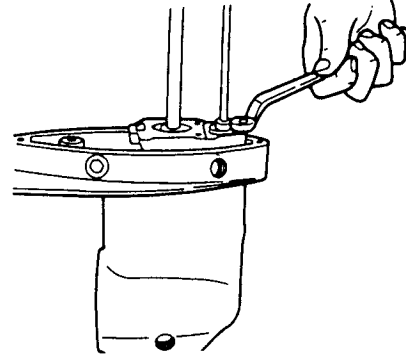
- ① Remove the water pump case bolt (H645-4) and pull out the pump case.
- ② Pull out the water pump case gasket, water pump guide plate, water pump guide plate gasket in this order.



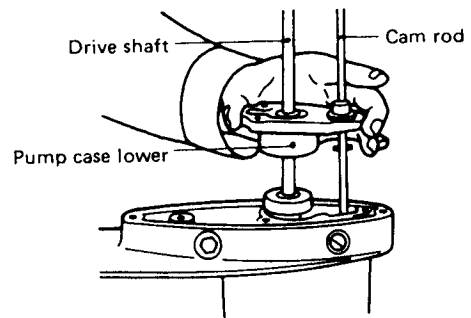
CHAPTER 5 LOWER UNIT

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

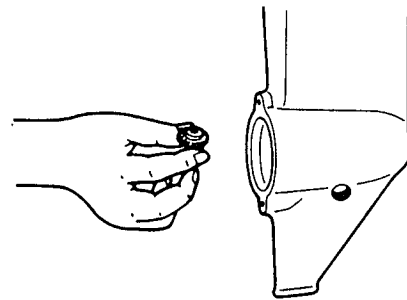
- ① Remove the cam rod bushing stopper bolt (H625-1) and then pull out the cam rod bushing stopper.



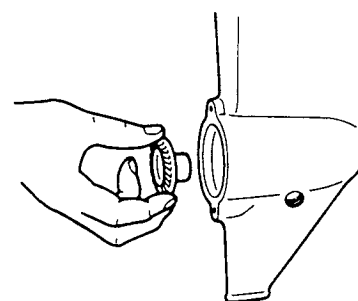
- ② Remove the pump case (lower), cam rod and drive shaft as an assembly.



- ③ Remove the bevel gear B.



- ④ Remove the bevel gear A.



CHAPTER 5 LOWER UNIT

2. Inspection of Parts Related to Gear Case

Part name	Check item	Remedy
Bevel gears A, B, C, and Clutch	<ul style="list-style-type: none"> ● Wear in the dog of the bevel gears A and C ● Wear in the dog of the clutch ● Conformity of the gear teeth of the bevel gears A, B and C ● Wear in the bearings of the bevel gears A and B ● Backlash (0.05 – 0.15 mm, 0.002 – 0.006 in) of the bevel gears A and B 	Replace. Replace. Replace depending on the damage. Replace depending on the wear.
Propeller shaft	<ul style="list-style-type: none"> ● Wear in the mating parts (splines) to the clutch 	Replace depending on the degree of wear.
Drive shaft	<ul style="list-style-type: none"> ● Deflection of the drive shaft ● Wear in the splines 	Repair or replace. Replace depending on the degree of wear.
Water pump	<ul style="list-style-type: none"> ● Damage to the pump impeller ● Wear or deformation in the pump case liner 	Replace. Replace.
Anode	<ul style="list-style-type: none"> ● Wear in the gear case anode 	Replace.

CHAPTER 5 LOWER UNIT

3. Reassembling Gear Case

Reassemble the gear case in the reverse order of disassembling with careful attention to the following points.

(1) Clutch and related parts

- ① Reassemble the clutch and the propeller shaft to each other and check to see if they operate smoothly without wobble.
- ② When reassembling, use a new spring pin (3 mm \varnothing × 10 mm) to connect the clutch cam and cam rod with each other, and carefully insert it with the special tool not to stick out of the periphery of the clutch cam.
- ③ Apply grease onto the inner and outer O-rings of the cam rod bushing.
- ④ Insert the cam rod and check to see if it smoothly moves up and down.
- ⑤ When connecting the cam rod and shift rod to each other with the shift rod joint, set the cam rod and shift rod at the reverse position beforehand.

(2) Bevel gears and related parts

- ① When inserting the bevel gear A bearing into the gear case, press it in by the outer ring.
- ② Be sure to measure the backlash between the bevel gears A and B with the special measuring tool. The allowable backlash is 0.05 – 0.15 mm (0.16 – 0.49 mm in reading of the special measuring tool). If necessary, insert a proper adjusting shim between the lower pump case and upper drive shaft bearing.

Thickness of adjusting shim: 0.1 mm or 0.15 mm
(two kinds)

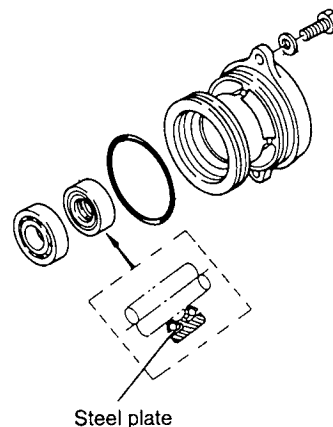
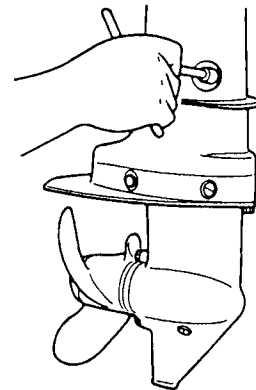
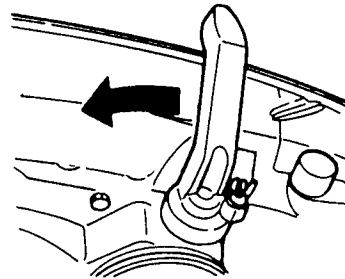
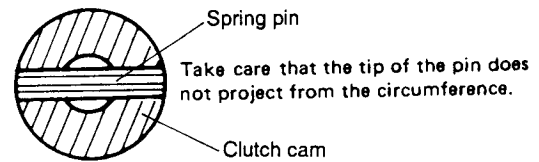
- ③ Press the drive shaft bearing into the gear case with the special tool.

(3) Propeller shaft housing

- ① After setting the propeller shaft oil seal in the propeller shaft housing, press the propeller shaft bearing into the housing.
- ② Apply grease onto the lips of the oil seal.
- ③ Set the oil seal with the steel plate side facing the gear case.
- ④ When installing the propeller shaft housing into the gear case, apply grease onto the O-ring and fit joint.

(4) Propeller and related parts

When fitting the propeller to the propeller shaft, apply grease onto the splines of the propeller shaft.



CHAPTER 5 LOWER UNIT

(5) Water pump and related parts

① When inserting the oil seal into the lower pump case, apply grease to the lips of the oil seal.

② Set the oil seal so that its steel plate side faces the gear case.

③ When inserting the pump case liner into the pump case, correctly set its projection in the mating hollow.

④ Securely fit the pump impeller into the impeller key so that the bending direction of the blades corresponds to the rotating direction of the drive shaft (clockwise rotation as viewed from the engine side). Be careful not to be rotated it in the counter clockwise direction.

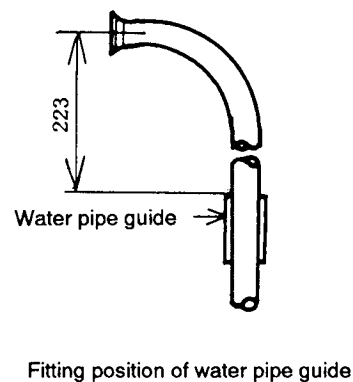
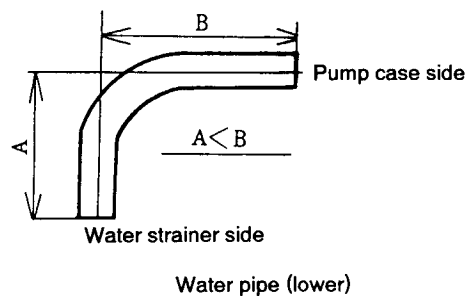
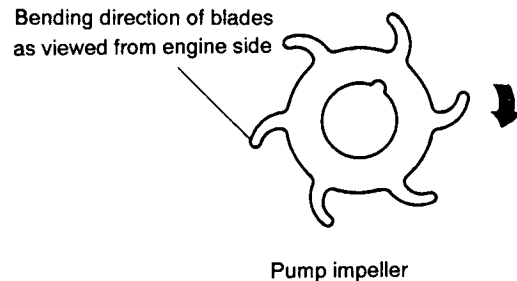
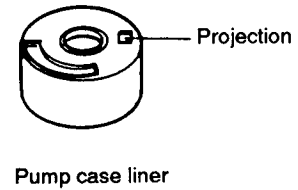
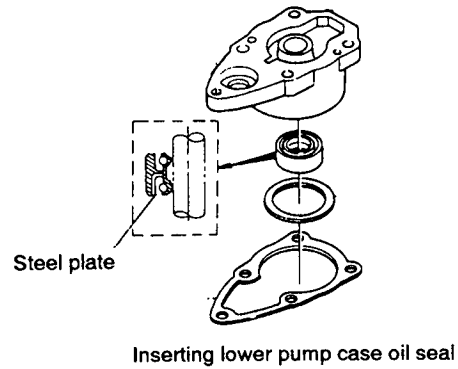
⑤ Set the water pump guide plate, water pump guide plate gasket, water pump case gasket so that their knock-holes meet at the same point.

⑥ Fit the lower water pipe to the pump case and then fit the pump case.

⑦ Assemble the lower water pipe as shown in the figure.

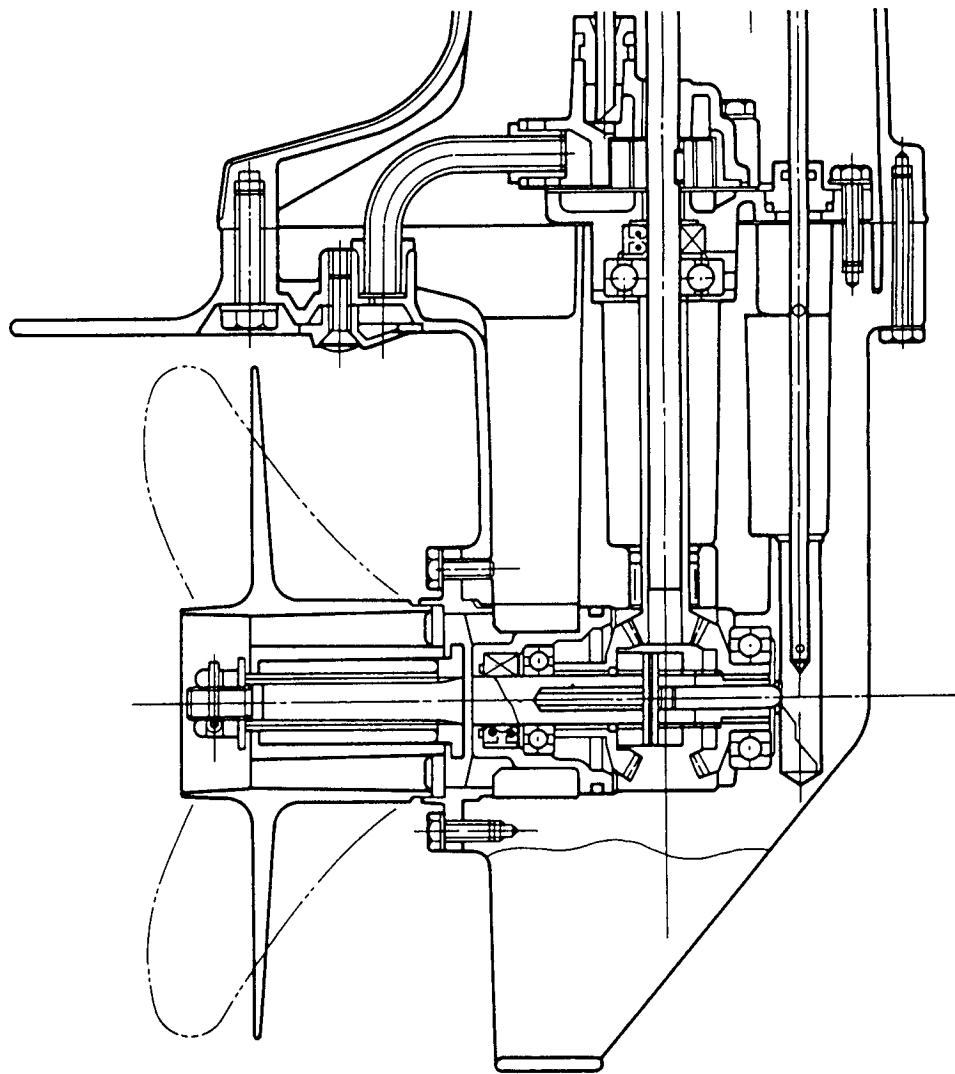
⑧ Check to see if the water pipe guide is fitted to the water pipe at the correct position.

(6) Volume of gear oil required to pour in
195 cc approx. (genuine gear oil)



CHAPTER 5 LOWER UNIT

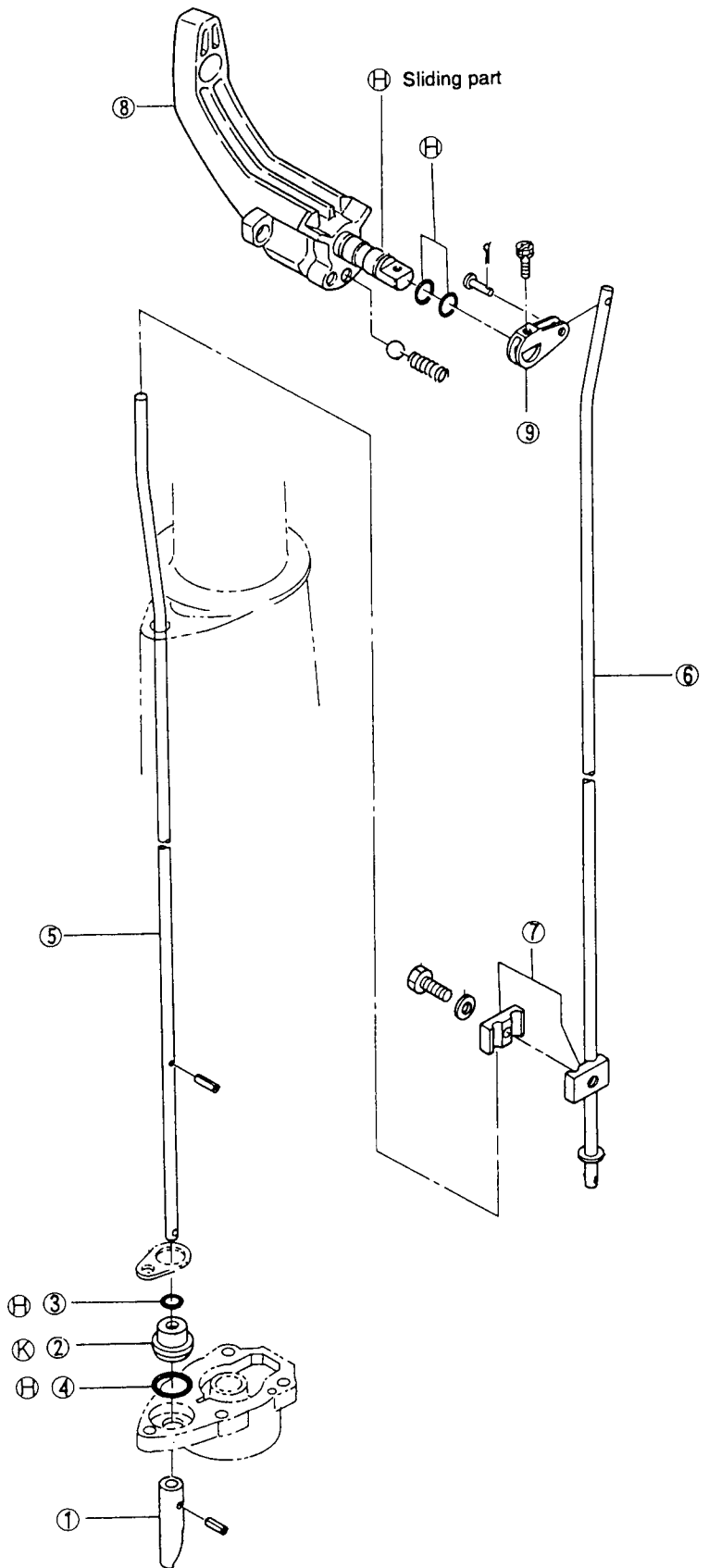
Sectional View of Gear Case Assembly



CHAPTER 5 LOWER UNIT

Gear Shift

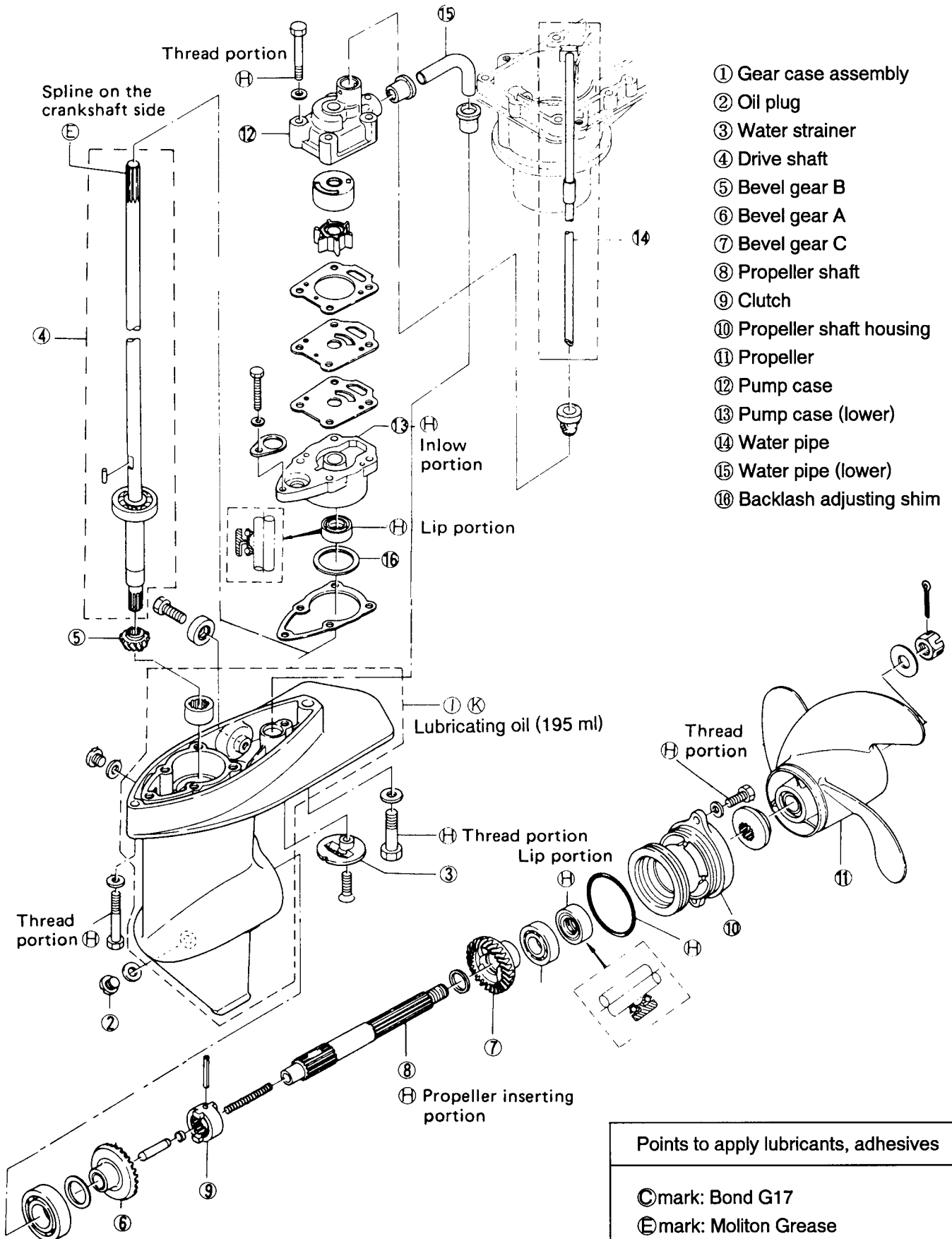
- ① Clutch cam
- ② Cam rod bushing
- ③ O-ring (2.4 – 4.7 mmø)
- ④ O-ring (2.4 – 15.4 mmø)
- ⑤ Cam rod
- ⑥ Shift rod
- ⑦ Shift rod joint
- ⑧ Shift lever
- ⑨ Shift rod lever



Points to apply lubricants
⊕ mark: Genuine grease
⊗ mark: Genuine gear oil

CHAPTER 5 LOWER UNIT

Gear Case, Shaft, Water Pump



- ① Gear case assembly
- ② Oil plug
- ③ Water strainer
- ④ Drive shaft
- ⑤ Bevel gear B
- ⑥ Bevel gear A
- ⑦ Bevel gear C
- ⑧ Propeller shaft
- ⑨ Clutch
- ⑩ Propeller shaft housing
- ⑪ Propeller
- ⑫ Pump case
- ⑬ Pump case (lower)
- ⑭ Water pipe
- ⑮ Water pipe (lower)
- ⑯ Backlash adjusting shim

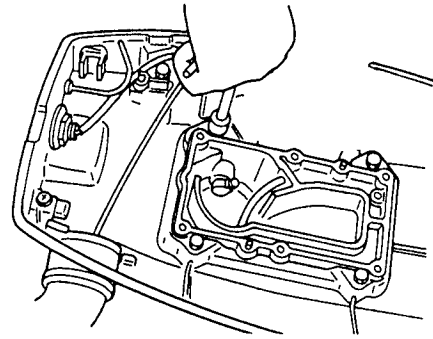
Points to apply lubricants, adhesives	
Ⓒ mark:	Bond G17
Ⓔ mark:	Moliton Grease
Ⓕ mark:	Genuine grease
Ⓖ mark:	Genuine gear oil

CHAPTER 5 LOWER UNIT

4. Disassembling Lower Motor Cover and Drive Shaft Housing

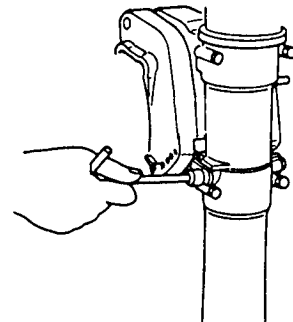
(1) Removing lower motor cover

Remove the lower motor cover fitting bolt (H616-4), and then remove the lower motor cover upwards while holding it by both the sides.

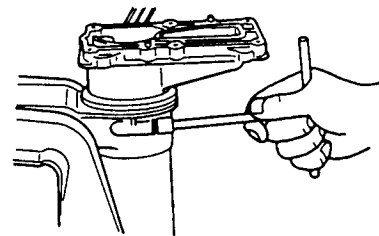


(2) Disassembling swivel bracket, stern bracket

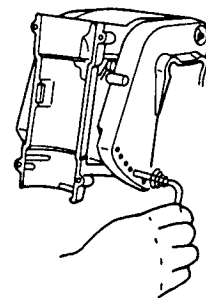
- ① Remove the reverse lock arm fitting bolt (H610-2) and then remove the reverse lock arm, springs R and L.



- ② Remove the swivel bracket fitting bolt (H640-4), and then remove the drive shaft housing, thrust plates (upper, lower) and bushings (upper, lower).

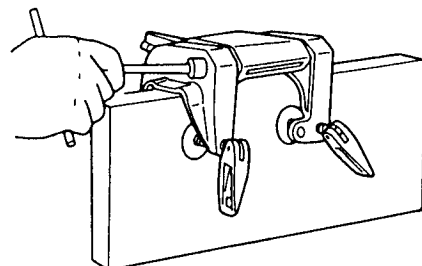


- ③ Pull out the thrust rod.



- ④ Remove the bracket distance plate fitting screw and then remove the distance plate.

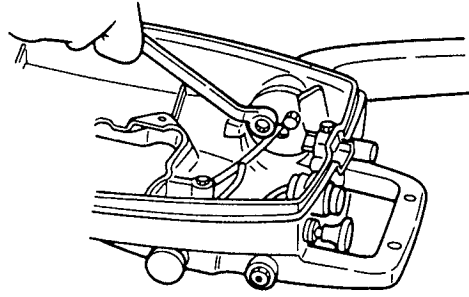
- ⑤ Remove the stern bracket nut and then remove the bracket bolt.



CHAPTER 5 LOWER UNIT

(3) Removing handle

- ① Remove the handle stopper fitting nut (N6-2) first and then remove the handle.



CHAPTER 5 LOWER UNIT

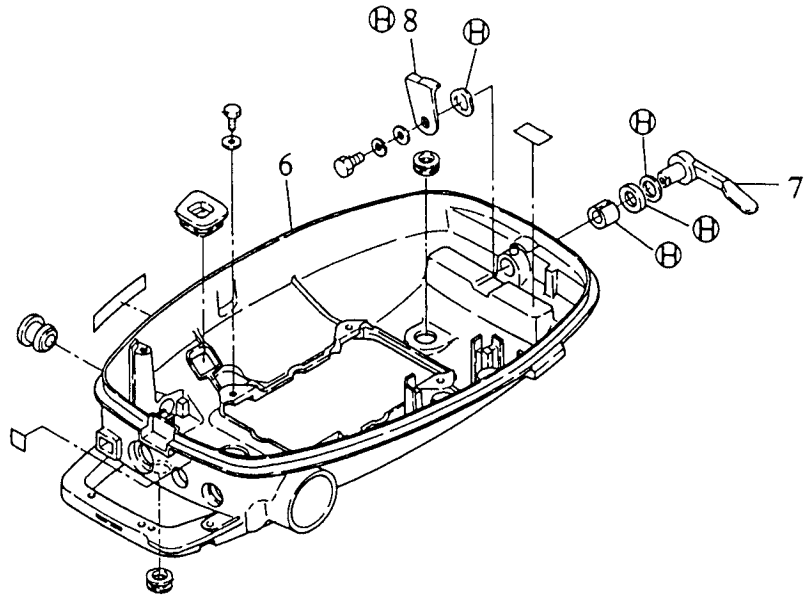
5. Reassembling Lower Motor Cover and Drive Shaft Housing

Reassemble the lower motor cover and drive shaft housing in the reverse order of disassembling. Refer to the figure.

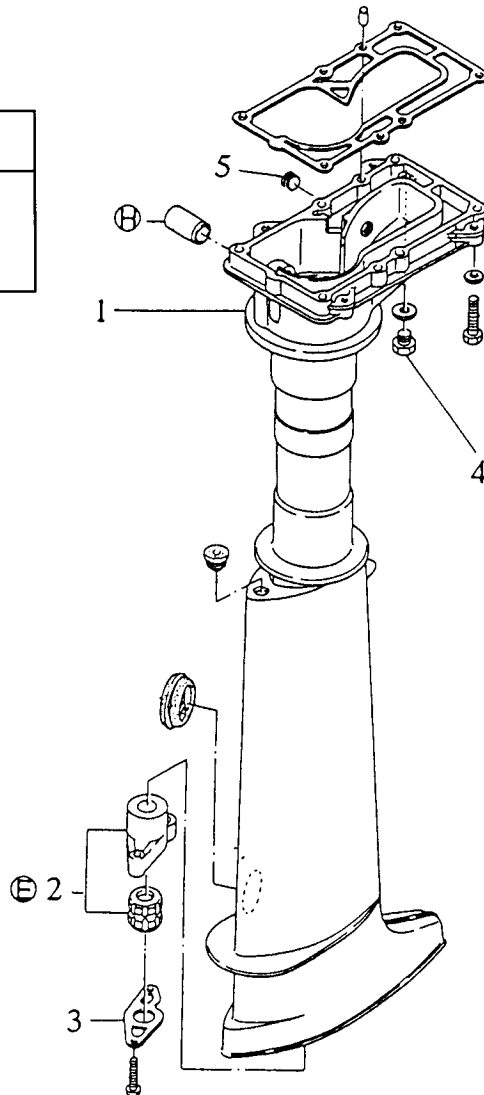
CHAPTER 5 LOWER UNIT

Drive Shaft Housing, Gear Case, Motor Cover

- 1 Drive shaft housing
- 2 Drive shaft bushing (L & UL only)
- 3 Drive shaft bushing stopper (L & UL only)
- 4 Water plug
- 5 Exhaust plug
- 6 Motor cover, lower
- 7 Hook lever
- 8 Cover hook

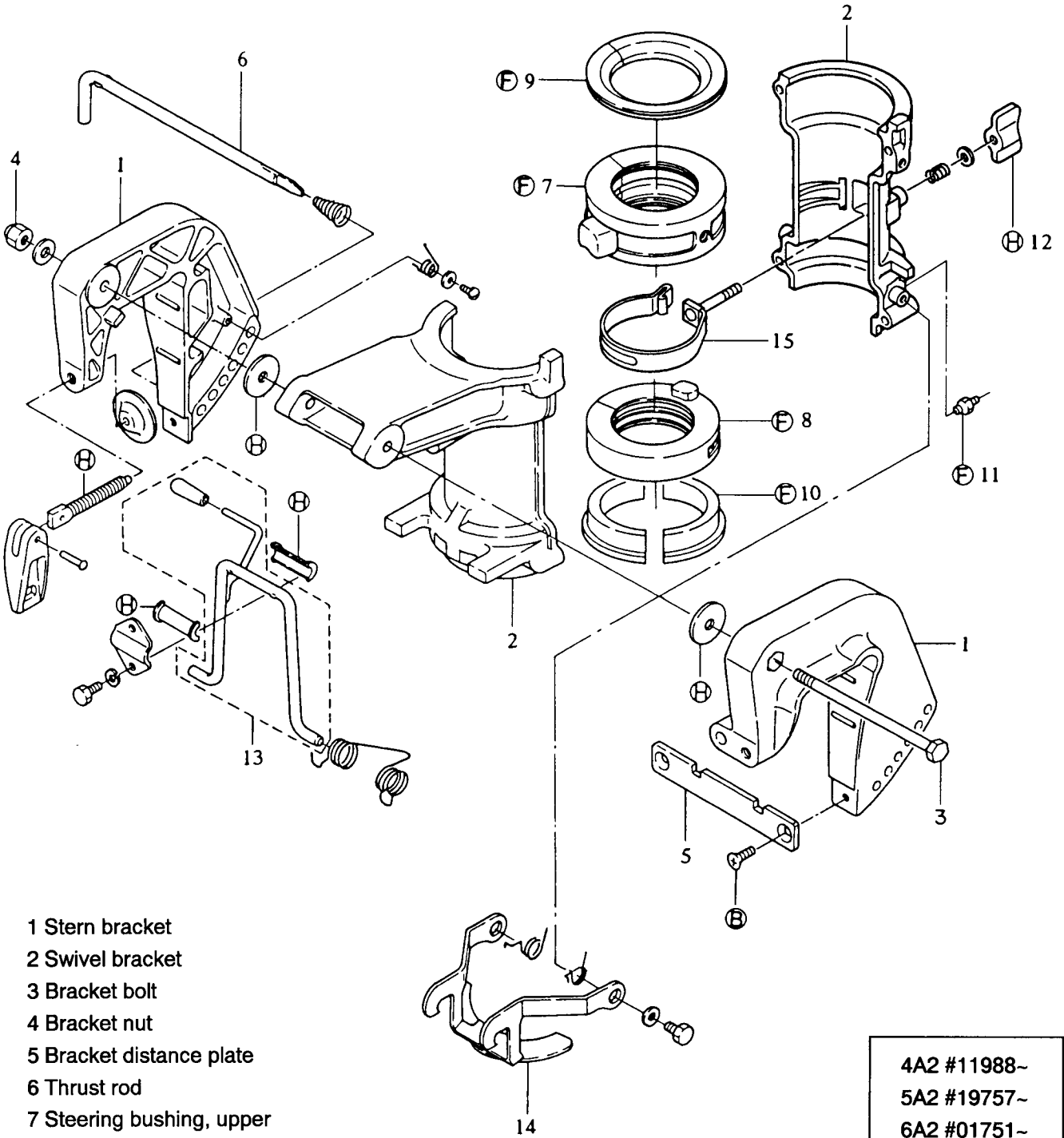


Points to apply lubricants
⊕ mark: Genuine grease
⊖ mark: Moliton Grease



CHAPTER 5 LOWER UNIT

Bracket, Reverse Lock



- 1 Stern bracket
- 2 Swivel bracket
- 3 Bracket bolt
- 4 Bracket nut
- 5 Bracket distance plate
- 6 Thrust rod
- 7 Steering bushing, upper
- 8 Steering bushing, lower
- 9 Thrust plate
- 10 Thrust plate B
- 11 Grease nipple
- 12 Wing nut
- 13 Tilt stopper assembly
- 14 Reverse lock arm
- 15 Friction band

4A2 #11988~
 5A2 #19757~
 6A2 #01751~

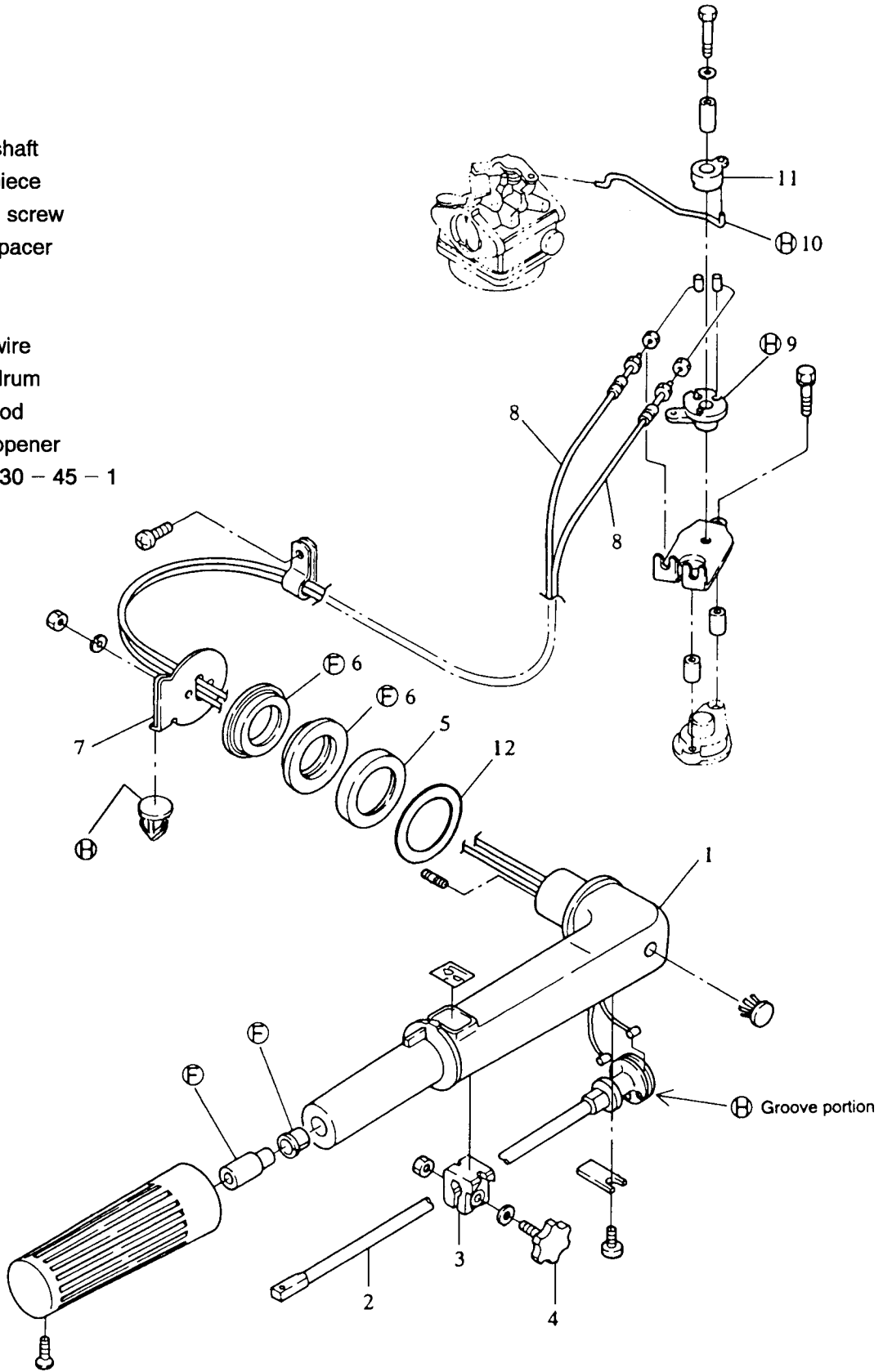
Points to apply lubricants, sealants

ⓑ mark: Three Bond 1107
 ⓕ mark: Rubber grease
 ⓓ mark: Genuine grease

CHAPTER 5 LOWER UNIT

Handle and Throttle

- 1 Handle
- 2 Throttle shaft
- 3 Friction piece
- 4 Adjusting screw
- 5 Handle spacer
- 6 Bushing
- 7 Stopper
- 8 Throttle wire
- 9 Throttle drum
- 10 Throttle rod
- 11 Throttle opener
- 12 Washer, 30 - 45 - 1



Points to apply lubricant
ⓔ mark: Rubber grease
Ⓜ mark: Genuine grease

CHAPTER 5 LOWER UNIT

Installation and Adjustment of Throttle Wire

Throttle wire installation

Take care not to mix up each wire for slow speed and high speed.

Slow speed wire

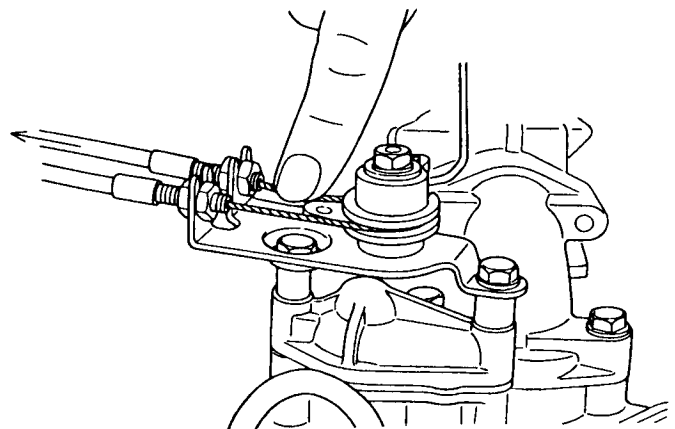
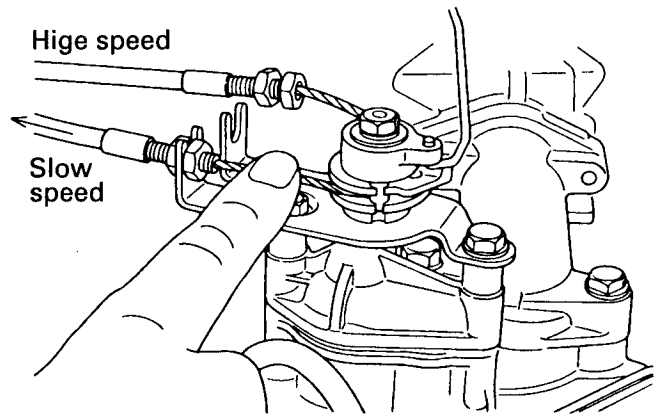
1. Turn the throttle grip into fully closed position. Pull the choke knob fully to the "ON (Closed)" position.
2. While pulling out wire of slow speed wire so as to remove any slack from the inner wire, tighten the nut to fix the slow speed wire to the Bracket, throttle wire.

〈Important Hint for Perfect Adjustment〉

Push the inner wire by your finger to check the tension of it. About 1 mm slack at the mid point of the inner wire is the best.

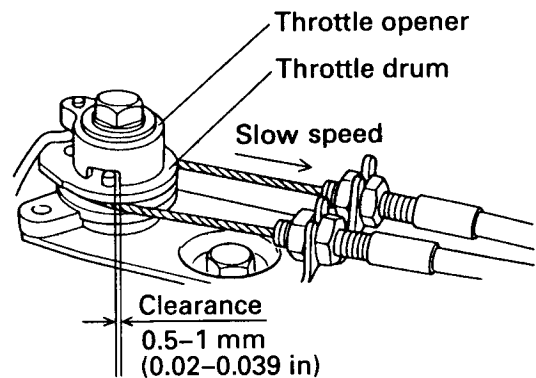
High speed wire

Proceed to install the high speed wire as same manner as the slow speed wire show above.



Position of throttle drum and throttle opener

1. Push the choke knob fully into the "OFF (Open)" position.
2. Confirm the throttle grip if it is in the fully closed position.
3. The clearance between throttle drum and throttle opener shall be 0.5 – 1.0 mm (0.02 – 0.039 in) as shown in the illustration.



WOT position

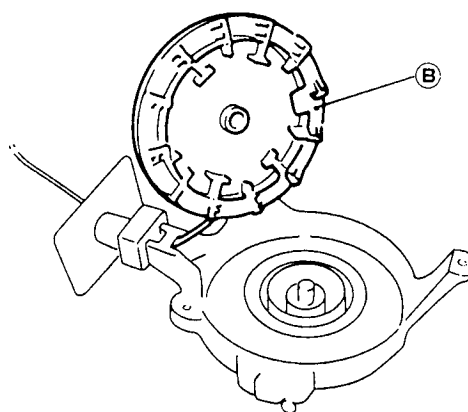
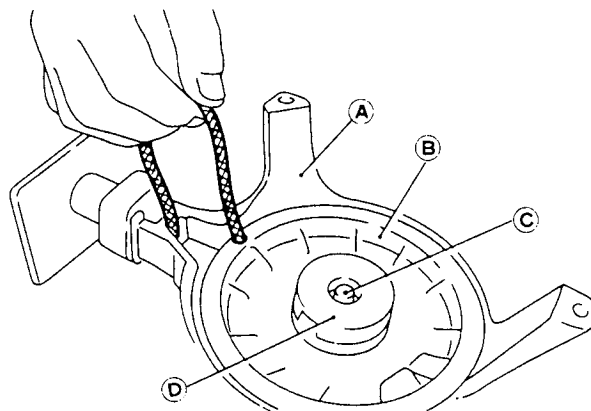
Confirm if the throttle lever of carburetor touches to its stop when the throttle grip is fully opened.

CHAPTER 6 RECOIL STARTER

1. Disassembling

- ① Remove the rope from the starter handle. While holding the starter case (A) and reel (B), turn the reel (B) gently to rewind the starter spring for getting it loose.
 - Loosen the starter shaft bolt (C) and remove it, then remove the friction plate (D). Moreover, remove the following parts.
 - Friction spring
 - Ratchet
 - Return spring
- ② While turning the reel (B) in the coiling direction, lift it upwards for removing.

Note: Carefully lift the reel (B) up because the starter spring may vigorously break out of the spring case.



2. Reassembling

Reassemble the recoil starter in the reverse order of the disassembling with care attention to the following points.

- When resetting the starter spring in the starter spring case, engage the end hook of the starter spring with the notch on the starter spring case while holding the spring with the end hook rightwards.
- When coiling up the starter spring, turn the reel counterclockwise (in the direction to pull the rope). After the spring is entirely coiled up, continue to turn the reel by a quarter to one and a quarter turn before fixing the spring.

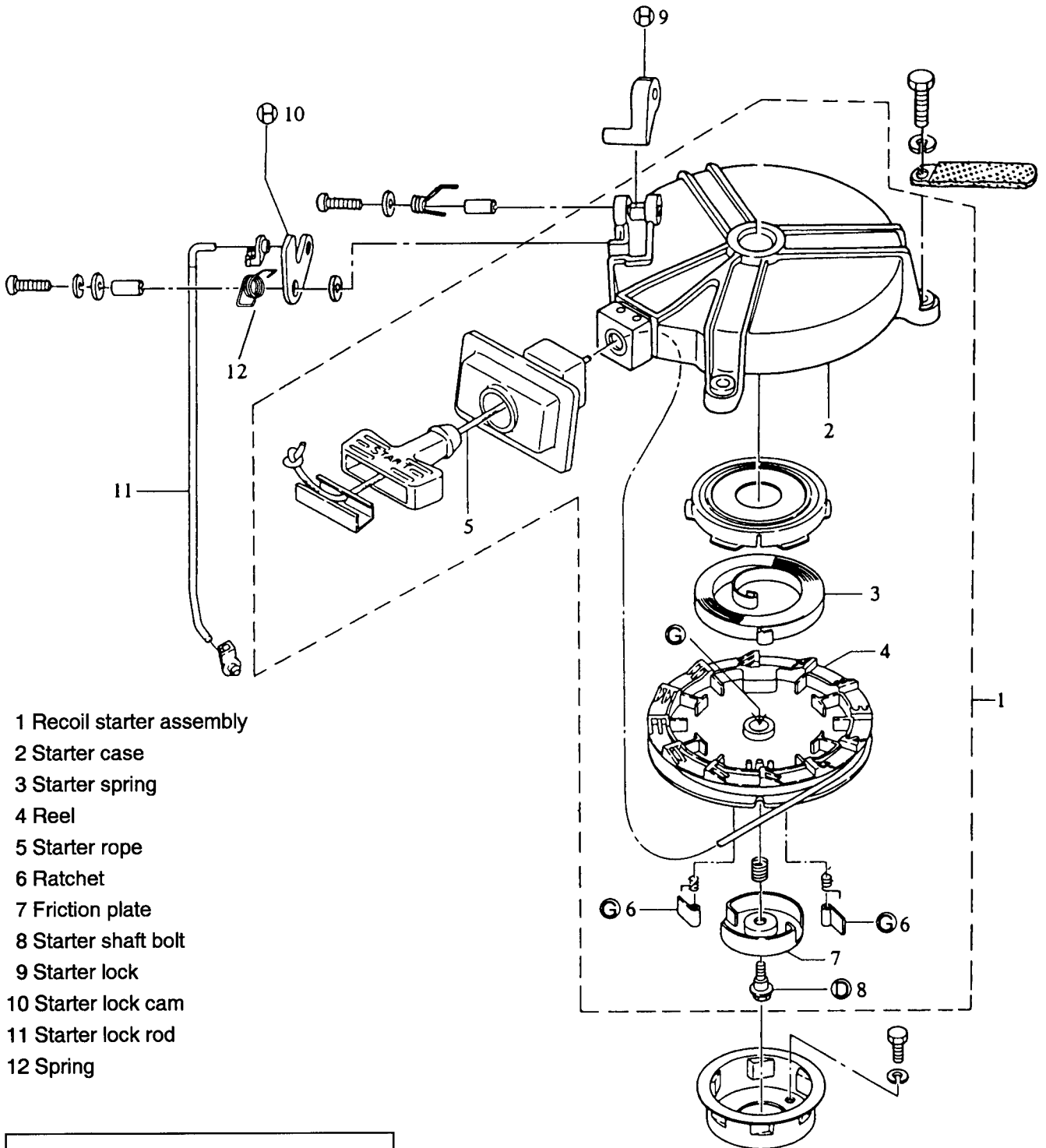
After the outboard motor is completely reassembled, operate the shifting lever to check to see if the shifting lever is locked at all positions except the neutral position.

- Apply cold-resistant grease to both ends of the starter spring, starter shaft bolt and friction plate.
- Tighten the starter shaft bolt with the specified torque of 3.5 – 4 N – m (0.35 – 0.40 kg – m).
- Apply Three Bond 1342 to the thread of the starter shaft bolt.

Note: If the starter lock rod is deformed, it does not work correctly. Be careful not to bend it by hand, etc.

CHAPTER 6 RECOIL STARTER

Recoil Starter, Starter Lock



- 1 Recoil starter assembly
- 2 Starter case
- 3 Starter spring
- 4 Reel
- 5 Starter rope
- 6 Ratchet
- 7 Friction plate
- 8 Starter shaft bolt
- 9 Starter lock
- 10 Starter lock cam
- 11 Starter lock rod
- 12 Spring

Points to apply lubricant, adhesives

- Ⓧ mark: Three Bond 1342
- Ⓞ mark: Cold-resistant grease,
Moliton Grese
- Ⓢ mark: Genuine grease

CHAPTER 7 CARBURETOR AND FUEL PUMP

1. Carburetor

CAUTION

Fire and extreme heat are strictly prohibited through disassembly and reassembly of the carburetor.

Cleaning manner: After washing the carburetor with wash liquid, dry it by air blow.

Throttle stop screw

Adjustment:

- Tightening the screw increases engine speed.
- Loosening the screw reduces engine speed.

Carburetor body

Note: Assemble after cleaning.

Main nozzle

Inspection:

- Check to see if there is any clogging in the main nozzle.

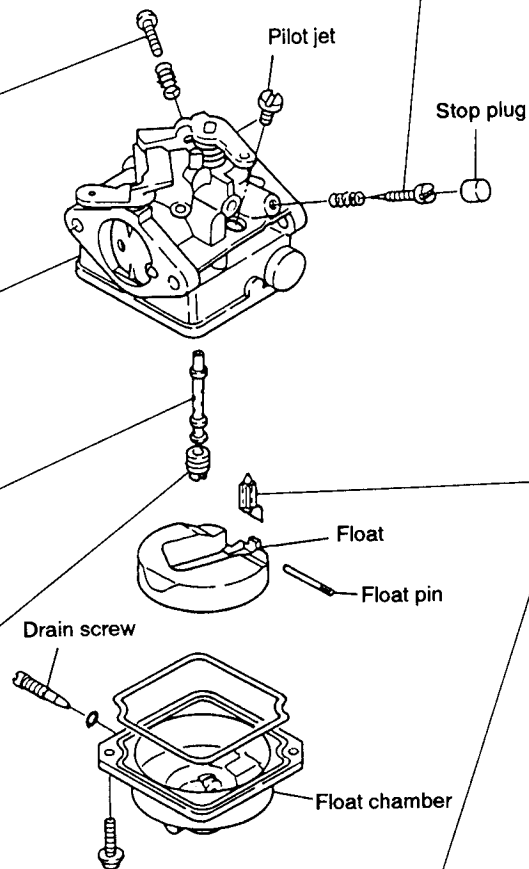
Main jet

Inspection:

- Check to see if there is any clogging in the jet hole.

Pilot screw

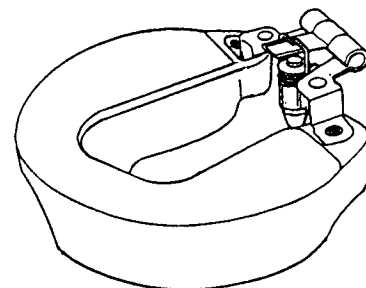
Note: Unadjustable because it is fixed.



Float valve

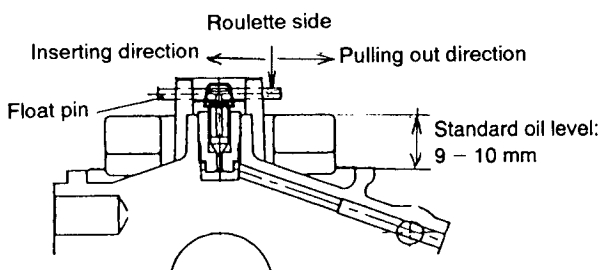
Inspection:

- Wear of the float valve in the contact plane to the seat.
 - Wear in the float arm that contacts the float valve.
- Note: Engage the float valve wire with the float arm.



Oil level adjustment: Adjustable by bending the float arm.

Float pin: Pay heed to the inserting/pulling out direction.



CHAPTER 7 CARBURETOR AND FUEL PUMP

2. Fuel pump

CAUTION

Fire and extreme heat are strictly prohibited through disassembly and reassembly of the fuel pump.

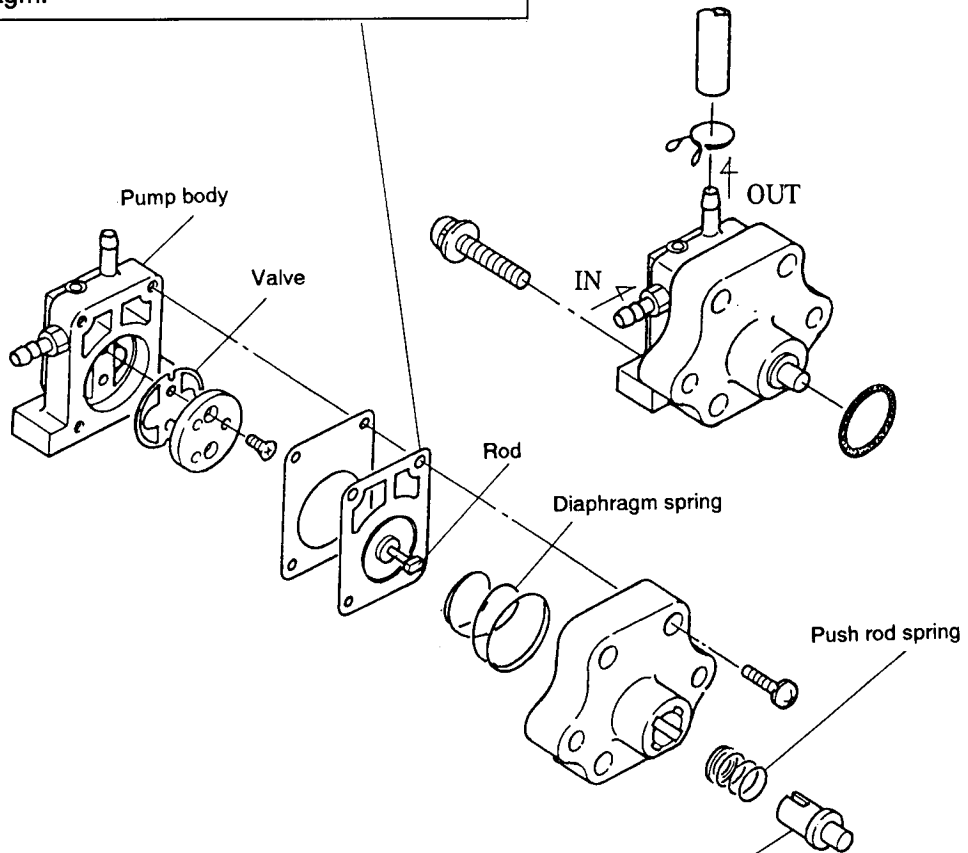
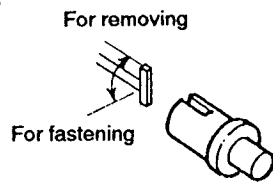
Diaphragm

Disassembling:

Turn the diaphragm clockwise or counterclockwise to set the foot of the diaphragm in parallel with the groove of the push rod, then remove the diaphragm.

Inspection:

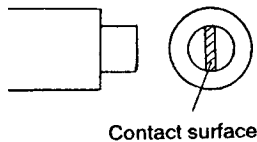
- Check to see if there is no burst, crack, swelling in the diaphragm.



Push rod

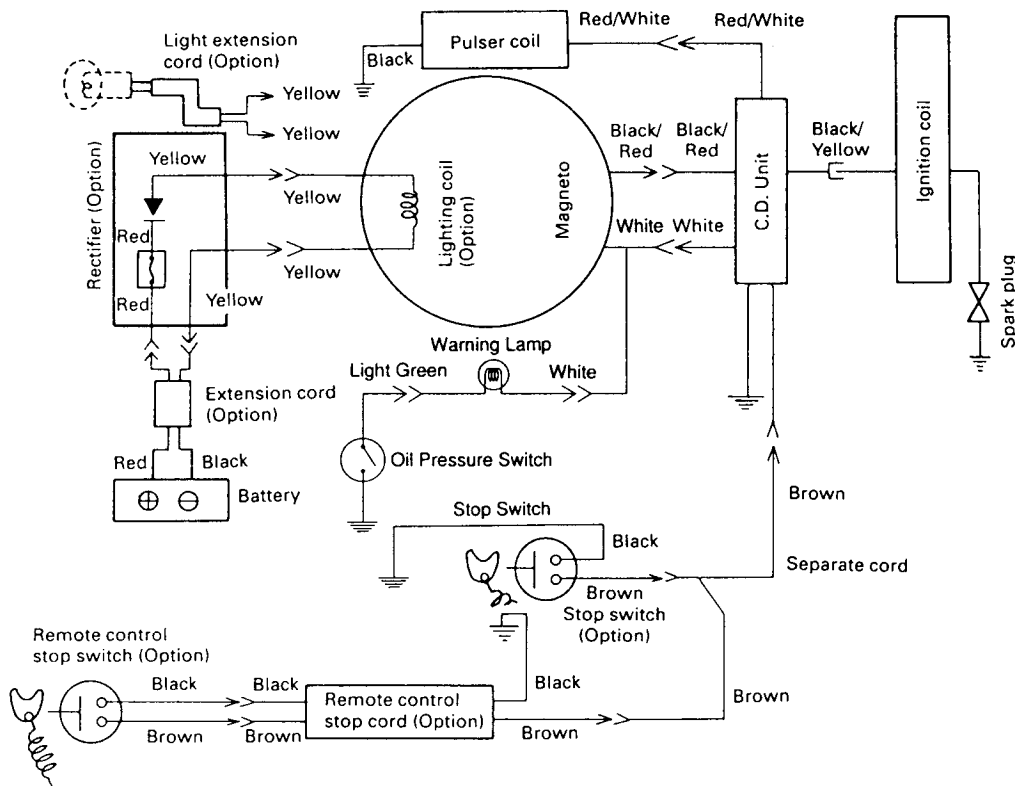
Inspection:

- Wear in the slipper surface
- If there is wear, even if it is a little, replace the push rod.
- Note: After reassembling, push the push rod by finger to check to see if it moves smoothly.



CHAPTER 8 ELECTRICAL SYSTEM

1. Electric Circuit



2. Inspection

1) Flywheel

The flywheel has no need of general inspection, however, pay heed to the following points through servicing the electrical system.

- Since the flywheel magnet is fixed by glue, carefully handle it following the notes appearing below.

Notes:

- When mounting/dismounting the flywheel on/from the engine, be careful not to apply any shock to it such as tapping by a hammer.
- When dismantling the flywheel from the engine, don't use any general tool available on the market but use the specified tool only.
- Be careful not to get the flywheel falling down. If it is dropped, precisely check it for deformation and crack.

- If the periphery of the flywheel is scratched or damaged, its firing performance may deteriorate because the pulser coil is fitted to near the periphery of the flywheel.

2) Exciter coil, pulsator coil, ignition coil

	Normal resistance R (Ω) (Tolerance: $\pm 20\%$)	Terminals to connect tester
Exciter coil	119	Black – Red & White
Pulser coil	186	Red – White & Earth (Black)
Lamp coil	0.39	Yellow – Red & Yellow – Red

Note: Since the pulser coil incorporates the magnet inside, pay careful attention to keep it away from iron powder.

* Ignition coil

Primary coil – Between Black – Yellow cord and core: 0.02 – 0.38 Ω

Secondary coil – Between high tension cord and core: 3,000 – 4,400 Ω

CHAPTER 8 ELECTRICAL SYSTEM

3) C.D. unit (mark CU2568)

- Check to see if there is neither breakdown nor disconnection in the wire harness and terminals.
- Check connections and resistances referring to the following table that shows standard values.

		Positive ⊕ terminal of tester					
		Brown Stop	Red – White Pulser	Black (LE106) Ground	Black – Red Exciter	White Exciter	Black – Yellow IG coil
Negative ⊖ terminal of tester	Brown Stop		OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)
	Red – White Pulser	ON (17kΩ approx.)		ON (1.8kΩ approx.)	ON (7kΩ approx.)	ON (6.5kΩ approx.)	CON (∞)
	Black (LE106) Ground	ON (13kΩ approx.)	ON (1.8kΩ approx.)		ON (4kΩ approx.)	ON (4kΩ approx.)	CON (∞)
	Black – Red Exciter	ON (4kΩ approx.)	CON (2MΩ approx.)	CON (2MkΩ approx.)		CON (2MkΩ approx.)	CON (∞)
	White Exciter	CON (170kΩ approx.)	CON (21kΩ approx.)	CON (17kΩ approx.)	CON (48kΩ approx.)		CON (∞)
	Black – Yellow IG coil	ON (40kΩ approx.)	ON (6.5kΩ approx.)	ON (4kΩ approx.)	ON (13kΩ approx.)	ON (13kΩ approx.)	

Notes:

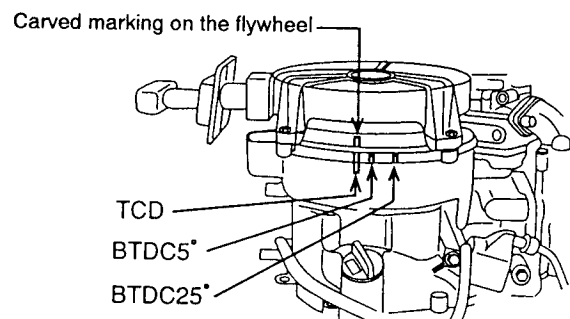
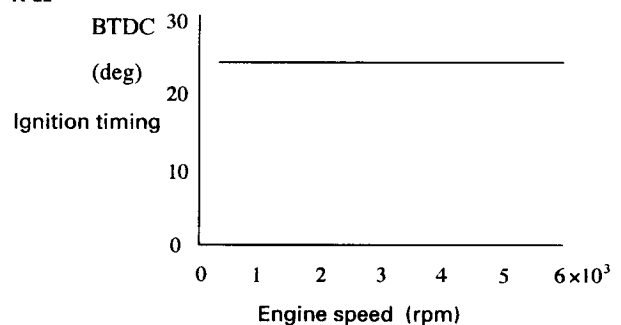
- When measuring the item marked with "CON", shortcircuit the Black – Yellow wire and Black wire (LE106) beforehand.
- Since the value marked with "CON" is the capacitor characteristic, it becomes stable with the value shown in parentheses after the tester pointer shakes once.
- The (∞) marked with "CON" indicates a minute value because the tester pointer shakes a little.
- Measuring condition: Tester used: HIOKI 3030, Range: 1 k Ω
- The values shown in the table are just standards, and it is difficult to obtain accurate values.

4) Manner to check ignition timing

The magneto employs the fixed ignition advance system that no advances ignition timing with increase of engine speed.

While running the engine, check ignition timing with the timing light.

There are three carved markings (TDC, BTDC 5°, BTDC 25°) on the cylinder side. Check the ignition timing while observing the position of the carved marking on the flywheel.

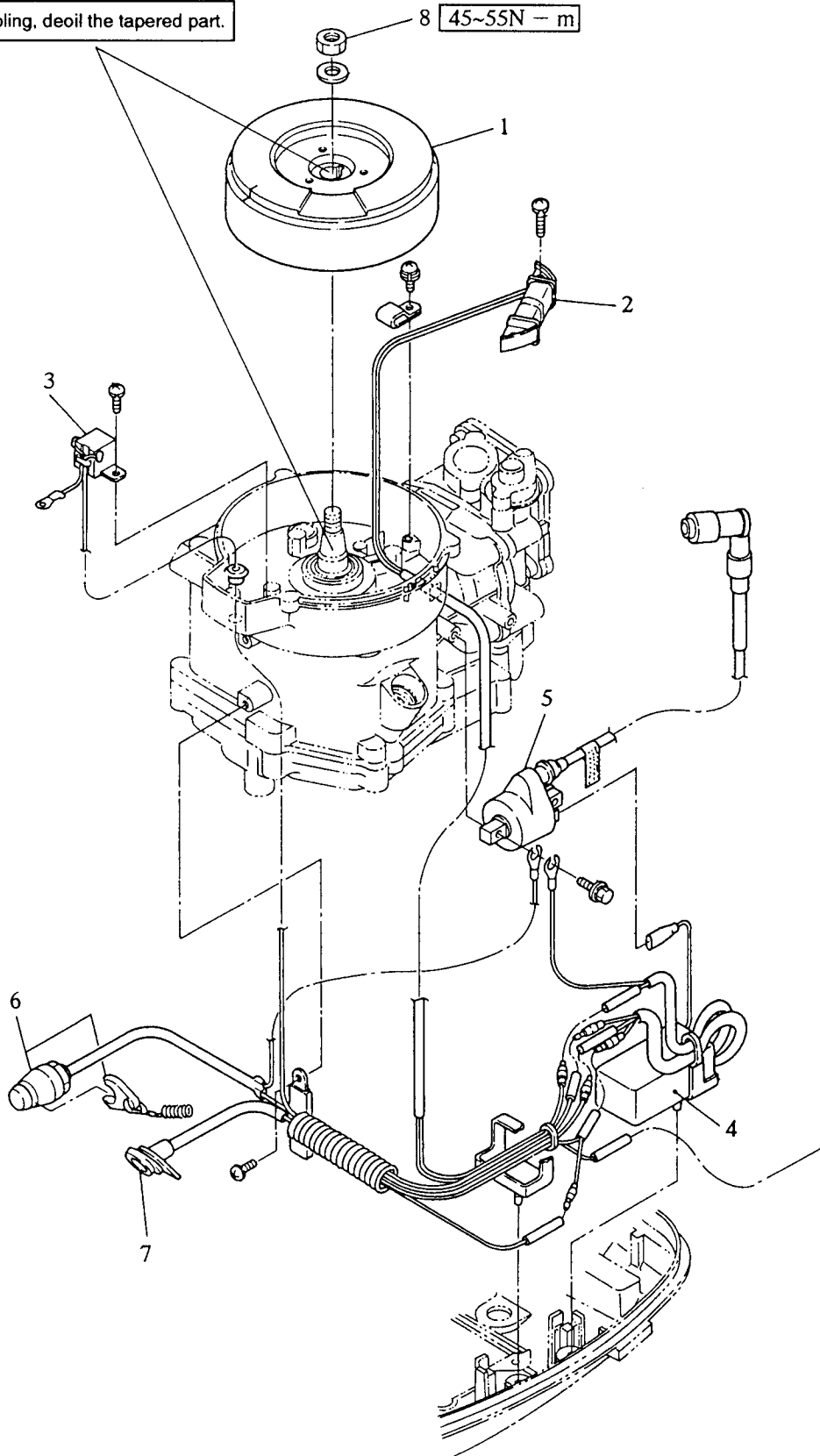


CHAPTER 8 ELECTRICAL SYSTEM

Magneto

Note: On reassembling, deoil the tapered part.

- 1 Flywheel cup
- 2 Exciter coil
- 3 Pulser coil
- 4 C.D. unit
- 5 Ignition coil
- 6 Stop switch
- 7 Warning lamp
- 8 Nut, 12P1.25



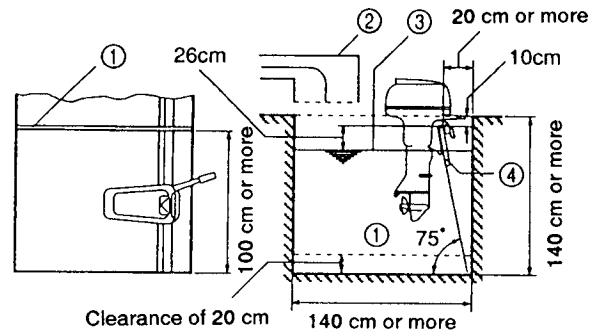
CHAPTER 9 TEST RUN AND INSPECTION AFTER COMPLETE ASSEMBLY

1. Test Run Tank and Test Propeller

● Requirements for the test run tank

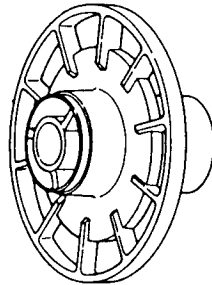
- ① Partition (in case of a test run tank for two machines)
- ② Ventilation duct
- ③ Water level
- ④ Transom board

- The test run tank must have the measurements specified in the figure at least.
- If two outboard motors are set in the test run tank for two or more motors, the minimum measurements required for a motor must be secured by a fixed partition.



● Test propeller

Outer diameter: 164 mm \varnothing
Depth: 9.5 mm



● Notes on test run tank

- If test run is continuously performed in the same tank, always pay heed to the water temperature not to raise it to 25 °C or more, because continuous operation raises the water temperature and high water temperature may cause engine seizure. If possible, use a water cooling equipment to keep the water temperature constant or continuously add fresh water to the tank to lower the water temperature.
- If the same water is used for tests many times, the water not only is soiled but may cause poor cooling of the engine because waste matters accumulating in the water stick to the cooling surface of the engine. Keep the water fresh for every test without fail.
- If the engine continues running for a considerably long time, exhaust gas collects around the outboard motor and the carburetor supplies mixture containing the exhaust gas. If worst comes to worst, such exhaust gas may cause engine failure. Therefore, it is important to discharge exhaust gas forcibly out of the test run tank and keep the tank and its surroundings well – ventilated.
- Since the water in the tank frequently splashes, keep the water level high as shown in the figure.

2. Inspection

● Items to be checked before test run

- Condition of the fuel pipe line
- Operation of the shifting lever
- Electric wiring, connection and wire clamp condition
- Operation of reverse lock and its locking condition

CHAPTER 9 TEST RUN AND INSPECTION AFTER COMPLETE ASSEMBLY

● **Items to be checked during test run**

While idling the engine, check the following items.

- Fuel leak from parts joined spots of the engine.
- Cooling water leak from parts joined spots of the engine.
- Extraordinary noise
- Idle speed and stable idling
- Operation of the stop switch
- On/off operation of the engine oil warning lamp
 - Off: The lamp goes out as the engine starts.
 - On: The lamp goes on when the lead wire of the oil pressure switch is grounded to the body.
- Operation of the clutch
- Engine speed at acceleration and deceleration
- Cooling water discharge condition (Cooling water must vigorously be discharged from the water inspection hole.)

● **Additional tightening after test run**

Check the tightening condition of respective bolts and nuts after test run, and additionally tighten them with the specified tightening torque.

● **Break-in**

When any of the piston, piston ring, piston pin, crank shaft, connecting rod, cylinder, inlet/exhaust valve, etc. is replaced, perform a break-in of the engine for fitting the sliding surfaces.

Note: Perform a break-in of the engine according to the following standards.

Break-in period 10 hours

Minutes and hours	0	10 minutes	2 hours	3 hours	10 hours
Break-in manner	Trolling or idling	Half or less throttle opening, 3,000 rpm approx.	Three-quarter or less throttle opening, 4,000 rpm approx.	Three-quarter throttle opening, 4,000 rpm approx.	Normal running

▽
Navigation at the lowest speed

▽
Full throttle running for about 1 minute at 10 – minutes intervals

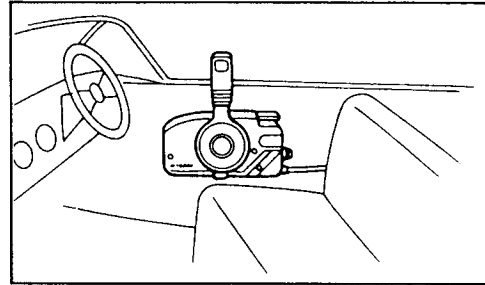
▽
Full throttle running for a short time

CHAPTER 10 OPTIONAL PARTS

1. Remote Control System (5A2 • 6A2)

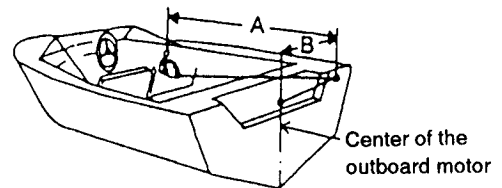
(1) Location of remote control box

Determine a proper spot to install the remote control box after checking that there is nothing to interfere with operation of the remote control lever as well as arrangement of the remote control cable.



(2) Determination of length of remote control cable

Since the cable length depends on the size of the boat, measure the distance between A and B after determination of the location of the remote control box, and add 300 mm (1 foot) to the measured length to decide the cable length.

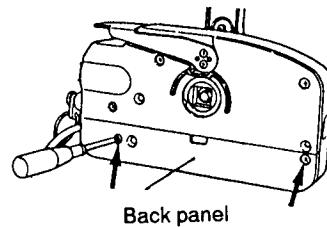


$$\text{Standard length} = (A + B) + 300 \text{ (mm)}$$

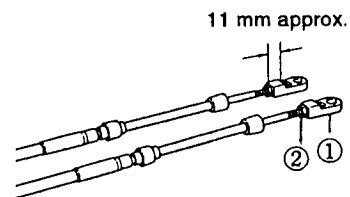
Note: Don't curve the remote control cable into an arc of 406 mm (16 inches) or less radius. If the cable is curved into a sharper arc, the control lever is heavy to operate and the service life of the cable is shortened.

(3) Installing remote control cable (control box side)

① Loosen the two back panel fitting screws and remove the back panel.

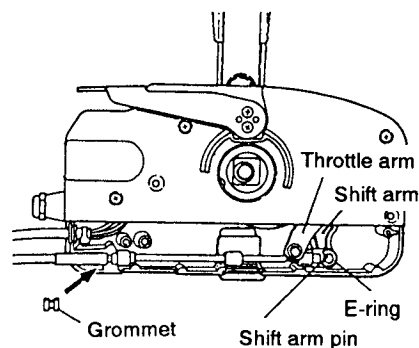


② Screw the terminal eye ① into the remote control cable by about 11 mm in depth, and lock the terminal eye with the nut ② to prevent it from turning.



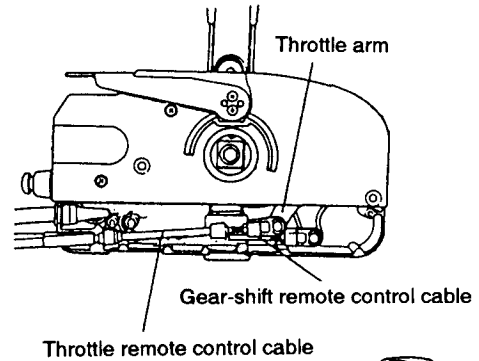
③ Insert the outer groove of the remote control cable for gear-shift into the groove of the housing clamp. Next, put the terminal eye on the pin at the end of the shift arm and fix them with the E-ring.

④ Insert the grommet supplied as an accessory of the remote control box into the groove of the clamp.

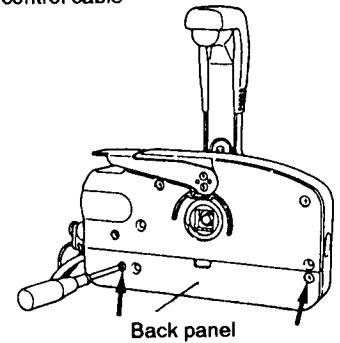


CHAPTER 10 OPTIONAL PARTS

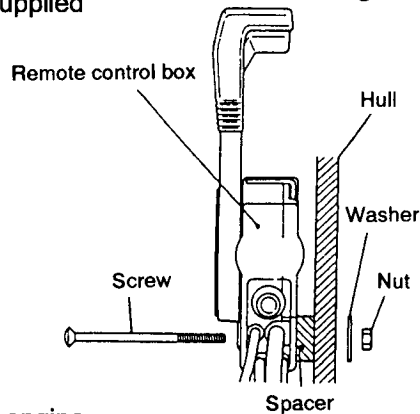
- ⑤ Connect the remote control cable for throttle control to the throttle arm in the same manner as the gear – shift remote control cable.



- ⑥ Restore the back panel to the remote control box.

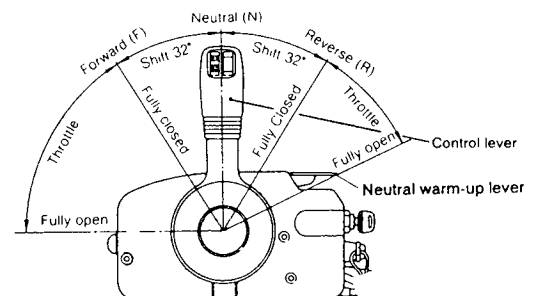
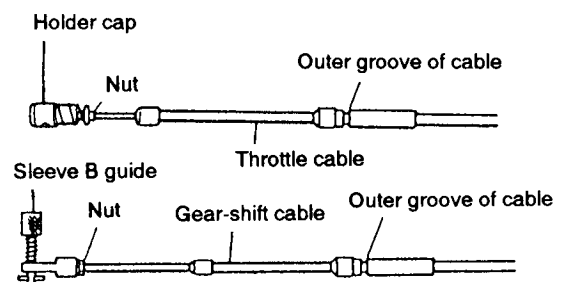


- ⑦ Fit the remote control box to the determined spot with the screws, spacers, washers and nuts (3 pcs. each) supplied as accessories of the remote control box.



(4) Installing the remote control cable (engine side)

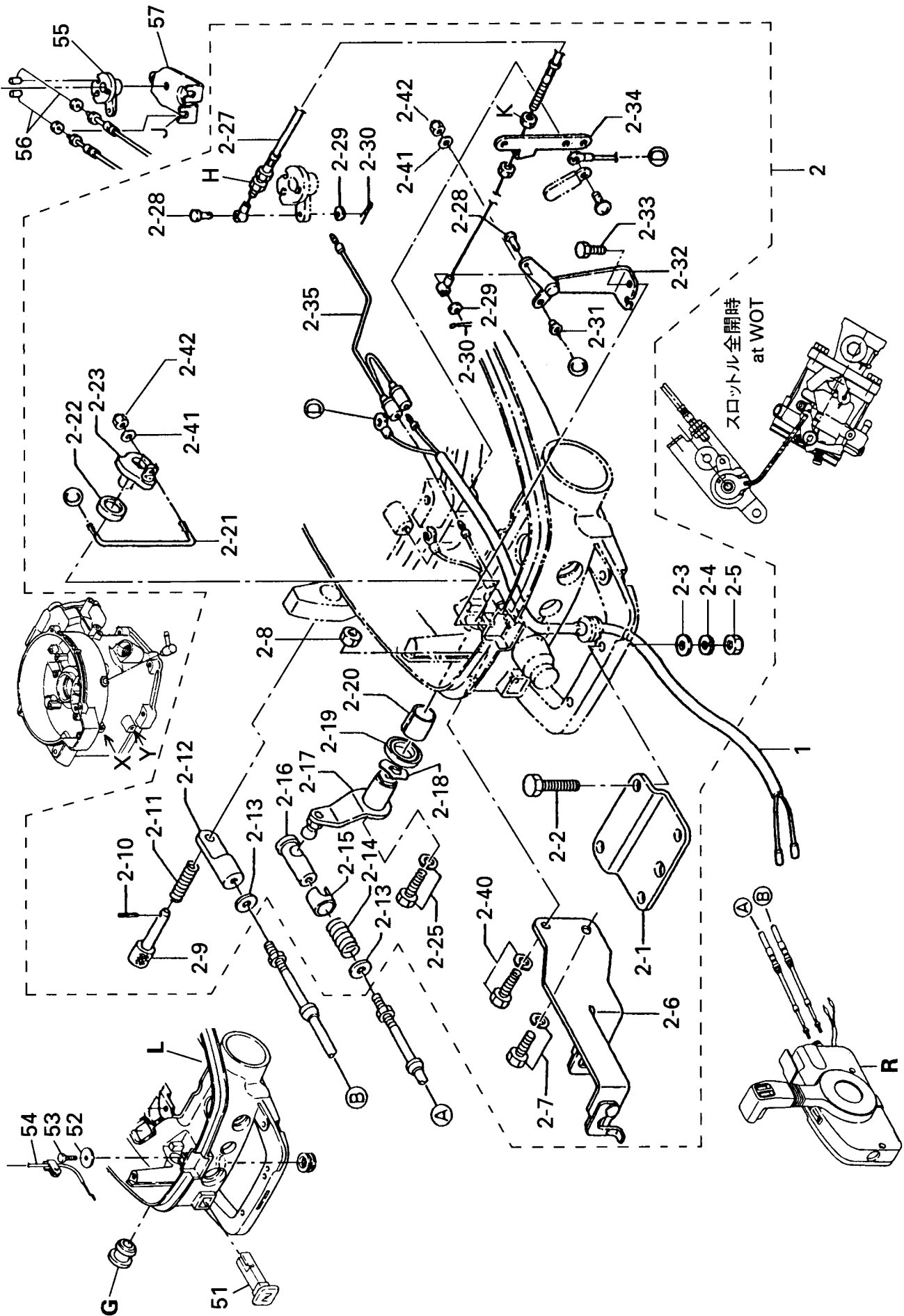
- ① Before installing the remote control cable in the engine side, fit the optional fitting parts as shown in the figure on the next page.
- ② Fitting holder cap and sleeve B guide
- Throttle side: Fit the holder cap to the end of the cable and fix it with the nut.
 - Gear-shift side: Fit the sleeve B guide to the end of the cable and fix it with the nut.
- ③ Installing the remote control cable in the engine side
- Throttle side:
Insert the outer groove of the throttle control cable into the cable clip and join the holder cap at the end of the cable and ball joint of the throttle lever to each other.
 - Gear-shift side:
Press the lock pin of the sleeve B guide at the end of the cable into the hole on the shift lever, and turn it at an angle of 90° to lock it. Then, insert the outer groove of the cable into the cable clip.



Note: Through the installation work, set the control lever at the neutral position and the neutral warm-up lever at the closed position.

CHAPTER 10 OPTIONAL PARTS

Fitting parts for remote control



CHAPTER 10 OPTIONAL PARTS

Assembling Remote Control Parts (5A2 • 6A2)

In regard to assembling remote control fitting parts (Kit part: in dotted line of Ref. No. 2 of the attached figure), take the following procedures referring to the attached figure.

- 1 Remove throttle lever grommet (G) from lower motor cover (L) and install steering hook plate (I)
- 2 Install throttle link rod (21) to throttle link lever ass'y (23).
Tighten M3 nylon nut (42) with washer (41) to secure throttle link rod.
At this time, adjust the tightness of the nylon nut so that the link rod moves smoothly without any loose-fitting.
Install collar (22) to the shaft of the throttle link lever ass'y (23).
- 3 Install wave washer (18), throttle lever seal ring (19) and throttle lever bushing (20) onto the shaft of throttle lever A ass'y (17). At this time, apply the genuine grease or equivalent on the inside and outside of the bushing.
- 4 On the condition as above, put throttle lever A ass'y (17) into the lower motor cover (L) and install throttle link lever ass'y (23) from the inside of lower motor cover by tightening bolt (25).
When tightening the bolt, mark sure that throttle lever A ass'y (17) and throttle link lever ass'y (23) are in meshed condition, properly.
- 5 Remove bolt (53) and washer (52). Scrap the washer (52). Install throttle link ass'y (32) to the lower motor cover (L) with the same bolt (53), and at the same time, fix the end of choke wire (54).
- 6 Connect throttle link rod (21) to throttle link ass'y (32).
Put rod bushing (31) into the hole (C) of throttle link ass'y and then, put the throttle link rod into the rod bushing. After that, fit throttle link rod and tighten M3 nylon nut (42) with washer (41).
REMARK Adjust tightness of the nylon nut so that the link rod moves smoothly without any loose-fitting
- 7 Remove two throttle wires (56) installed between steering handle and throttle drum (55).
- 8 Remove two screws 612 (X & Y) which are fitting the clamp at the front-side of cylinder.
Install throttle wire bracket (34) with two screws 612 removed just before.
At this time, the clamp that was secured by screw (Y) must be installed together.
(The clamp that was secured by screw (X) should not be installed.)
- 9 Install throttle wire (27) for remote control. Install the longer outer tube screw to the part (J) of throttle wire bracket (57) which is carburetor side. Put throttle wire pins (28) into the each hole of throttle drum (55) and throttle link ass'y (32) with getting through the both ends of throttle wire for remote control.
Set washer (29) and split pin (30) through the throttle wire pin at the both ends of the throttle wire and bend the split pin.

CHAPTER 10 OPTIONAL PARTS

- 10 Properly adjust the length of the throttle wire (27) for remote control as follows. At first, fix the throttle wire (27) position on the throttle wire bracket (34).

Fix the position of the nut (K) so that the nut (K) is completely screwed in. Then, turn throttle lever A ass'y (17) fully to forward. (This is the fully opened throttle position.)

At this time, adjust the position of the nut (H) of the throttle wire (27) at throttle wire bracket (57) side so that the carburetor throttle valve is fully opened.

If the carburetor throttle valve is not fully opened even after the nut (H) is moved to the end of the outer tube, move the position of the wire to carburetor side by adjusting nut (K) of throttle wire bracket (34) and adjust the position of the nut (H) again.

After fixing the position, tighten the nut and make sure whether carburetor throttle valve can be fully opened and closed by operating throttle lever A ass'y (17) again.

Make sure if there is any deformation of the lever and linkage because of the excessive stress.

- 11 Install cable clip ass'y (6) to lower motor cover (L) with bolts (78, 40) and nut (8).
- 12 Install sleeve guide ass'y (9 – 13) to remote control cable (B) of shift side and ball holder ass'y (13 – 16) to the remote control cable (A) of the throttle side.

REMARK) Distinguishing difference of throttle side and shift side of remote control cable:

Set the control lever of remote control box at neutral position and operate neutral warm up lever. At this moment, the cable which the inner cable moves is the throttle side cable.

- 13 Insert groove of the shift side remote control cable outer into the holder at the lower side of cable clip ass'y (6). Then, on the condition of the control lever of the remote control and shift lever of the outboard motor being at neutral positions, screw in sleeve guide (12) to remote control cable and make a suitable position for lock pin (9) to get into the hole of the shift lever, and push lock pin (9) into the shift lever and turn lock pin by 90° for locking.

REMARK) In case sleeve guide is not in the adjustable range to screw in, open the remote control box and adjust the length of cable terminal of the shift side.

- 14 Insert the groove of the throttle side remote control cable outer into the holder at the upper side of cable clip ass'y (6).

On the condition of the control lever being at neutral position and throttle lever A ass'y (17) to be at the fully closed position, screw in holder cap (16) to remote control cable in order to the ball joint is slightly pushed back. After fixing the position, make sure that levers and links do not give any forcible load in operation of the control lever at any position of the forward, reverse, fully opened throttle and fully closed throttle.

REMARK) In case holder cap is not in the adjustable range for screw in, open the remote control box and adjust the length of cable terminal of the throttle side.

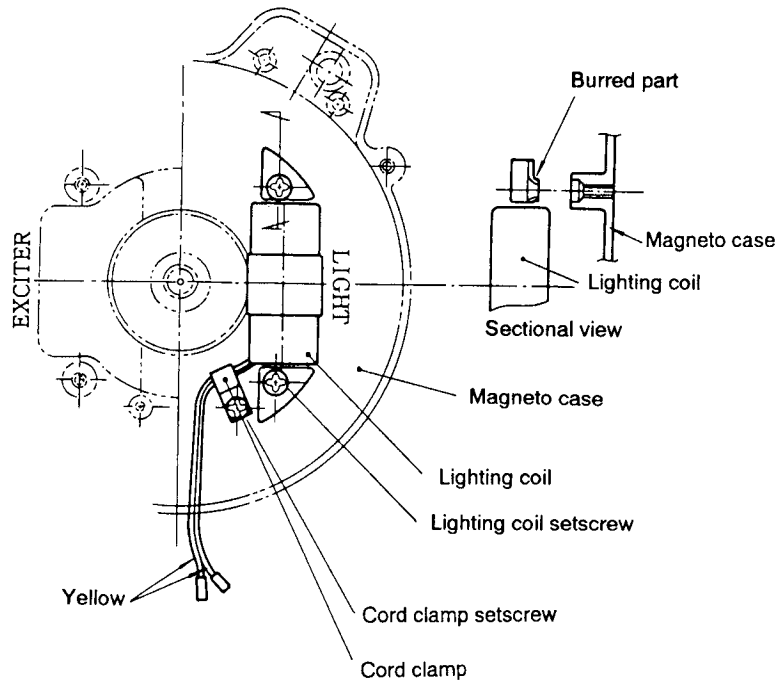
- 15 Connect separate cord (brown) (35) between stop switch and CDI unit.

Insert the engine side and remote control side stop switch cords into the two female connector respectively.

CHAPTER 10 OPTIONAL PARTS

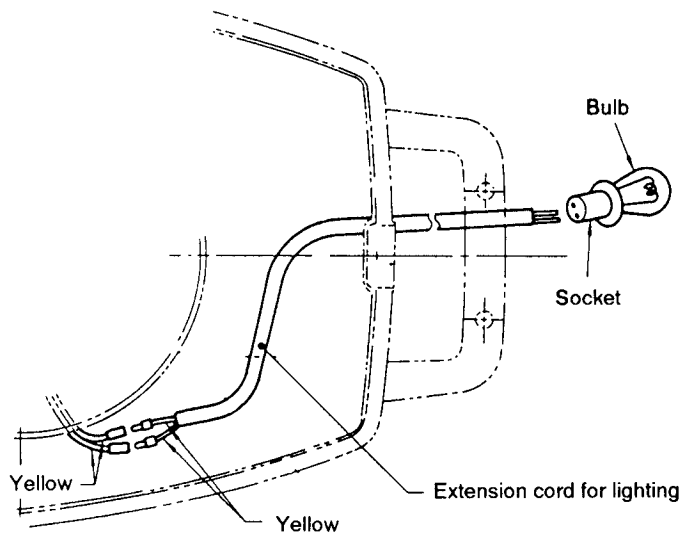
2. Lighting Coil and Rectifier Kit

(1) Lighting coil



- ① Fit the lighting coil to the magneto case as shown in the figure. When fitting, be sure to insert the burred part (refer to the sectional view) into the hole in the magneto case.
- ② After fitting the lighting coil, fasten the lead wires with the cord clamp.

(2) Extension cord for lighting



Only for turning on the bulb without any battery, connect the bulb (bulb socket) directly to the lighting output terminals (yellow lead wires).

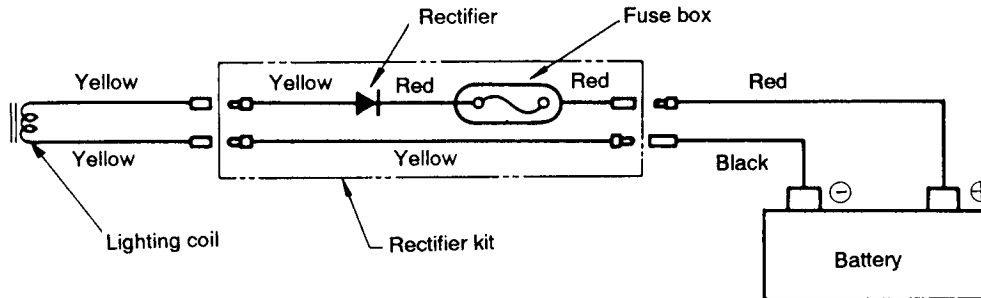
Note: Rating of bulb: 12 V, 60 W

CHAPTER 10 OPTIONAL PARTS

(3) Rectifier kit

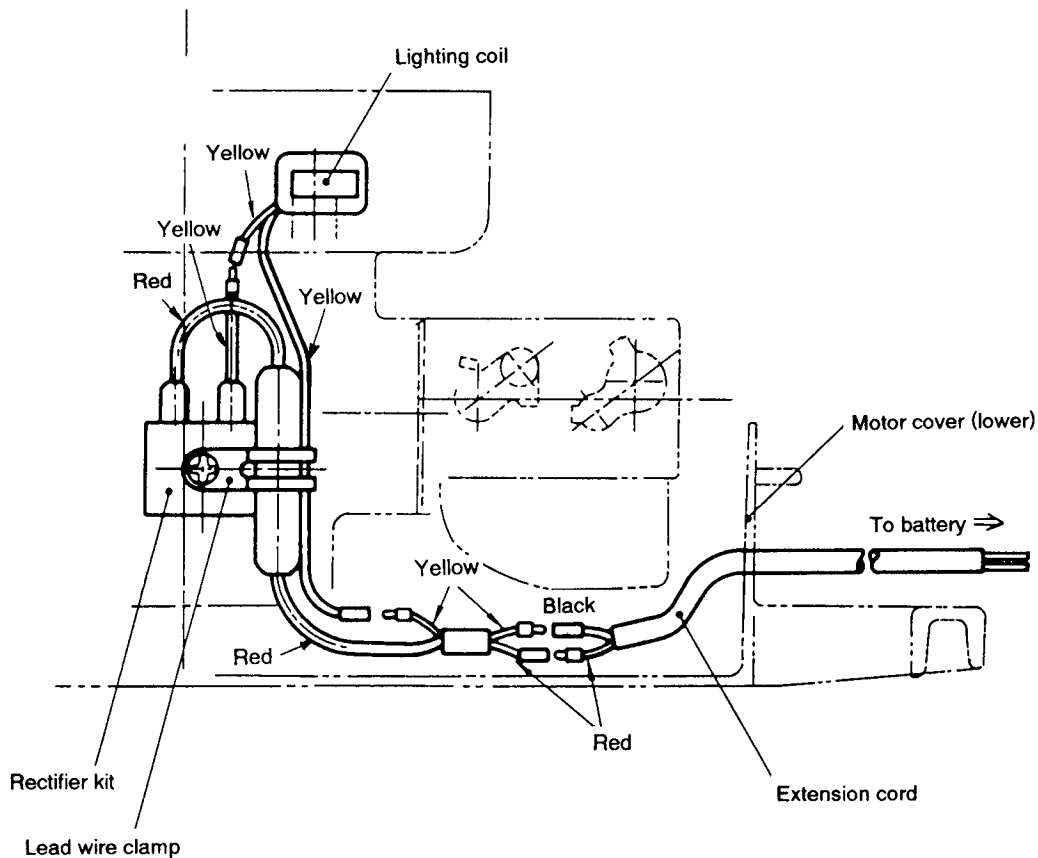
When a battery is used as the power supply for lighting and other purposes, the battery can be charged in operation of the outboard motor if the rectifier kit is installed in the boat.

(1) Wiring diagram of rectifier kit



(2) Installing rectifier kit

Install the rectifier kit and lead wire clamp on the bossed part of the crank case as shown in the figure, and wrap the fuse box with the wire clamp. After that, connect wires between the terminals properly.



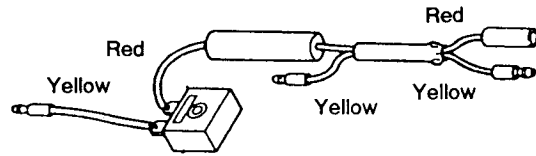
CHAPTER 10 OPTIONAL PARTS

(3) Inspection of rectifier and fuse

Part name	Check item	Remedy
Rectifier	Connection and insulation	Replace if it is faulty.
Fuse (10 A)	Blow-out (eye-check or by tester)	Replace if it is defective or has blown out.

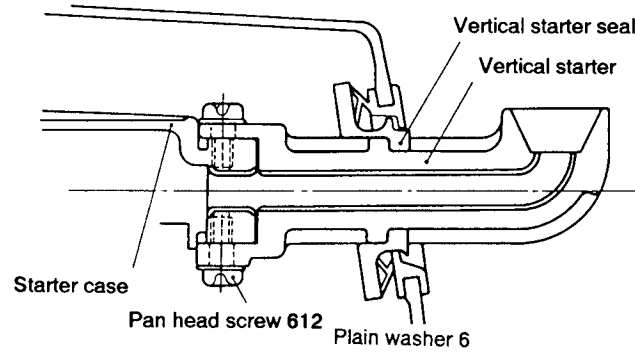
Connection test between rectifier terminals

Tester \oplus	Red	Yellow
\ominus		
Red		Disconnection
Yellow	Connection	



CHAPTER 10 OPTIONAL PARTS

3. Vertical Starter Kit



Fasten the starter case with four small pan head screws. In this case, it is required to modify the tapped holes for fitting screws (for M6P10 screws, 7 mm or more deep).



Address: 5-4, 3-chome, Azusawa, Itabashi-ku, TOKYO 174-0051, Japan

Facsimile: TOKYO (03) 3966-2951

Phone: TOKYO (03) 3966-3117

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