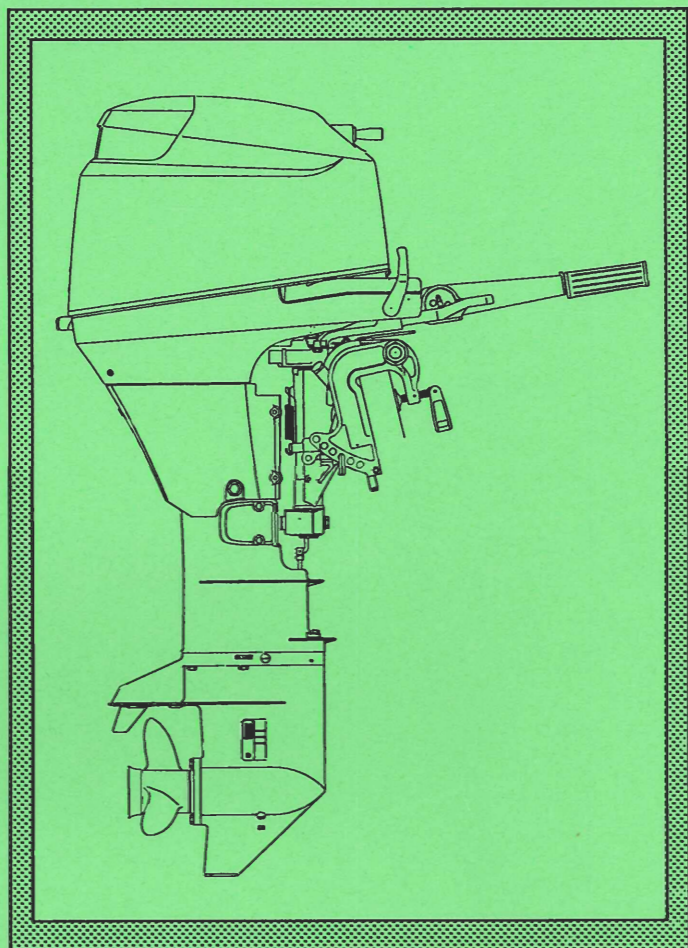


TOHATSU
OUTBOARD



**SERVICE
MANUAL**

4-Stroke **25·30**



TOHATSU CORPORATION

CONTENTS

Page

CHAPTER 1 SPECIFICATIONS

1. Specifications	1
2. Dimensions	3
3. Water Cooling System Diagram	4
4. Engine Lubrication System Diagram	5

CHAPTER 2 SERVICE DATA AND TOOLS

1. Service Data and Maintenance Standards	6
2. Sealants, Adhesives and Lubricants Application Chart	14
3. Tightening Torque	17
4. Service Tools and Instruments	19
5. How to Use Special Tools	21

CHAPTER 3 INSPECTION AND MAINTENANCE

1. Periodical Inspections	28
2. Troubleshooting	29
3. Change of Engine Oil	30
4. Change of Oil Filter	30
5. Inspection of Fuel System	31
6. Carburetor tune-up	32
7. Anode Replacement	33
8. Compression Test	33
9. Inspection and Replacement of Timing Belt	35
10. Change of Gear Oil	37
11. Flushing	38
12. Inspection of Cooling System	39

CHAPTER 4 POWER UNIT

1. General Notes on Service	40
2. Removing Power Unit	41
3. Removing Parts	41
4. Disassembling Engine	42
5. Inspection and Measurement of Engine Parts	46
6. Repair and Replacement of Engine Parts	54
7. Reassembling Engine	55

CONTENTS

CHAPTER 5 LOWER UNIT

- 1. Disassembly of Gear Case 64
- 2. Gear Case Assembly 69
- 3. Installation of Bracket and Throttle/Shift parts 72

CHAPTER 6 RECOIL STARTER 79

CHAPTER 7 CARBURETOR AND FUEL PUMP

- 1. Carburetor 83
- 2. Fuel pump 84

CHAPTER 8 OIL PUMP 85

CHAPTER 9 ELECTRICAL SYSTEM

- 1. Component Parts 86
- 2. Wiring Diagram 87
- 3. Inspection 88

CHAPTER 10 TEST RUN AND INSPECTION AFTER COMPLETE ASSEMBLY

- 1. Test Tank and Test Propeller 92
- 2. Inspection 93

CHAPTER 1 SPECIFICATIONS

1. Specifications

Item	Model or Type	25A/30A		
Dimensions				
Overall length (☆ : Handle is horizontally positioned.)	MF/EF ☆ EP	1,031 mm (40.6 in) approx. 652 mm (25.7 in) approx.		
Overall width (☆ : Handle is horizontally positioned.)	MF/EF ☆ EP	391 mm (15.4 in) approx. 367 mm (14.4 in) approx.		
Overall height	S L UL	1,187 mm (46.7 in) approx. 1,335 mm (52.6 in) approx. 1,462 mm (57.6 in) approx.		
Transom height	S L UL	404 mm (15.9 in) approx. 552 mm (21.7 in) approx. 679 mm (26.7 in) approx.		
Weight	MF EF EP	S: 68.5 kg (151 lb) approx. S: 71.5 kg (158 lb) approx. S: 70 kg (154 lb) approx.	L: 70 kg (154 lb) approx. L: 73 kg (161 lb) approx. L: 71.5 kg (158 lb) approx.	UL: 72 kg (159 lb) approx. UL: 75 kg (165 lb) approx. UL: 73.5 kg (162 lb) approx.

Performance

Maximum output	25 30	18.4kW (25 HP)/5,500 rpm 22.1kW (30 HP)/5,750 rpm
Maximum operating range	25 30	5,000 – 6,000 rpm 5,250 – 6,250 rpm
Idling (Neutral)		950 rpm
Trolling (Forward Gear)		900 rpm
Fuel consumption at full throttle	25 30	8.7 liter/hr (2.30 US gal/hr) at 5,500rpm 9.4 liter/hr (2.48 US gal/hr) at 5,750rpm

Engine

Engine type		4 stroke
Number of cylinder		3
Bore × stroke		59 mm (2.32 in) × 60 mm (2.36 in)
Displacement		492 ml (30.02 cu in)
Valve system		OHC, Cross flow
Lubrication system		Wet sump (Trochoid type oil pump)
Cooling system		Water cooled (Rubber impeller rotation system)
Starting system	MF EF/EP	Recoil starter Recoil starter & Electric starter
Ignition system		Flywheel magneto (C.D. ignition)
Spark plug		NGK DCPR6E
Alternator out put		14V 210W
Ignition timing		ATDC 2° – BTDC32° (Electric advance)
Carburetor		Horizontal butterfly valve with acceleration pump
Fuel primer system		Auto by-starter
Fuel pump		Mechanical plunger type
Direction of engine rotation		Clockwise
Engine oil		SAE 10W – 30/40, SF/SG/SH/SJ class in API classification
Volume of engine oil		1,800 ml (on change of oil filter) (1.9 US qt)
Speed control	MF/EF EP	Twist grip Remote control

CHAPTER 1 SPECIFICATIONS

Item	Model or Type	25A/30A
------	---------------	---------

Lower unit

Clutch		Dog type, F – N – R
Reduction gear ratio		1.92 (12 : 23)
Maximum tilt-up angle		72°
Trim angle		2.5° to 27.5°
Number of trim-adjustments		6 position
Tilt angle for shallow water drive		33.5°
Steering angle		72°
Allowable thickness of transom board		40 – 60 mm (1.575 – 2.362 in)
Exhaust system		Through-hub exhaust
Capacity of fuel tank		25 liter (separate) (6.60 US gal)
propeller mark (Standard)	25 30	S: DS13 L: DS11 UL: DS10 S: DS13 L: DS11 UL: DS10
Gear oil		Genuine gear oil or GL5, SAE #80 – #90
Volume of gear oil		280 ml (9.5 US. fl. oz.) approx.

Warning systems

Engine revolution limiter		6,500 rpm approx.
Engine oil pressure	EP	When activated, Red warning lamp turns on, warning buzzer turns on and engine rpm is down to 2,800 rpm.

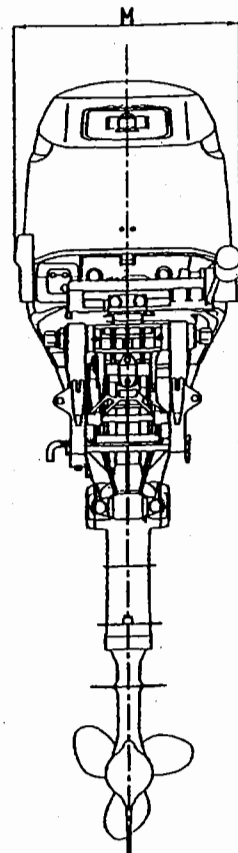
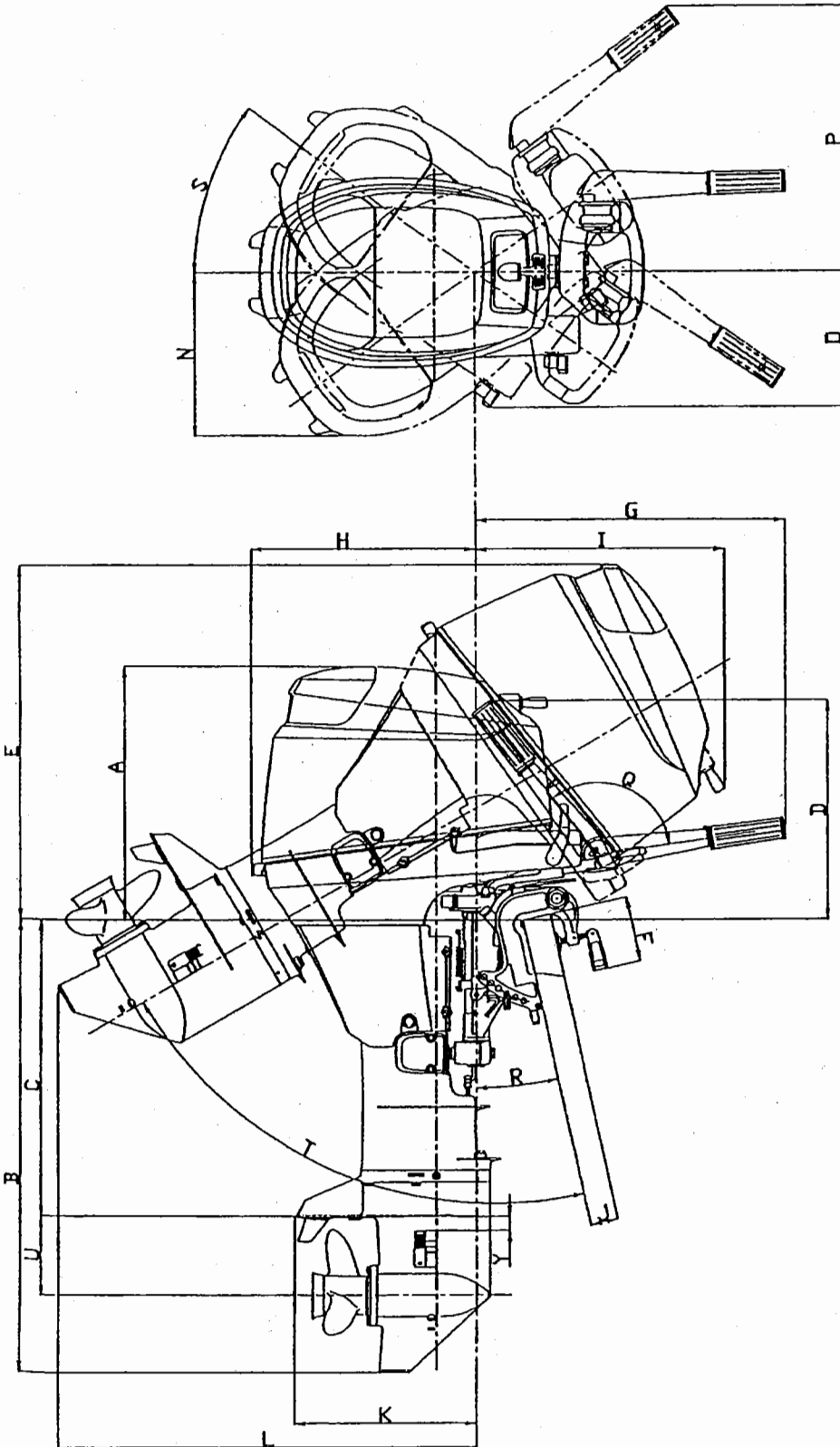
Optional parts

Optional propeller (No. of blades × Diameter × Pitch mm)		14 (3 × 252 × 360) DS13 (3 × 257 × 330) DS12 (3 × 252 × 305) DS11 (3 × 252 × 279) DS10 (3 × 252 × 254) DS9 (3 × 252 × 229) 8 (3 × 260 × 210)
Tachometer		
Remote control		Cable length: 7 – 30 ft

CHAPTER 1 SPECIFICATIONS

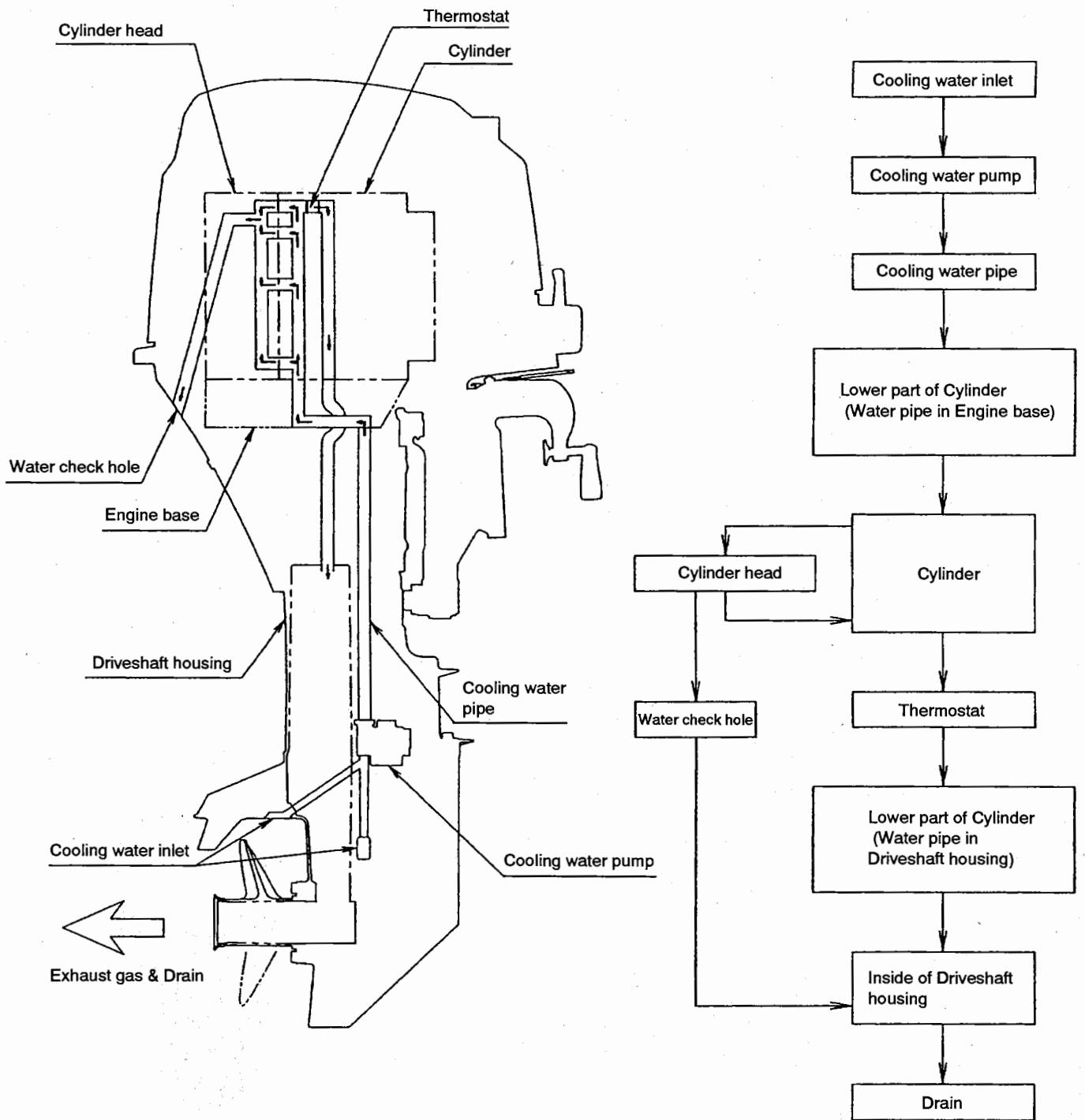
2. Dimensions

ITEM	Transom	UNITS	25A 30A
A		mm	487.5
B	S	mm	699.5
	L	mm	847
	UL	mm	974
C	S	mm	404.5
	L	mm	552
	UL	mm	679
D		mm	448
E		mm	673
F		mm	122
G		mm	612
H		mm	425
I		mm	474
J		mm	40-60
K		mm	342
L	S	mm	581
	L	mm	783
	UL	mm	818
M	MF/EF	mm	391
	EP	mm	367
N		mm	309
O		mm	256
P		mm	519
Q		deg.	116
R		deg.	12
S		deg.	36
T		deg.	72
U		mm	148
Y		mm	26
Trim angle (Position)		deg.	2.5-27.5 (6)



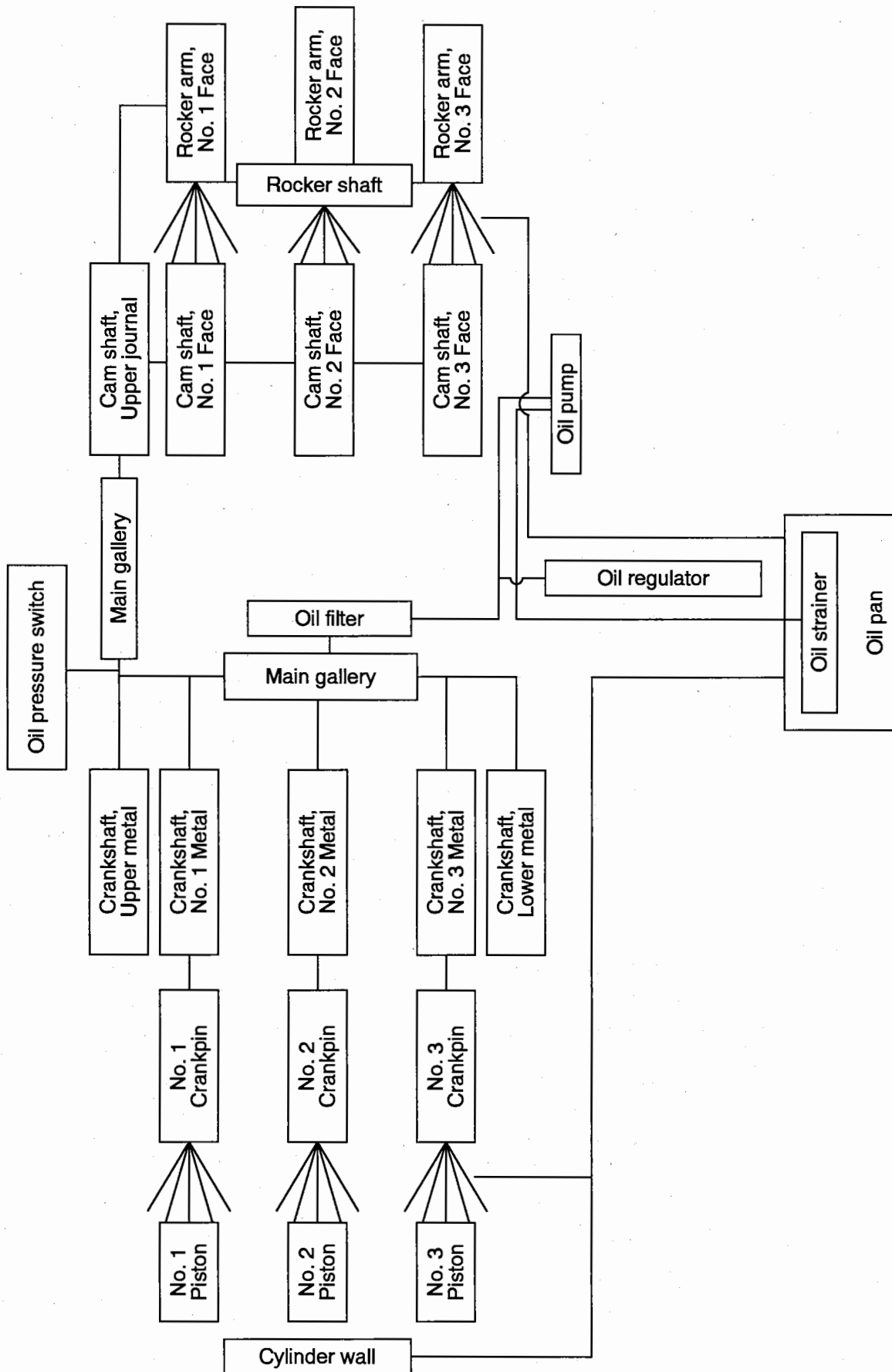
CHAPTER 1 SPECIFICATIONS

3. Water Cooling System Diagram



CHAPTER 1 SPECIFICATIONS

4. Engine Lubrication System Diagram



CHAPTER 2 SERVICE DATA AND TOOLS

1. Service Data and Maintenance Standards

	Part Name	Check Item	Standard value	
Engine-related items	Cylinder head	Carbon deposit on the combustion chamber		
		Scratch depth & distortion of the mounting surface		
		Corrosion in the mated surface		
		Clogging cooling water passage		
	Cylinder	Deposit in the water jacket		
		Wear of the inside cylinder diameter: Measure the bore with a cylinder gauge.	59.00 mm (2.3228 in)	
		Seizure Scratch and wearing down in the cylinder liner		
		Mating surfaces of the cylinder and cylinder head		
		Engine anode		
	Piston	Outside diameter ● Measure the diameter at 7 mm above the lower end of piston skirt. (and at right angles to piston pin) ● Piston clearance	Diameter: 58.960 mm (2.3213 in) Piston clearance: 0.020 – 0.055 mm (0.0008 – 0.0022 in)	
		Carbon deposit on piston crown and in piston ring groove.		
		Scratch on the sliding surface.		
		Clearance between piston ring and ring groove.	Top: 0.04–0.08 mm (0.0016–0.0031 in) 2nd: 0.03–0.07 mm (0.0012–0.0028 in) Oil: 0.01–0.18 mm (0.0004–0.0071 in)	
		Diameter of piston pin hole	Clearance between pin and hole 0.002–0.012 mm (0.00008–0.0005 in)	
	Piston ring	● End gap	Note: Measurement of end gap: When no ring gauge is available, measure ring end gap at lower part of cylinder bore.	
		Top		Top: 0.15 – 0.35 mm (0.006 – 0.014 in)
		Second		2nd: 0.30 – 0.50 mm (0.012 – 0.020 in)
		Oil		Oil: 0.20 – 0.7 mm (0.008 – 0.028 in)
	Piston pin	Outer diameter	16.00 mm (0.6299 in)	
	Crank shaft	Deflection of crank shaft: ☆	Less than 0.05 mm (0.002 in) (Both ends)	
Outer diameter of crank pin.		29.98 mm (1.1803 in)		
Outer diameter of bearing.		35.99 mm (1.4169 in)		
Oil clearance of bearing.		0.012 – 0.044 mm (0.0005 – 0.0017 in)		
Side clearance of crank shaft		0.05 – 0.15 mm (0.002 – 0.006 in)		
Connecting rod	Inner diameter of small end	16.01 mm (0.630 in)		
	Oil clearance of big end	0.015 – 0.041 mm (0.0006 – 0.0016 in)		
	Side clearance of big end	0.1 – 0.25 mm (0.004 – 0.01 in)		

☆: Both the main bearings of the crank shaft should be supported on V-blocks.

CHAPTER 2 SERVICE DATA AND TOOLS

	Repair Limit	Measure
Engine-related Items		Remove carbon deposit and clean.
	Scratch depth or distortion is 0.1 mm (0.004 in) or more.	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.
	59.06 mm (2.3252 in) or more	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.)
	When the liner cannot be repaired by means of #400 – #600 sandpaper because it is extremely scratched or scored, or the difference between the maximum wear and minimum wear is 0.06 mm (0.0024 in) or more.	Replace or use an over-sized piston after boring the cylinder. Bore and hone to $\varnothing 59.5 \pm 0.01$ mm ($\varnothing 2.3425 \pm 0.0004$ in). To be use over size piston and ringe.
	When the depth of scratch or distortion in/of the mating surface is 0.1 mm (0.004 in) or more.	Set #240 – #400 sandpaper on the surface plate and polish the surface. Use #600 sandpaper for finishing.
		Replace if worn down to 2/3 of the original in size.
	Outer diameter: 58.90 mm (2.3189 in) or more Piston clearance: 0.15 mm (0.0059 in) or more	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 (0.004 in) or more 2nd: 0.09 mm (0.0035 in) or more Oil: 0.21 mm (0.0083 in) or more	Replace if out of the repair limit. *
	0.04 mm (0.0016 in) or more	Replace if out of the repair limit.
	Top: 0.5 mm (0.020 in) or more 2nd: 0.7 mm (0.028 in) or more Oil	Replace with new piston ring if wear of the cylinder liner is within the repair limit. *
	15.97 mm (0.629 in) or less	Replace if out of the repair limit.
	0.05 mm (0.002 in) or more	Replace if out of the repair limit.
	29.95 mm (1.179 in) or less	Replace if out of the repair limit.
	35.97 mm (1.416 in) or less	Replace if out of the repair limit.
0.06 mm (0.002 in) or more	Replace if out of the repair limit.	
0.6 mm (0.024 in) or more	Replace if out of the repair limit.	
16.04 mm (0.631 in) or more	Replace if out of the repair limit.	
0.060 mm (0.002 in) or more	Replace if out of the repair limit.	
0.6 mm (0.024 in) or more	Replace if out of the repair limit.	

* : To be replaced with a new oil ring when replacing with new top and/or second rings.
Remark: Sandpaper means Water proof paper.

CHAPTER 2 SERVICE DATA AND TOOLS

	Part Name	Check Item	Standard value		
Engine-related Items	Connecting rod	Inner diameter of small end	16.01 mm (0.6303 in)		
		Oil clearance of big end	0.015–0.041 mm (0.00059–0.00161 in)		
		Side clearance of big end	0.1 – 0.25 mm (0.00394 – 0.00984 in)		
	Intake valve Exhaust valve	Valve clearance	IN	0.13 – 0.17 mm (0.005 – 0.007 in)	
			EX	0.18 – 0.22 mm (0.007 – 0.008 in)	
		Outer diameter of valve stem	IN	5.48 mm (0.216 in)	
			EX	5.46 mm (0.215 in)	
		Inner diameter of valve guide	IN	5.51 mm (0.217 in)	
			EX	5.51 mm (0.217 in)	
		Clearance to valve stem	IN	0.008–0.04 mm (0.0003–0.0016 in)	
	EX		0.025–0.057 mm (0.0010–0.0022 in)		
	Contact width of valve seat	IN	1.0 mm (0.0393 in)		
		EX	1.0 mm (0.0393 in)		
	Valve spring	Free length	35 mm (1.38 in)		
	Cam shaft	Height of cam (both IN and EX)	24.15 mm (0.95 in)		
		Outer diameter of bearing	Pulley side	17.98 mm (0.708 in)	
			Oil pump side	15.97 mm (0.629 in)	
Rocker arm & Shaft	Clearance to holder (bearing)	0.02 – 0.05 mm (0.0008 – 0.0020 in)			
		Inner diameter	13.01 mm (0.512 in)		
	Outer diameter	12.99 mm (0.511 in)			
Timing belt	Shaft clearance	0.006–0.035 mm (0.00024–0.00138 in)			
		Tension & Appearance			
Engine block	Compression pressure (reference value) at 650–700 rpm				
	With de-compressor Without de-compressor (Rocker arm in EX side is removed)	0.49 ± 0.1 MPa (5 ± 1kg/cm ² , 71 psi) 1.13 ± 0.1 MPa (11.5 ± 1kg/cm ² , 135 psi)			
Fuel-related Items	Carburetor		25	30	
		● Setting mark	3S9A	3R0B	
		● Throttle/Venturi bore	23/15 mm	25/21 mm	
		● Main jet (MJ)	#82	#100	
		● Main air jet (MAJ)	#125	#130	
		● Inner diameter of main nozzle	2.0 mm	2.2 mm	
		● Slow jet (SJ)	#45	#52	
		● Slow air jet (SAJ)	#95	#85	
		● Opening angle of throttle (at W.O.T.)	80°	80°	
		● Pilot screw (PS) Blind	–	–	
		● Fuel level (from flange surface to float bottom)	14 mm (0.55 in)	14 mm (0.55 in)	
		● Resistance of PTC heater * for auto-by starter at 20°C (68° F)	20 Ω	20 Ω	
	● Idle speed (clutch released)	950 rpm	950 rpm		
	Oil pump	Inner diameter of pump body			
Clearance between outer rotor and body					
Height of outer rotor					
Clearance between rotor and body side					
Clearance between outer rotor and inner rotor					

Remark *: PTC = Positive Temperature Coefficient Thermistor.

CHAPTER 2 SERVICE DATA AND TOOLS

	Part Name	Check Item	Standard value
Electrical Items	Magneto	● Ignition timing	ATDC 2° – 32° (Electric ignition advance)
		● Spark performance	10 mm (0.4 in) or more/500 rpm (Measured by genuine spark tester)
		● Spark plug	NGK DCPR6E
		● Spark gap	0.8 – 0.9 mm (0.032 – 0.035 in)
		● Alternator output	14V, 210W (5,000 rpm)
		● Starter coil resistance yellow – yellow yellow – yellow yellow – yellow	0.6 – 0.9Ω 0.6 – 0.9Ω 0.6 – 0.9Ω
		● ESG for high speed Overrev limiter	Restricting at 6,500 rpm
		● ESG for low speed Low oil pressure	Reducing to 2,800 rpm
	Ignition coil	● Primary coil resistance black – orange	0.18 – 0.24Ω
		● Secondary coil resistance high tension cord – core	2,700 – 3,700Ω
	C.D. unit	Refer to CHAPTER 9	
	Rectifier	Refer to CHAPTER 9	
	Starter motor	Battery	12V – 70AH to 12V – 100AH
		Output	12V 0.6KW
		Clutch	Over-running clutch
Brush length		12.5 mm (0.49 in)	
Commutator under-cut		0.5 – 0.8 mm (0.02 – 0.03 in)	
Commutator diameter		30 mm (1.18 in)	
Fuse	Capacity	20A	
Cooling Items	Thermostat	Operation of thermostat	● Start to open: 60°C ± 1.5°C (140 ± 3°F)
			● Temperature at which valve opens full: 75°C (167°F)
			● Valve lift stroke when it fully opens: 3 mm (0.12 in) or more
	Pump impeller	Worn-out, crack	
	Pump case liner	Worn-out	
Guide plate	Worn-out		

CHAPTER 2 SERVICE DATA AND TOOLS

	Repair Limit	Measure
Electrical Items		
	Spark gap: 1.2 mm (0.0047 in) or more	Adjust the side electrode. However, if the electrode is excessively worn out, replace the spark plug.
	9.5 mm (0.37 in) or less	Replace if out of the repair limit.
	0.2 mm (0.008 in) or less	Replace if out of the repair limit.
	29 mm (1.14 in) or less	Replace if out of the repair limit.
Cooling Items	If the valve opens at the room temperature, replace the thermostat.	
	While immersing the thermostat in water, raise the water temperature and check the temperature at which the valve opens.	
	Since there is a time lag in operation of the thermostat, keep the water temperature at 75 °C (167 °F) for about 5 minutes and measure the valve lift stroke.	
	When there is any worn, cracked or damaged.	Replace
		Replace
	Replace	

CHAPTER 2 SERVICE DATA AND TOOLS

	Part Name	Check Item	Standard value
Lower Unit Items	Anode	Gear case anode	
	Clutch spring	Free height	77.5 mm (3.051 in)
	Propeller shaft	● Wear-out or damage in bearing area	
		● Wear-out or damage in oil seal area	
		● Run out	
	Bevel gear	Backlash between bevel gears A and B • Refer to section 8 in this CHAPTER.	0.08 – 0.13 mm (0.003 – 0.005 in) [Gauge reading 0.33 – 0.54 mm (0.0130 – 0.0213 in)]
		Thickness of washer of bevel gear C	1,5 mm (0.059 in)
	Propeller	Wear-out, bend, crack, chipping	
	Drive shaft	Displacement over 3 spline (upper) teeth	7.9 mm (0.311 in)
		Worn-out or damage in bearing/oil seal area	
Run out			
Reverse lock spring	Free height	S	95 mm (3.740 in)
		L & UL	98 mm (3.858 in)
Other Items	Oil seals	Wear-out, damage	Replace when it is excessively worn out.

CHAPTER 2 SERVICE DATA AND TOOLS

	Repair Limit	Measure
Lower Unit Items		Replace when it is excessively worn out.
	75 mm or less	Replace
		Replace
		Replace
	0.05 mm or more	Replace
	0.05 mm or less (gauge reading: 0.21 mm or less), or 0.16 mm or more (gauge reading: 0.67 mm or more)	Adjustment or replace
	1.35 mm or less	Replace
	Replace depending on wear, bent or damage in the circumference.	
	7.5 mm or less	Replace
		Replace
	0.5 mm or more	Replace
	97 mm or more	Replace
100 mm or more	Replace	
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. Sealants, Adhesives and Lubricants Application Chart

Description	Items							Insulated Grease	Teflon Grease	Cold-resistant Lithium Grease	Grease for OBM	4st Engine Oil	Gear Oil	Oil Compound Jyoetsu-Silicone	Remarks
	Three Bond 1342	Three Bond 1373B	Instantaneous Adhesive Three Bond 1741	Three Bond 1207B	Three Bond 1141C	Bond G17	K-84								
Cylinder liner												●			Inside wall
Piston												●			Ring groove, Periphery
Piston ring												●			Periphery
Piston pin												●			Periphery
Connecting rod												●			Inside big and small ends
Metal (Cylinder block, crank case)												●			Both sides
Crank shaft (thrust surface)												●			Sliding surfaces
Crank shaft oil seal									●						Lips
Crank case/cylinder					●										Mating surface
Valve (IN, EX)												●			Shaft, Stem head
Valve stem seal (IN, EX)												●			Lips
Retainer												●			Complete
Valve spring seat												●			Complete
Valve spring												●			Complete
Camshaft												●			Bearing, cam
Camshaft oil seal									●						Lips
Cam pulley bolt	●														Thread
Rocker arm												●			Bearing, Slipper
Rocker arm shaft												●			Shaft, side
Tappet adjust screw												●			Complete
Washer (rocker arm, t=0.5)												●			Complete
Washer (rocker arm, t=2.5)												●			Complete
Spring (for rocker arm)												●			Complete
Fuel pump												●			Periphery of O-ring, end of plunger
Oil pump												●			2ml at Suction port and discharge port , O-ring at boss
Oil pump O-ring												●			Complete
Breather plate	●														Set-screw
Oil pressure switch	●														Thread

Engine block

CHAPTER 2 SERVICE DATA AND TOOLS

2. Sealants, Adhesives and Lubricants Application Chart

Description	Items										Remarks				
	Three Bond	Three Bond	Instantaneous Adhesive Three Bond	Three Bond	Three Bond	Bond	Insulated Grease	Teflon Grease	Cold-resistant Lithium Grease	Grease for OBM		4st Engine Oil	Gear Oil	Oil Compound Jyoetsu-Silicone	
	1342	1373B	1741	1207B	1141C	G17								KS-84	
Engine block	Oil filter										●			Seal	
	Oil filter bolt	●												Thread	
	Plunger ass'y										●			Inside (Pour 1ml)	
	Filler cap O-ring										●			Periphery	
	Solenoid switch							●						Terminal	
	Spark plug cap						●							●	Spark plug insertion part
															High tention cord
	Starter motor								●						Terminal
											●				Spread at pinion part slightly
	Starter case	●													Bolt and screw for Reel
										●					Friction plate, reel shaft part, Spiral spring, ratchet
Starter seal rubber			●												
Engine oil											●			1,800 ml : with filter replacement 1,600 ml : without filter replacement	
Engine base oil seal									●						
Stern bracket	Clamp screw										●			Thread	
Swivel bracket	Bolt (Mount bracket lower)	●												Thread	
	Steering friction (Co-pilot)									●				Thread	
	Steering shaft									●					
	Swivel bracket (steering shaft)										●				Sliding surface
		Grease nipple (bracket bolt)									●				Sliding surface
	Grease nipple (bracket bolt) (Co-pilot)										●				Thread
											●				Thread
Drag link										●				Sliding surface	
Bolt (drag link bracket)		●												Thread	

CHAPTER 2 SERVICE DATA AND TOOLS

2. Sealants, Adhesives and Lubricants Application Chart

Description	Items										Remarks				
	Three Bond	Three Bond	Instantaneous Adhesive Three Bond	Three Bond	Three Bond	Bond	Insulated Grease	Teflon Grease	Cold-resistant Lithium Grease	Grease for OBM		4st Engine Oil	Specified Gear Oil	Oil Compound	Jyetsu-Silicone
	1342	1373B	1741	1207B	1141C	G17								KS-64	
Bolt (upper pump case)	●														Thread
Upper pump case										●					Impeller sliding surfaces Joint area for water pipe guide
Oil seal (lower pump case; drive shaft housing side)	●									●					Lips Periphery
Oil seal (lower pump case; gear case side)	●									●					Lips Periphery
Cam rod bushing (lower pump case)										●					Sliding surface
Lower pump case												●			Inserting part area
Bolt (lower pump case)	●														Thread
Drive shaft								●							Spline (crank shaft side)
Exhaust plug (D-S-H)	●														
Seal rubber (Engine base & apron)			●												
Needle bearing (bevel gear B)												●			
Taper roller bearing (bevel gear A)												●			
Clutch push rod										●					Sliding surface
Oil seal (propeller shaft housing; gear case side)	●									●					Lips Periphery
Oil seal (propeller shaft housing; propeller side)	●									●					Lips Periphery
Bushing (propeller shaft housing)												●			
O-ring (propeller shaft housing)										●					
Propeller shaft housing	●														Thread
Propeller shaft (spline part)										●					
Gear case												●			Oil 280ml
Bolt (gear case)	●														Thread
Bevel gear B nut		●													Thread
Shift shaft									●						Bearing sliding surface
Throttle link									●						Sliding surface
Bushing (handle)										●					In and out side surface
Bolt (streeing arm bracket)		●													Thread

CHAPTER 2 SERVICE DATA AND TOOLS

3. Tightening Torque

	Location	Thread size	Bolt or Nut	Tightening Torque		
				N-m	kg-m	lb-ft
Engine	Cylinder Block – Cylinder Head	M8 × 1.25	Bolt	28-32	2.8-3.2	20-23
		M6 × 1.0	Bolt	8-10	0.8-1.0	5.8-7.2
	Cylinder Block – Crank Case	M8 × 1.25	Bolt	23-25	2.3-2.5	17-18
		M6 × 1.0	Bolt	8-10	0.8-1.0	5.8-7.2
	Connecting Rod	M7 × 1.0	Bolt	11-13	1.1-1.3	8.0-9.4
	Tappet Lock Nut	M6 × 0.75	Nut	6-8	0.6-0.8	4.3-5.8
	Flywheel Cup	M18 × 1.5	Nut	110-130	11-13	80-94
	Drive (Timing) Pulley	M32 × 1.0	Nut	63-65	6.3-6.5	46-47
	Driven (Camshaft) Pulley	M6 × 1.0	Bolt	10-12	1.0-1.2	7.2-8.7
	Plunger Assembly	M16 × 1.5	–	19-21	1.9-2.1	14-15
	Oil Filter	M20 × 1.5	–	18	1.8	13
	Oil Pressure Switch	PT1/8	–	7-9	0.7-0.9	5-6
	Cylinder Head Cover	M6 × 1.0	Bolt	8-10	0.8-1.0	5.8-7.2
	Inlet Manifold	M6 × 1.0	Bolt	8-10	0.8-1.0	5.8-7.2
	Spark Plug	M12 × 1.25	–	15-20	1.5-2.0	11-14
Engine Assembly	M8 × 1.25	Bolt	29-31	2.9-3.1	21-22	

Stern Bracket	Bracket Bolt	0.875"	Nylon nut	24	2.4	17
---------------	--------------	--------	-----------	----	-----	----

Swivel Bracket	Co-Pilot Handle	M8 × 1.25	Nylon nut	6.0	0.6	4.3
	Drag Link	0.375"	Bolt	27.1	2.8	20

CHAPTER 2 SERVICE DATA AND TOOLS

3. Tightening Torque

	Location	Thread size	Bolt or Nut	Tightening Torque		
				N-m	kg-m	lb-ft
Driveshaft Housing	Upper mount rubber	M10 × 1.5	Bolt	20.3	2.1	15
	Lower mount rubber	M12 × 1.25	Bolt, Nut	40	4.0	29
	1/4-tapered plug	PT1/4	–	8	0.8	5.8
	Drain plug (engine oil)	M14 × 1.5	–	23.7	2.4	17

Gear Case	Propeller Nut	M12 × 1.5	Nut	25	2.5	18
	Bevel gear B nut	–	Nut	35	3.5	25

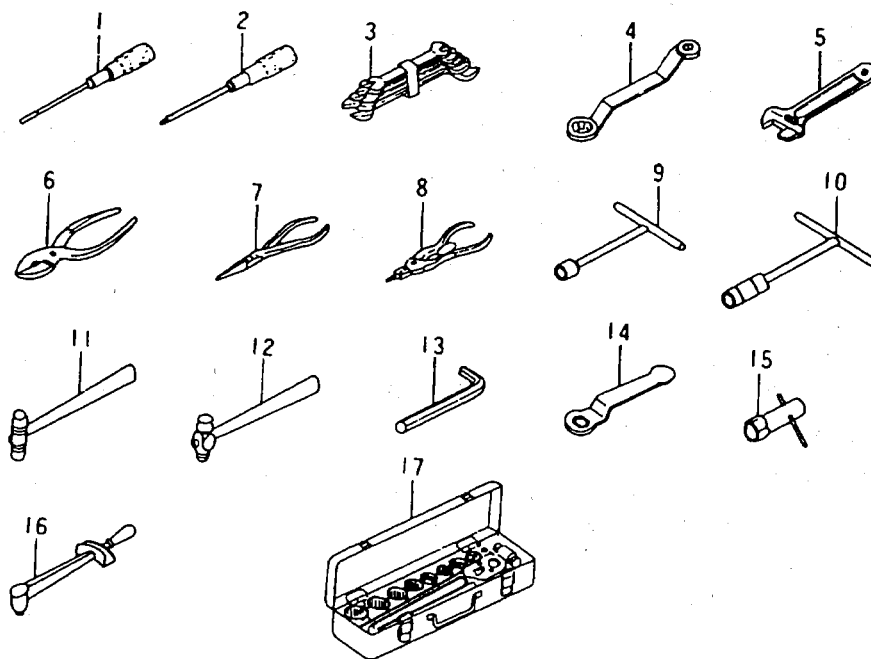
Motor cover (Lower)	Main switch	M16 × 1.5	Nut	3.5	0.35	2.5
	Run-yard stop switch	M16 × 1.5	Nut	2.3	0.23	1.7
	Neutral switch	M12 × 1.5	Nut	3.3	0.33	2.4

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

CHAPTER 2 SERVICE DATA AND TOOLS

4. Service Tools and Instruments

(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. Wrench set (6 pieces)

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

5. Adjustable spanner (300 mm)

6. Pliers

7. Needle-nose pliers

8. Snap ring pliers

9. T-bar socket wrench (10 mm)
 - do. - (12 mm)
 - do. - (13 mm)
 - do. - (17 mm)

10. T-bar universal wrench (10 mm)
 - do. - (12 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 (130 N - m)
 - do. - (12 N - m)
 - do. - (5 N - m)

Pre-setting type box torque wrench

(10 mm, 7N - m) for the tappet lock nut

17. Socket wrench set

CHAPTER 2 SERVICE DATA AND TOOLS

(2) Compression gauge

(3) Test propeller

(4) Measuring instruments

The following instruments are available locally.

Tachometer: 600 – 7,000 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, 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 Dia.

Dial gauge: JIS B7503; 0.01 mm scale

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

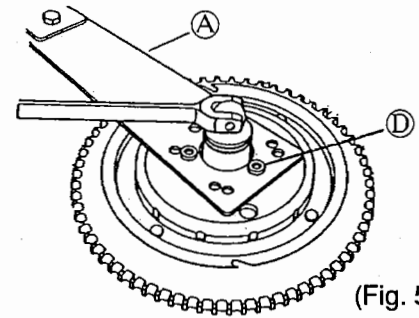
5. How to Use Special Tools

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

① Disassemble

Attach the tool **A** to the flywheel cup of the magneto with the bolts **D** (three), and then remove the magneto nut (right hand nut) with the socket wrench of size 27 mm. (Fig. 5-1)

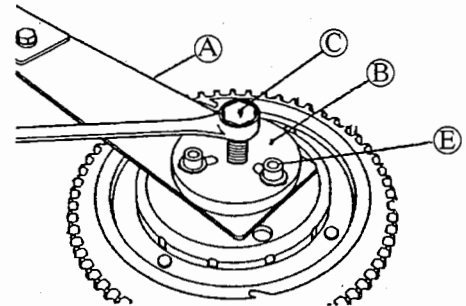
Next, after removing three bolts **D**, fasten the tool **B** together with the tool **A** to the flywheel with the bolts **E** (three), and then remove the flywheel by tightening the tool **C** with the socket wrench of size 17 mm.



(Fig. 5-1)

② Assemble

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

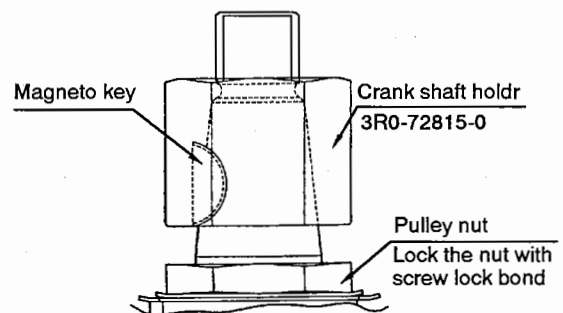


(Fig. 5-2)

Tightening torque: 110-130 N-m (11-13 kg-m)
(80-94 lb-ft)

2. Crank shaft holder (3R0-72815-0)

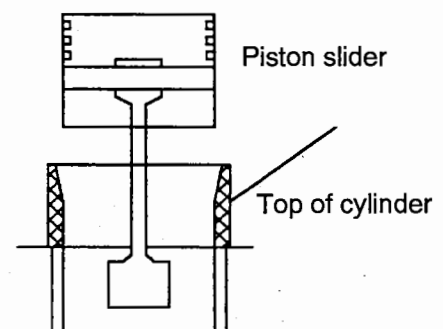
Refer to page 59 "Chapter 4 Power Unit"



(Fig. 5-3)

3. 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)



(Fig. 5-4)

Note:

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

CHAPTER 2 SERVICE DATA AND TOOLS

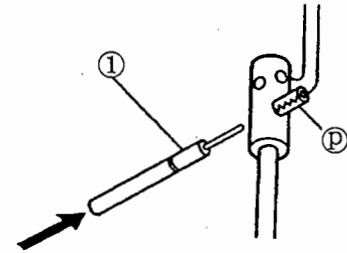
4. Spring pin tool

- ① Spring pin tool A (345-72227-0)
- ② Spring pin tool B (345-72228-0)
- Ⓟ Spring pin

(1) To remove the spring pin from the shift rod joint

- Insert the tip of the spring pin tool A ① in the hole of the spring pin Ⓟ, tap the tool lightly with a hammer in the direction of the arrow and remove the spring pin.

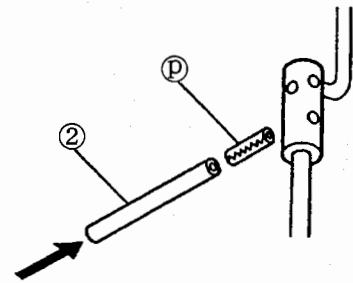
(This tool can be used for removing spring pins at other locations also.)



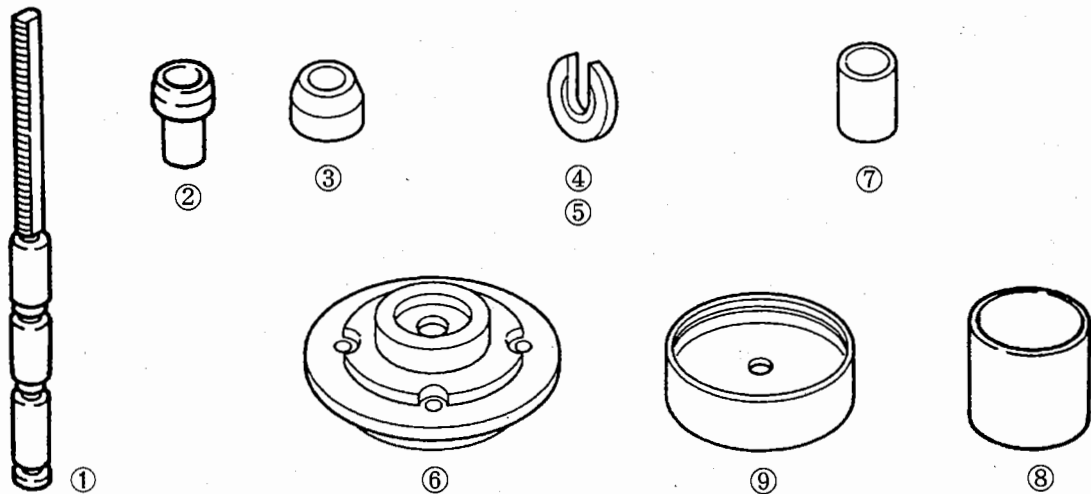
(2) To insert the spring pin in the shift rod joint

- Insert the spring pin Ⓟ in the hole of the spring pin tool B ②. Align the front end of the spring pin with the spring pin hole of the clutch lever joint, and tap the end face lightly with a hammer in the direction of the arrow, to insert the spring pin.

(This tool may be used for inserting spring pins at other locations also.)



5. Needle roller bearing tool (3C8-72700-0)



No.	Description	Size	Part No.	Applicable needle bearing			
				Propeller shaft housing		Gear case	
				Installation	Removal	Installation	Removal
①	Shaft A		346-72702-0	○	○	○	○
②	Guide A	Inner diameter: 17.5 mm	346-72705-0			○	○
③	Guide B	Inner diameter: 18 mm	346-72705-5	○			
④	Retainer A	Outer diameter: 26.5 mm	346-72703-0			○	○
⑤	Retainer B	Outer diameter: 24.5 mm	346-72703-5	○	○		
⑥	Flange A		3C8-72701-0			○	○
⑦	Shaft stopper	Length: 61 mm	346-72704-0			○	
⑧	Spacer		346-72708-0		○		
⑨	Flange B		346-72701-5	○	○		

CHAPTER 2 SERVICE DATA AND TOOLS

- ① Shaft A
- ③ Guide B
- ⑤ Retainer B
- ⑨ Flange B
- Ⓜ Propeller shaft housing
- Ⓝ Needle roller bearing

(1) Needle roller bearing in propeller shaft housing

1. Installation

Put the retainer B ⑤ in the groove (indicated by the arrow in the figure) of the shaft A ①, then put the needle roller bearing ③ and guide B ④ on the retainer B.

Note:

Be sure to set so that the chamfered side of guide B, non-mark side of needle roller bearing and V-groove side of retainer B are all facing the threaded side of the shaft A ①.

As the said tools and part are assembled as mentioned above, insert them together into the propeller shaft housing ⑥ in the direction of the arrow A in the figure. Then, set the flange B ⑨ as shown in the figure and tighten the assembly with the washer and nut so that it is tightly fastened.

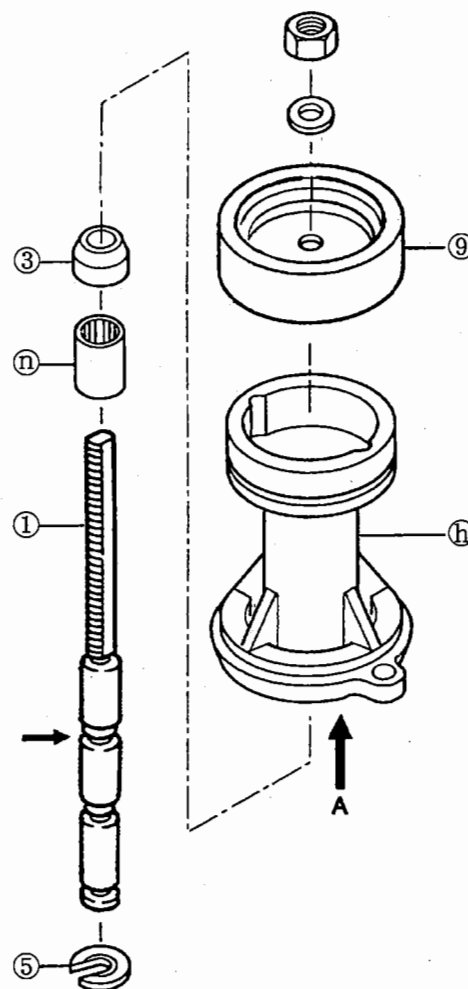
2. Removal

For removing the needle roller bearing, put only the retainer B in the narrow part (indicated by the arrow in the figure) of the shaft A and the assembled shaft in the reverse direction of the arrow A shown in the figure. (Be sure to remove the oil seal of the propeller shaft housing beforehand.)

Then, set the spacer ⑧ and flange B in the side of the arrow A shown in the figure, and tighten the assembled shaft with the washer and nut until the needle roller comes out. (Set the flange B with the wide collar facing the propeller shaft housing – reverse orientation to that in the press-in setting.)

Note:

Never reuse the needle roller bearing once removed.



CHAPTER 2 SERVICE DATA AND TOOLS

- ① Shaft A
- ② Guide A (inside diameter 16)
- ④ Retainer A (dia. 23.5)
- ⑥ Flange A
- ⑦ Shaft stopper

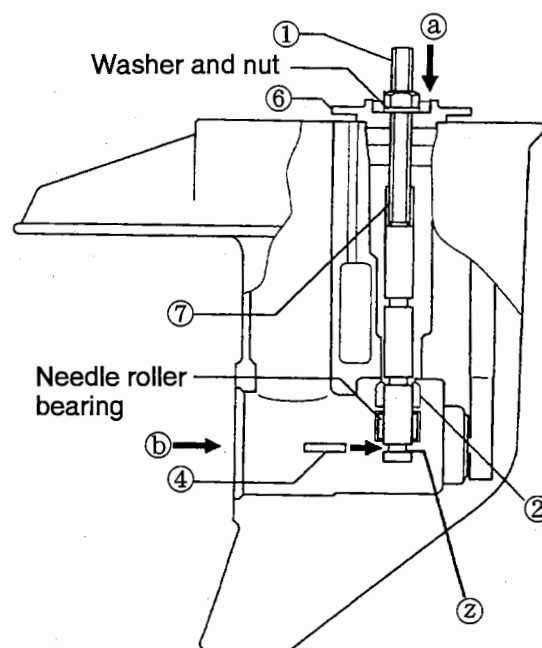
(2) Needle roller bearing of gear case

1. Installation

Insert the shaft A ① into the gear case in the direction of the arrow ③, and set the retainer A ④ in the groove ② in the direction of the arrow ④ after the needle bearing is set on the guide A ②. (Make sure that the larger diameter step in guide A, non-marking side of needle roller bearing, and the V-groove side of retainer A are all facing the threaded side of the shaft A ①.) Then set the shaft stopper ⑦ and flange A ⑥ as shown in the figure on the right. Insert flange A in the cavity (hole for lower pump case), support the flange A with your hand, set the washer and nut and tighten the nut so that the shaft is firmly secured. The press-fit of the needle bearing is complete at this step. (Flange A has many steps; use the part with dia. 43mm, for the cavity of the lower pump case.) Now, if you loosen the nut and remove the retainer A, the tool can be removed.

2. Removal

Insert the shaft A with the guide A assembled with it in the direction of the arrow ③, and set the retainer A in the narrow part ② of the shaft A in the direction of the arrow ④. Then, put the flange A on the shaft and place it on the gear case. Tighten the shaft with the washer and nut until the needle roller bearing comes out.



CHAPTER 2 SERVICE DATA AND TOOLS

6. Socket and wrench for bevel gear B nut

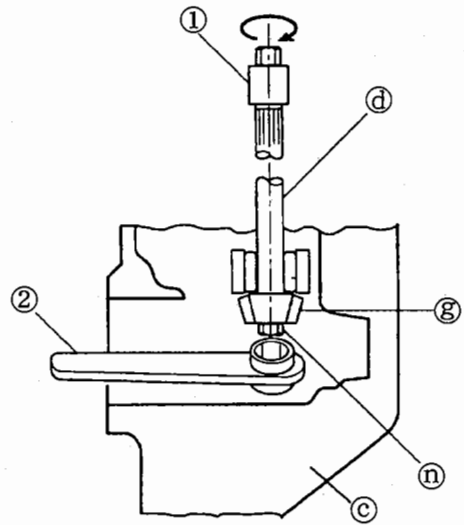
- ① Socket for bevel gear B nut (346-72232-0)
- ② Wrench for bevel gear B nut (346-72231-0)

- Hold the bevel gear B nut ① in the gear case ③ with the wrench ②, and tighten the socket ① that is inserted into the engine-side spline of the drive shaft at the specified torque using the torque wrench.

Note:

The threaded area of the bevel gear B nut and drive shaft must be completely degreased before applying a coating of thread locking agent (Three Bond 1373-B). Do not apply an excessive amount of locking agent.

Tightening torque: 30-35 N – m
3.0-3.5 kg – m
22-25 lb – ft



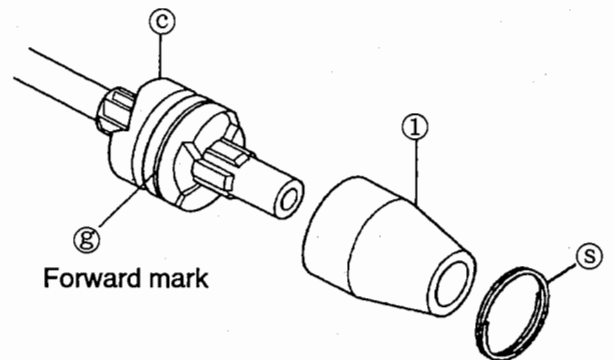
7. Clutch pin snap tool

- ① Clutch pin snap tool (346-72229-0)

- Install clutch spring, clutch push rod, clutch and clutch pin on the propeller shaft. Then install snap tool ① on the propeller shaft so that the clutch pin snap ⑤ spreads out gradually along the tapered part and install it in the groove of clutch.

Note:

Do not re-use a snap ring that has been removed.



CHAPTER 2 SERVICE DATA AND TOOLS

8. Backlash measuring tool

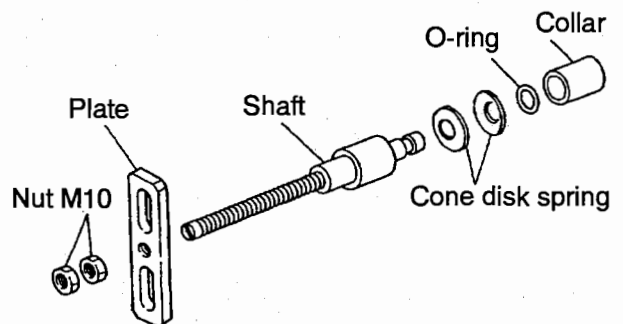
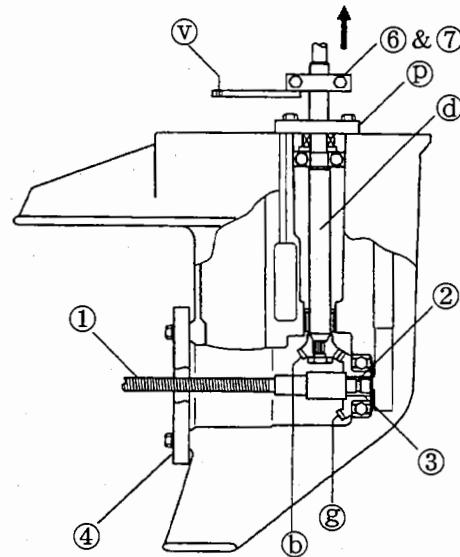
- ① Shaft (345-72723-0)
- ② O-ring (332-60002-0)
- ③ Collar (346-72245-0)
- ④ Plate (3A3-72713-0)
- ⑤ Cone disk spring (3B7-72734-0)
- ⑥ Clamp A (3B7-72720-0)
- ⑦ Clamp B (3B7-72720-0)
- Ⓟ Lower pump case
- Ⓡ Bevel gear B

- (1) For measuring the backlash between the bevel gear A and B, remove the propeller shaft housing, propeller shaft and bevel gear C from the gear case.

Put the cone disk springs back to back on the shaft ① (in the narrow part side) and set the O-ring ② in the narrow part and then collar ③ on the shaft. Then, screw the plate ④ completely on the thread side of the shaft. Set the collar side of the shaft in the bearing of the bevel gear A Ⓡ and fasten the plate to the gear case with the bolts.

Set an ordinary screwdriver in the ⊖ slot on the tip of the shaft and turn the shaft until the drive shaft ④ turns together with the shaft ①. Then continue to turn the shaft for additional half a turn. After that, lock the nuts M10.

- (2) Fasten the clamps A ⑥ and B ⑦ to the drive shaft ④ with the bolts. Turning the drive shaft while raising it in the direction of the arrow, read the dial gauge shaking in the notched part ⑤.



Dial gauge reading

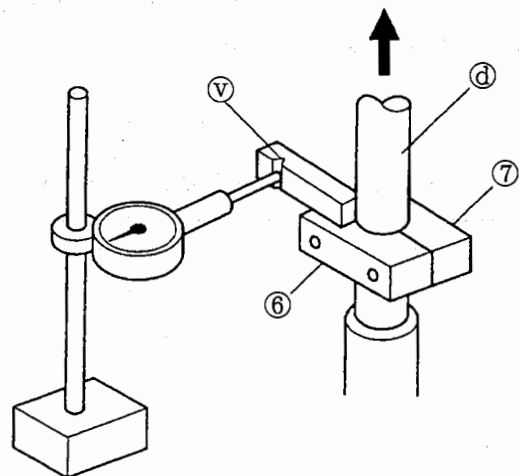
Correct backlash: 0.33-0.54 mm

0.0130-0.0213 in

Types of adjusting shims :

For gear B side: 0.1, 0.15, 0.3, 0.5 mm

For gear A side: 0.1, 0.15 mm



CHAPTER 2 SERVICE DATA AND TOOLS

Relation between the dial gauge reading and shim thickness is as follows.

Notes:

1. Determine Dial Gauge Reading range in table that has a low end value closest to the obtained dial gauge reading.
2. Find corresponding Shim Thickness value in the table.
3. Add or remove shims to increase or decrease shim thickness by the value specified. (+ : add, - : remove)
4. Re-check the backlash measurement.

Example:

If the dial gauge reading is within from 0.33 to 0.54 mm (0.0130 – 0.0213 in), the shim thickness is proper, and no further shim adjustment is required. If the reading is 0.85 mm (0.0335 in), the shim needs additional 0.15 mm (0.0059 in) thickness.

Gauge Reading		Shim Thickness + Increase shim thickness - Decrease shim thickness	
mm	in	mm	in
0.00 – 0.05	0.0000 – 0.0020	- 0.15	- 0.0059
0.06 – 0.20	0.0024 – 0.0079	- 0.10	- 0.0039
0.21 – 0.32	0.0083 – 0.0126	- 0.05	- 0.0020
0.33 – 0.54	0.0130 – 0.0213	0.0	0.0000
0.55 – 0.65	0.0217 – 0.0256	+ 0.05	+ 0.0020
0.66 – 0.80	0.0260 – 0.0315	+ 0.10	+ 0.0039
0.81 – 0.95	0.0319 – 0.0374	+ 0.15	+ 0.0059
0.96 – 1.11	0.0378 – 0.0437	+ 0.20	+ 0.0079
1.12 – 1.30	0.0441 – 0.0512	+ 0.25	+ 0.0098
1.31 – 1.45	0.0516 – 0.0571	+ 0.30	+ 0.0118
1.46 – 1.60	0.0575 – 0.0630	+ 0.35	+ 0.0138
1.61 – 1.75	0.0634 – 0.0689	+ 0.40	+ 0.0157
1.76 – 1.90	0.0693 – 0.0748	+ 0.45	+ 0.0177
1.91 – 2.05	0.0752 – 0.0807	+ 0.50	+ 0.0200
2.06 – 2.25	0.0811 – 0.0886	+ 0.55	+ 0.0217

 =Acceptable range

Take the following precautions during measurement:

- Make sure that the shaft to which the bevel gear is attached, does not rotate when the drive shaft is lightly rotated.
- Confirm that the drive shaft bearing B is secured only to the lower pump case. Clamps A and B must be fitted as close to the lower pump case as possible.
- After securing the gear case and the dial gauge, pull up the drive shaft while rotating it and take the dial gauge reading. The measurements should be made such that play does not occur in other parts (deflection of drive shaft, play between drive shaft and bearing).

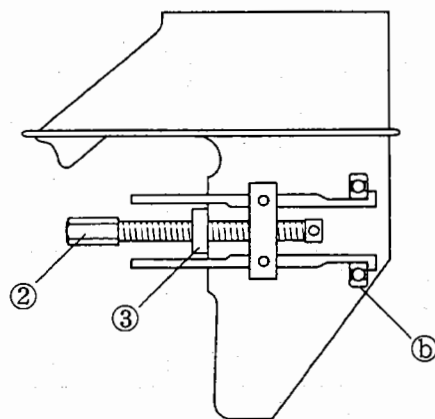
9. Bevel gear A bearing puller

(345-72224-1)

② Hexagonal part

③ Plate

- To remove the bevel gear A bearing ①, set the puller in the gear case as shown in the figure and tighten the hexagonal part ② using a wrench.
- Do not re-use bearings once removed.



CHAPTER 3 INSPECTION AND MAINTENANCE

1. Periodical Inspections

Classification	Description	Inspection frequency						Check and maintenance	Remarks
		First 20 hours or 1 month	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 spark gap and remove carbon deposits or Replace.	0.8~0.9 mm
Starting system	Starter rope	○	○	○	○	○	○	Check wear.	
	Starter motor			○	○	○	○	Check for salt deposits and the battery cable condition.	
	Battery	○	○	○	○	○	○	Check installation, fluid level, gravity.	
Engine	Engine oil & Filter	○ Replace		○ Replace	○ Replace	○ Replace	○ Replace		
	Valve clearance	○			○		○	Check and adjust.	
	Compression pressure				○		○	Check.	
	Combustion chamber					○		Clean.	Including valve lapping
	Timing belt			○	○	○	○	Check wear, crack and lengthen	
Lower system	Propeller	○	○	○	○	○	○	Check any bent, damage, wear in blade.	
	Gear oil	○ Replace	○	○ Replace	○ Replace	○ Replace	○ Replace	Change or replenish oil. Check water in oil.	Genuine gear oil (GL5, SAE80 – 90),
	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 every 300-hours running.

CHAPTER 3 INSPECTION AND MAINTENANCE

2. Troubleshooting

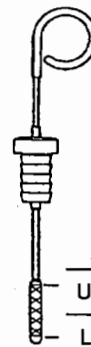
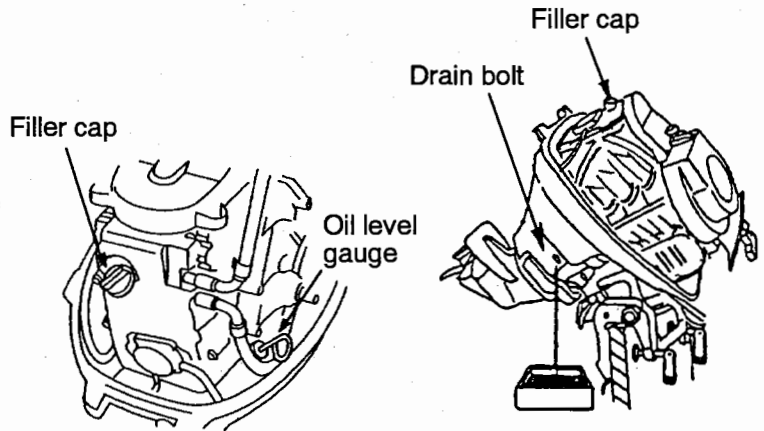
	Engine failing to start	Engine starting but stopping soon	Poor idling	Poor acceleration	Engine speed abnormally high	Engine speed abnormally low	Boat speed low	Overheating of engine	Possible cause
FUEL SYSTEM	●	●							Empty fuel tank
	●	●	●	●		●	●	●	Incorrect connection of fuel system
	●	●	●	●		●	●	●	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
	●			●					Excessive supply of fuel
	●	●	●	●		●	●	●	Poor carburetor adjustment
ELECTRICAL SYSTEM	●	●	●	●		●	●	●	Spark plug other than specified
	●	●	●	●		●	●		Dirt, soot, etc. on spark plug
	●	●	●	●		●	●		No spark or weak spark
	●								Short circuit of engine stop switch
	●		●	●		●	●		Ignition timing incorrect
	●								Lack of stop switch lock plate.
	●								Disconnection of wire or loose ground connection
	●								Blown 20 Amp fuse in the starting circuit
	●								Not shifted into neutral position
	●								Weak battery or battery connections are loose or corroded
	●								Ignition key switch failure
	●								Wiring or electrical connection faulty
	●								Starter motor or starter solenoid failure
●								Faulty Auto-By-Starter	
COMPRESSION SYSTEM		●	●	●		●	●		Low compression
			●					●	Carbon deposits in the combustion chamber
				●			●		Incorrect valve clearance
								●	Low oil pressure/level
OTHERS	●		●	●		●	●		Incorrect adjustment of throttle link
							●	●	Insufficient cooling water flow, clogged or defective pump
			●				●	●	Faulty thermostat
				●	●		●	●	Cavitation or ventilation
				●	●	●	●	●	Incorrect propeller selection
			●	●	●	●	●	●	Damaged and bent propeller
				●	●		●	●	Improper thrust rod position
				●	●	●	●	●	Unbalanced load on boat
			●	●	●	●	●	Transom too high or too low	

CHAPTER 3 INSPECTION AND MAINTENANCE

3. Change of Engine Oil

Engine oil mixed with dirt or water will dramatically shorten the life of the engine.

- ① Stop the engine and set it in a tilted position.
- ② Remove the upper motor cover. Allow engine to cool.
- ③ Turn the outboard so that the drain bolt is facing downward. Remove oil filler cap.
- ④ Put drain pan under the oil drain bolt.
- ⑤ Remove the oil drain bolt and completely drain oil from the engine.
- ⑥ Tighten the oil drain bolt (Apply engine oil to the drain bolt gasket).
- ⑦ Reset the engine in a vertical position.
- ⑧ Fill the engine through filler port with recommended oil (see chart below) to the upper mark of the oil level gauge.
- ⑨ Tighten the oil filler cap.



	Oil volume needed for complete oil change	
	With oil filter replacement	Without oil filter replacement
Upper limit (Max.)	1,800ml (1.90 US qt)	1,600ml (1.69 US qt)
Lower limit (Min.)	1,500ml (1.58 US qt)	1,300ml (1.37 US qt)

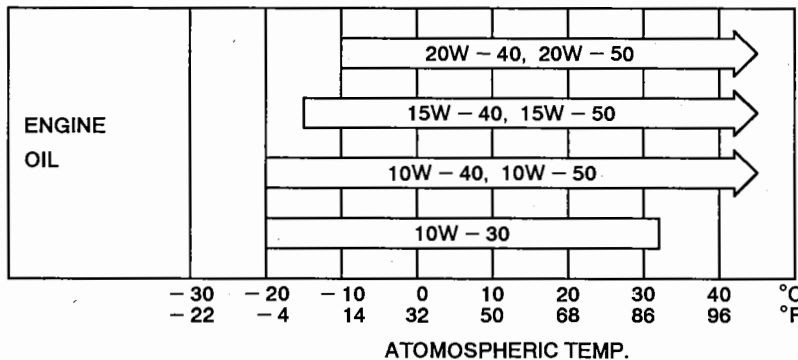
(Note)

Recommended engine oil:

4 stroke engine oil Use SAE 10W-30/40 of rated SF, SG, SH or SJ.

Use the proper viscosity oil from the chart below. This chart is based on the atmospheric temperature where the engine will be used.

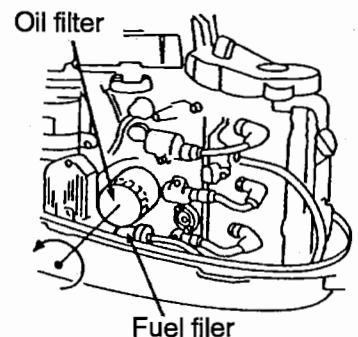
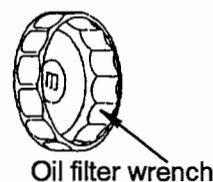
Oil capacity 1,800 ml



4. Change of Oil Filter

Change oil filter after engine oil drained.

- ① Using the oil filter wrench, unscrew old filter by turning the filter to counterclockwise.
- ② Clean the mounting base. Apply film of clean oil to filter gasket. Do not use grease.
- ③ Screw new filter on until gasket contacts base, then hand-tighten 3/4 to 1 turn.



CHAPTER 3 INSPECTION AND MAINTENANCE

5. Inspection of Fuel System

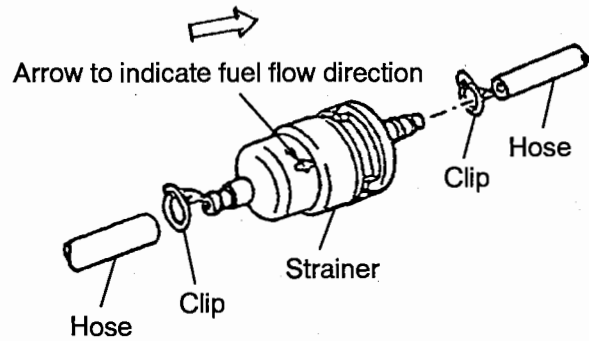
Fuel filters are provided inside the fuel tank and engine.

① Changing engine filter

Replace the filter if there is water or dirt inside.

Notes:

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



② Fuel tank filter

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

③ Fuel tank

Water or dirt in the fuel tank will cause engine performance problems.

Check and clean the tank if there is water or dirt inside.

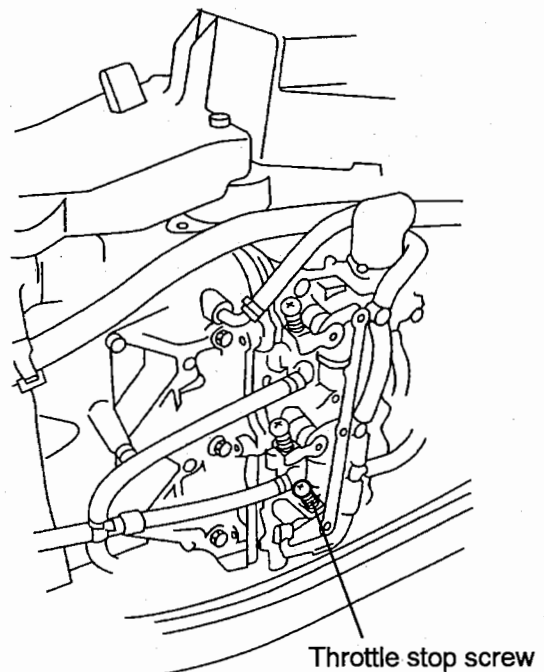
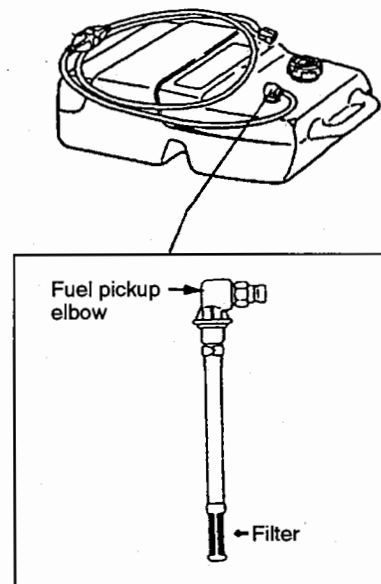
④ Carburetor adjustment for specified idle speed

Turn the throttle stop screw of the #3 carburetor for the specified idle speed.

Notes:

- Adjust engine speed with a tachometer after warming up the engine.
- Specified engine speed
Neutral: 950 rpm approx.
Forward gear: 900 rpm approx.

Remarks: The pilot screw is not adjustable.



CHAPTER 3 INSPECTION AND MAINTENANCE

6. Carburetor adjustment

Be sure to adjust the carburetor after warming up the engine.

- ① Set the shift lever at the neutral position and stop the engine.
- ② Remove the H510 bolt with three washers from the inlet manifold.
- ③ Set the vacuum gauge adapter to every spark plug hole and connect the vacuum gauge tube to each gauge adapter.

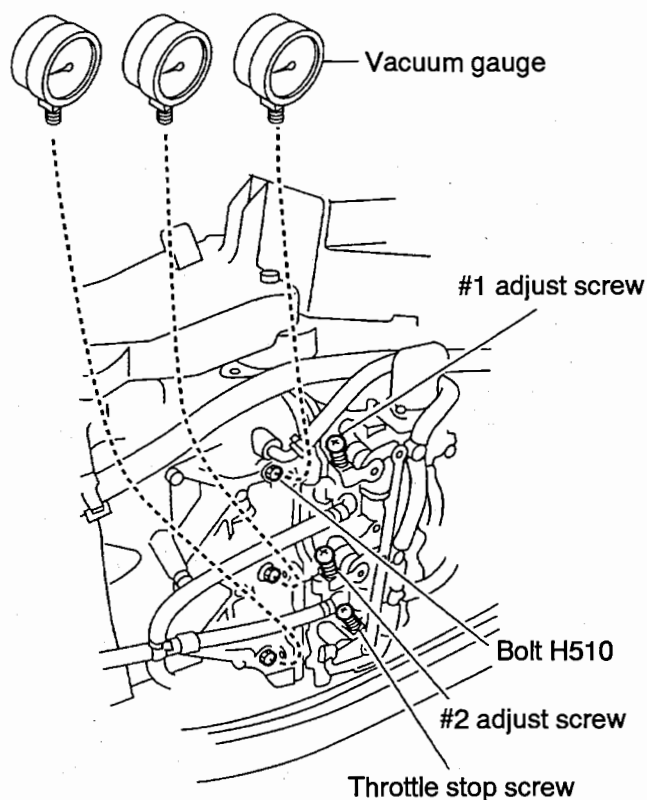
Note:

- When connecting the vacuum gauges, pay heed to the number of each gauge so that it agrees with the number of vacuum gauge adapter to connect.

- ④ Start the engine and adjust idle speed. (Refer to the preceding section.)
- ⑤ Measure the vacuum of each cylinder.
If vacuum difference between the cylinders exceeds 2.7 kPa (20 mm Hg), adjust the vacuum as follows.
- ⑥ For adjusting the vacuum of the cylinder, turn the adjust screws of the #1 and #2 carburetors so that difference in the negative pressure between the two carburetors and #3 carburetor is lower than 2.7 kPa (20 mm Hg) respectively referring to the negative pressure of the #3 carburetor.

Repeat racing the engine several times and adjust the negative pressure of the #1 and #2 carburetor until each pressure becomes equal to that of the #3 carburetor.

- ⑦ Stop the engine and remove the vacuum gauge adapters from the inlet manifold.
- ⑧ Restore the H510 bolt with washers to the inlet manifold.
- ⑨ Start the engine and measure idle speed. If it is out of the specified rate, adjust the throttle stop screw of the #3 carburetor and check the idle speed again.



CHAPTER 3 INSPECTION AND MAINTENANCE

7. Anode Replacement

The anode protects the engine from corrosion (metal abrasion caused by feeble electricity).

The anode is installed on the gear case and cylinder block of the power unit respectively.

If the anode is worn down to 2/3 of the original in size, replace it with a new one.

Notes:

- Apply neither oil nor paint to the anode.
- Since the periphery of the bolt fixing the anode is easily affected by electrolytic corrosion, be sure to tighten the fixing bolt at every inspection.

8. Compression Test

(1) Compression Pressure Measurement

- ① After warming up the engine remove all the spark plugs.
- ② Install the compression gauge in the spark plug hole.
- ③ Fully open the throttle grip.
- ④ Pull the recoil starter several times quickly so that the pointer of the compression gauge reaches maximum.

Notes: Standard compression pressure at 650 to 700 rpm

With de-compressor: $0.49 \pm 0.1\text{MPa}$

($5 \pm 1\text{kg/cm}^2$)

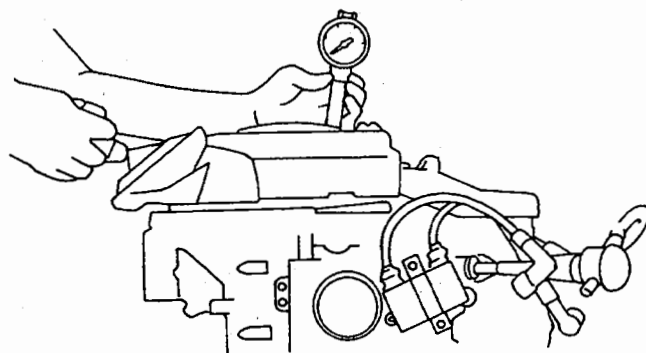
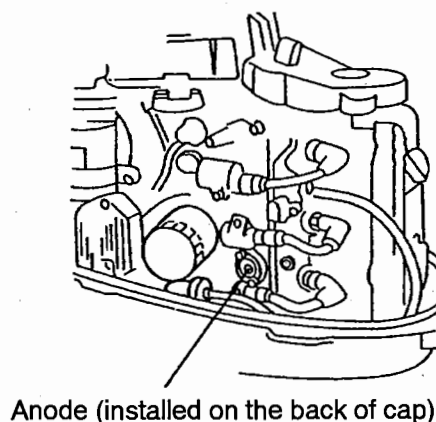
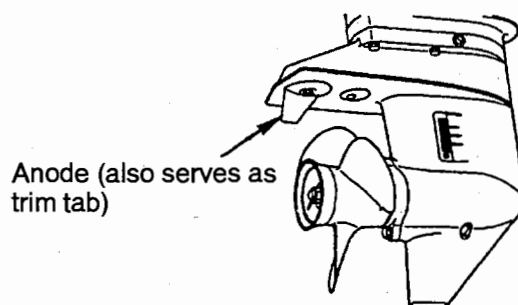
($71 \pm 14\text{psi}$)

Without de-compressor: $1.13 \pm 0.1\text{MPa}$

($11.5 \pm 1\text{kg/cm}^2$)

($164 \pm 14\text{psi}$)

(Remove the rocker arm of EX side)



CAUTION

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

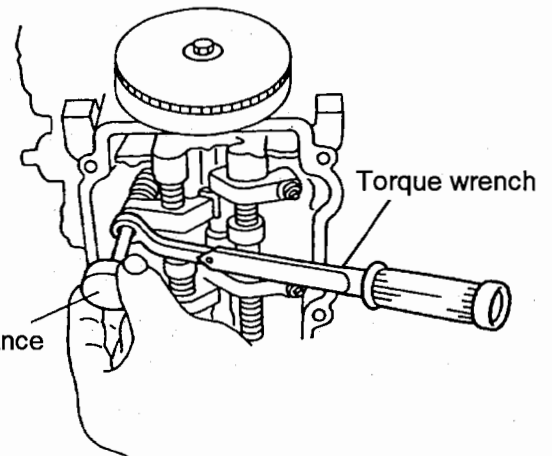
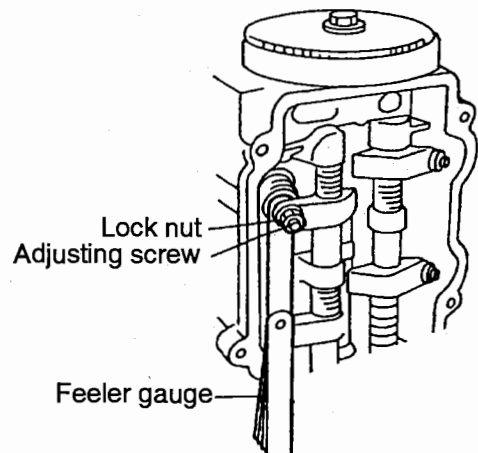
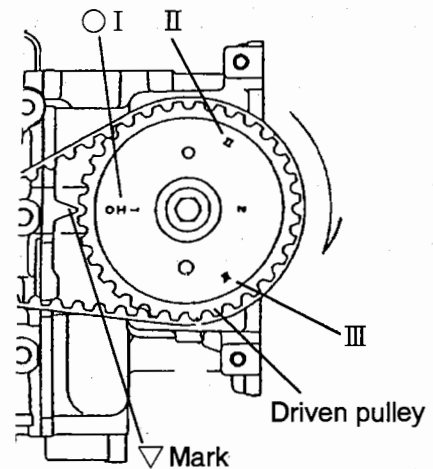
CHAPTER 3 INSPECTION AND MAINTENANCE

(2) Valve clearance adjustment

Valve clearance adjustment must be performed when the engine is cool, piston must be the top dead center of compression stroke.

Perform the following adjustment steps:

- ① Remove the belt cover, spark plugs and cylinder head cover.
- ② Turn the driven pulley (cam shaft pulley) so that the "○ I" mark meets the "▽" mark on the cylinder head.
- ③ Adjust the intake and exhaust valve clearance for cylinder #1.
 - Loosen the lock nut.
 - Insert a feeler gauge between the valve end and the adjusting screw.
 - Set the valve clearance by the adjusting screw.
 - Tighten the lock nut.
 - Again check the valve clearance.
- ④ Turn the driven pulley clockwise so that the "II" mark meets the "▽" mark on the cylinder head.
- ⑤ Adjust the intake and exhaust valve clearance for cylinder #2 in the same manner as cylinder #1.
- ⑥ Adjust the valve of the #3 cylinder in the same manner as mentioned above.



Valve clearance	IN: 0.13-0.17 mm (0.005-0.007 in)
	EX: 0.18-0.22 mm (0.007-0.009 in)

Note:

When loosening and tightening lock nut, hold the adjusting screw with a valve clearance driver to prevent it from moving.

Tightening torque of the lock nut:

6-8 N - m (0.6-0.8 kg - m) (4.4-5.8 lb - ft)

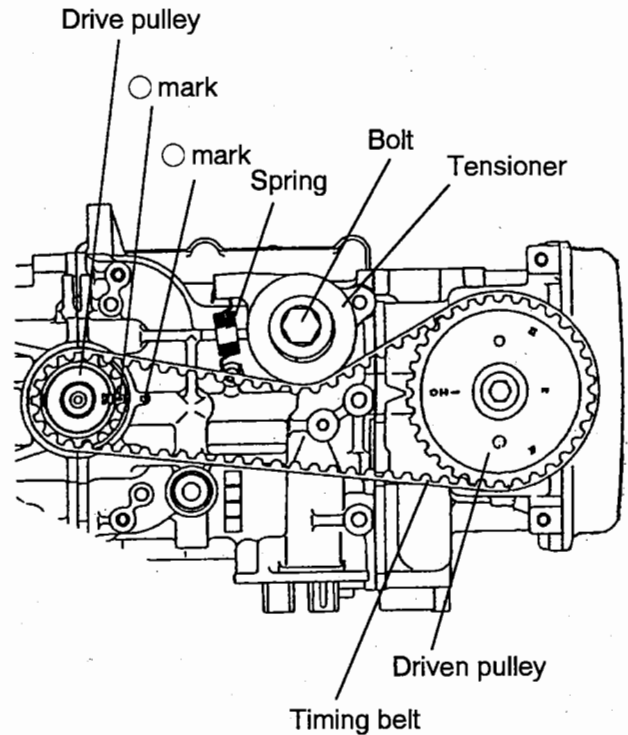
CHAPTER 3 INSPECTION AND MAINTENANCE

9. Inspection and Replacement of Timing Belt

If cracks, wear, lengthening or other damage is found, replace the timing belt.

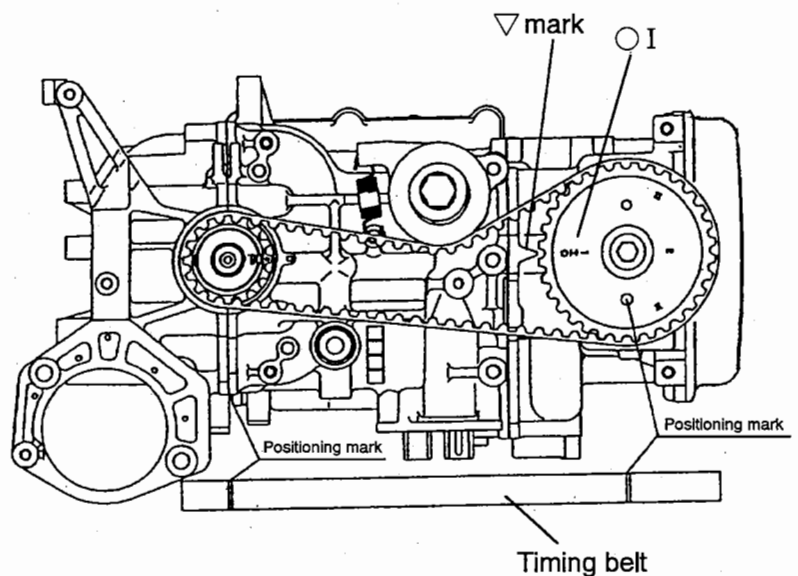
Removal of timing belt

- ① Remove the parts in following order.
 - Spark plugs
 - Recoil starter
 - Magneto flywheel cup
 - Alternator assembly
 - Alternator bracket
- ② Turn the crankshaft so that the "○" mark on the drive pulley (timing pulley) meets the "○" mark on the cylinder block.
- ③ Loosen the tensioner fastening bolt (H1040) and remove the tensioner spring.
- ④ Disengage the timing belt from the driven pulley.



Installation of timing belt

- ① Turn the crankshaft so that the "○" mark on the drive pulley meets the "○" mark on the cylinder block.
- ② Turn the crankshaft clockwise until the "○ I" mark on the driven pulley meets the "▽" mark on the cylinder head.



CHAPTER 3 INSPECTION AND MAINTENANCE

- ③ Install and engage the timing belt while properly locating the positioning marks.
- ④ Turn the drive pulley counterclockwise until one tooth of driven pulley turns counterclockwise. Stop to turn the drive pulley and tighten the tensioner fastening bolt completely while keeping the drive pulley at the same position to give the timing belt proper tension.

Note: Follow the above-mentioned method to give the timing belt proper tension.

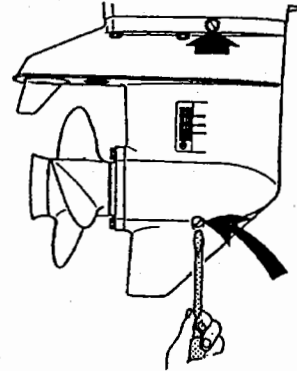
Notes:

- After install the timing belt, make sure that the "○ I" mark on the driven pulley meets the "▽" mark on the cylinder head while the "○" mark on the drive pulley meets the "○" mark on the cylinder block.
- Don't apply oil, grease or the like to the timing belt.

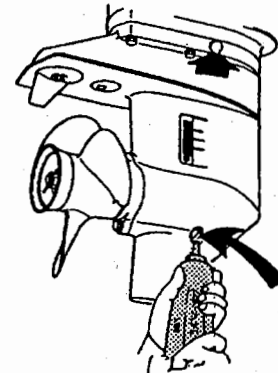
CHAPTER 3 INSPECTION AND MAINTENANCE

10. Change of Gear Oil

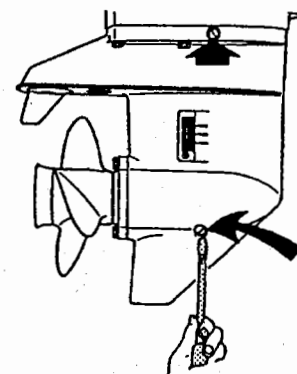
- ① Remove the oil plugs (upper and lower), and completely drain the gear oil into a pan.



- ② Insert the oil tube nozzle into the lower oil plug hole, and fill with gear oil by squeezing the oil tube until oil flows out of the upper plug hole.



- ③ Install the upper oil plug, and then remove oil tube nozzle and install the lower oil plug.



Notes: Recommended gear oil and oil volume

- Genuine gear oil or GL5, SAE #80 to 90 gear oil
- Oil volume: 280 ml (9.5 US fl. oz) approx.

CHAPTER 3 INSPECTION AND MAINTENANCE

11. Flushing

▲ WARNING

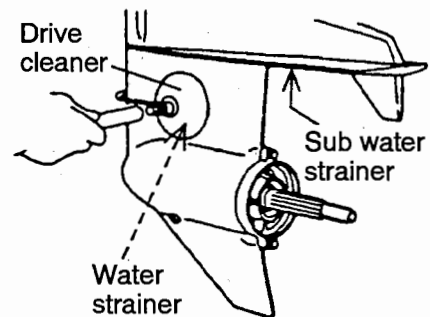
Before flushing, remove the propeller and the forward thrust hub.

▲ WARNING

Never start or operate the engine indoors or in any space which is not well ventilated. Exhaust gas contains carbon monoxide, a colorless and odorless gas which can be fatal if inhaled for any length of time.

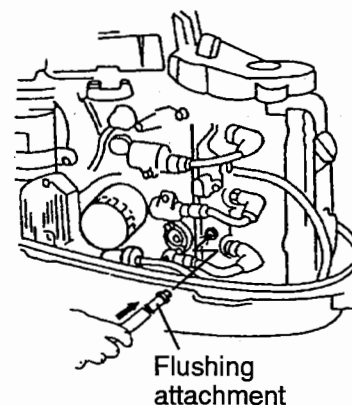
Washing with drive cleaner

- ① Remove the propeller, thrust holder, etc.
- ② Cover the sub water strainer with adhesive tape.
- ③ Attach the drive cleaner to the water strainer.
- ④ Connect the drive cleaner to a faucet with a hose and turn it on to wash.
- ⑤ Set the shift lever at the neutral position and start the engine.
- ⑥ Make sure that cooling water flows out of the water check hole and run the engine at a low speed for 3 to 5 minutes.
- ⑦ Stop the engine and turn off the faucet. Remove the drive cleaner and adhesive tape and reinstall the propeller as it was.



Washing with flushing attachment (hose adapter)

- ① Remove the propeller, thrust holder, etc.
- ② Cover the water strainer and sub water strainer with adhesive tape.
- ③ Remove the water plug and attach the flushing attachment.
- ④ Connect the flushing attachment to a faucet with a hose and turn it on to wash.
- ⑤ Set the shift lever at the neutral position and start the engine.
- ⑥ Make sure that cooling water flows out of the water check hole and run the engine at a low speed for 3 to 5 minutes.
- ⑦ Stop the engine and turn off the faucet. Remove the flushing attachment and adhesive tape, then tighten the water plug and reinstall the propeller as it was.



CHAPTER 3 INSPECTION AND MAINTENANCE

12. Inspection of Cooling System

(1) Thermostat test

- 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.

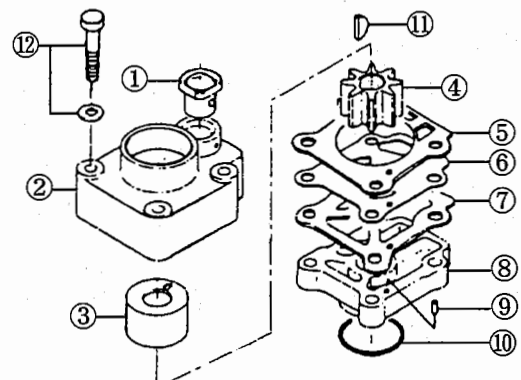
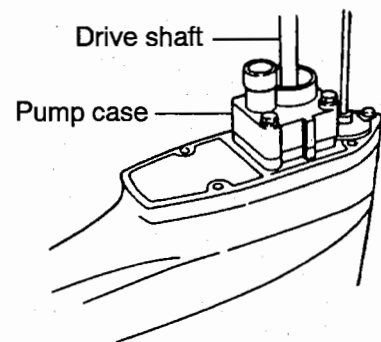
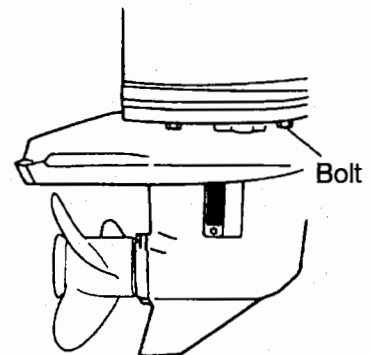
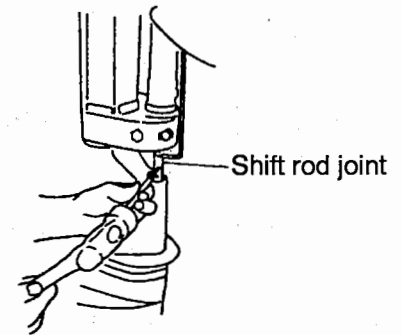
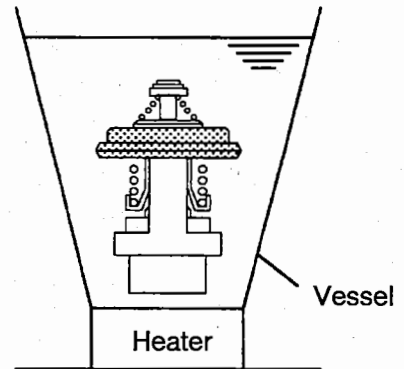
Valve operation start temperature: $60^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$
 $140^{\circ}\text{F} \pm 3^{\circ}\text{F}$
Valve full open temperature: $75^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$
 $167^{\circ}\text{F} \pm 3^{\circ}\text{F}$
Valve full open lift: 3 mm or more

(2) Water pump impeller replacement.

- ① Remove the lower side spring pin (3-12) from the shift rod joint with the spring pin tool A.
- ② Remove the five (5) gear case bolts and pull the gear case assembly.
- ③ Remove the four (4) pump case bolts and pull up the pump case (with the liner).
- ④ Remove the pump impeller and replace it with new one.

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

- ① Lower water pipe grommet
- ② Water pump case
- ③ Pump case liner
- ④ Pump impeller
- ⑤ Upper gasket
- ⑥ Water pump guide plate
- ⑦ Lower gasket
- ⑧ Lower water pump case
- ⑨ Knock 4-10
- ⑩ O-ring
- ⑪ Pump impeller key
- ⑫ Pump case bolt



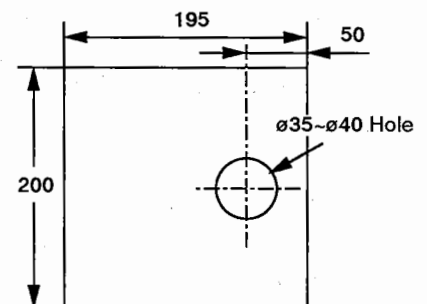
CHAPTER 4 POWER UNIT

1. General Notes on Service

When servicing the outboard motors, pay attention to the following instructions.

- (1) When servicing the outboard motor, be sure to securely fix it on a proper workstand.
For servicing the power head, it is convenient to use the setting board shown below.
- (2) Be careful not to scratch or damage the mating surfaces of the cylinder, cylinder head, drive shaft housing and coated surfaces, etc. during servicing.
- (3) When the packing, gasket, O-ring, split pin, bearing, etc. are once removed, replace them with new ones on reassembling. If the snap ring is deformed, replace it with a new one.
- (4) Be sure to use genuine parts. Always use genuine or specified oil and grease.
- (5) For services that require to use a special tool(s), use the specified tool(s) following the instructions.
- (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 them off and wash them with solvent and then check to see if they are worn or damaged.
- (9) While reassembling, pay attention 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 the part for which many bolts and nuts are used (cylinder head, crankcase, etc.), carefully, gradually and evenly tighten the bolts and nuts starting with inner ones to outer ones diagonally or circularly (if tightening order is indicated for those bolts and nuts, tighten them as indicated). (When removing bolts and nuts from such a part, carefully loosen and remove them in the same manner but reverse order.)
 - 2) When inserting an oil seal, be careful in setting the correct 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 too much sealant is applied, the excess may not only stick out and flow into the case but also have a bad influence. When using an adhesive, carefully follow the instructions.
 - 4) If a fastener is hard to loosen and remove because of rust, spray penetrating oil to loosen and remove it after five or more minutes.
 - 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.

H820-6	Hexagon headed bolt	Diameter 8 mm	Length 20 mm	6 pcs.
N8-4	Normal hexagon nut	Diameter 8 mm		4 pcs.
L8-2	Hexagon lock nut	Diameter 8 mm		2 pcs.
W6-8	Plain washer	Diameter 6 mm		8 pcs.
SW6-1	Spring washer	Diameter 6 mm		1 pcs.
Pan 620-7	Pan headed screw	Diameter 6 mm	Length 20 mm	7 pcs.
- (10) Work carefully during maintenance and repair to avoid injuries and accidents.



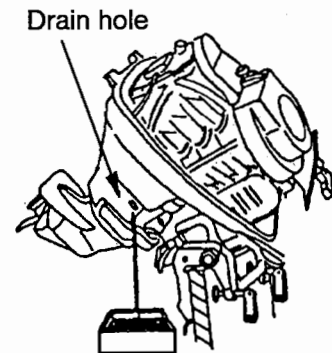
Thickness: 25 or more
Unit: mm

Setting board for power unit

CHAPTER 4 POWER UNIT

2. Removing Power Unit

- ① Drain the engine oil.
- ② Disconnect or remove the following connections, wires, hoses, links, etc.
 - Terminals of the battery cord
 - Parts connected with the lower unit such as plug terminals of the main switcher, stop switch, etc.
 - Plug terminals of pilot lamps
 - Fuel hose
 - Wire for start in gear protection
 - Throttle link
 - Hose for tell-tale
- ③ Remove the bolt (pan headed bolt 660-2) fastening the apron, and remove the apron.
- ④ Remove the engine fitting bolts (H8105-6) and lift the power unit upwards.



3. Removing Parts

1) Oil strainer

- ① Cut the hose band, and remove the oil strainer from the hose.

2) Recoil starter and belt cover

- ① Remove the fitting bolt (H620-5 & H625-2) and then remove the recoil starter assembly and the belt cover.

3) Ignition coil

- ① Remove the plug cap from the spark plug.
- ② Remove the ignition coil fitting bolt (H620-3) and then remove ignition coil.

4) C.D. Unit

- ① Remove the distributing coupler of the C.D. unit.
- ② Remove the C.D. unit fitting bolt (H620-2) and then remove the C.D. unit.

CHAPTER 4 POWER UNIT

5) Magneto flywheel cup

- ① Remove the flywheel cup with a special tool according to the instructions of "How to Use Special Tools" (Chapter 2, 5).

6) Alternator

- ① Remove the alternator fitting screw (Screw 625-3) and then remove the alternator.

7) Pulser coil

- ① Remove the pulser coil fitting screw (Screw 516-6) and then remove the pulser coil.

8) Starter motor and starter solenoid

- ① Remove the starter motor fitting bolt (H825-2 & H818-2) and then remove the starter motor.
- ② Pull the starter solenoid from the electric bracket.

9) Rectifier

- ① Remove the bolt (MF: H630-2, EF & EP: H655-2) fastening the rectifier and remove the rectifier.

10) Carburetor

- ① Loosen 3 (three) of clamp 60 screw, remove the bolt (H620-3) fastening the air silencer and remove the air silencer.
- ② Disconnect the fuel hose (between the fuel pump and carburetor) by the fuel pump side.
- ③ Remove the bolt (H6100-6) fastening the carburetor, and remove the carburetor together with the carburetor flange, insulator and gasket.

11) Fuel pump

- ① Remove the fuel pump fitting bolt (H625-2) and then remove the fuel pump.

4. Disassembling Engine

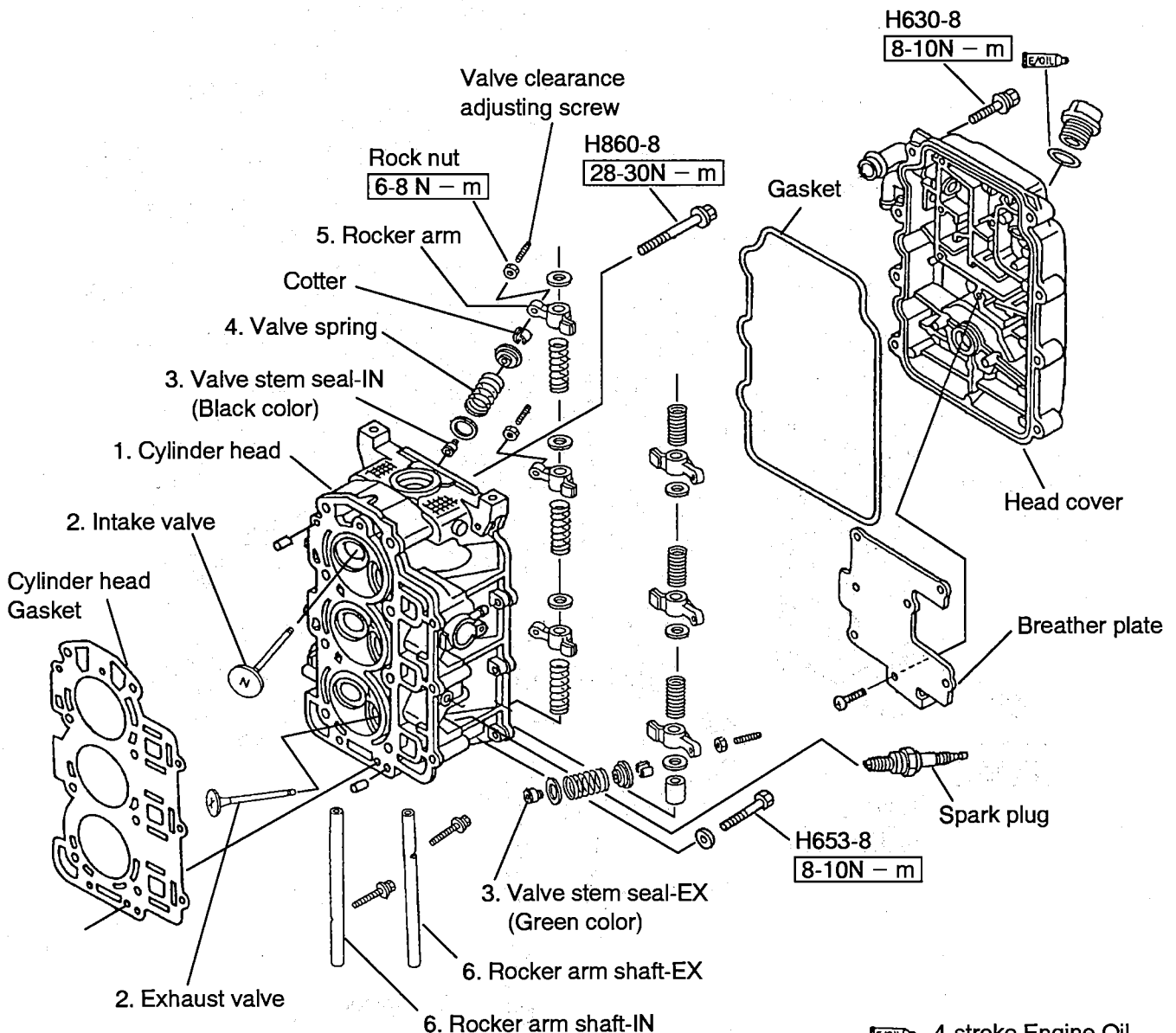
Disassemble the engine according to the illustrations provided by mechanisms.

- 1) Cylinder head, valves and related parts
- 2) Crank shaft, pistons, cylinder/crank case and related parts
- 3) Cam shaft, oil pump and related parts

CHAPTER 4 POWER UNIT

1) Cylinder head, valves and relating parts

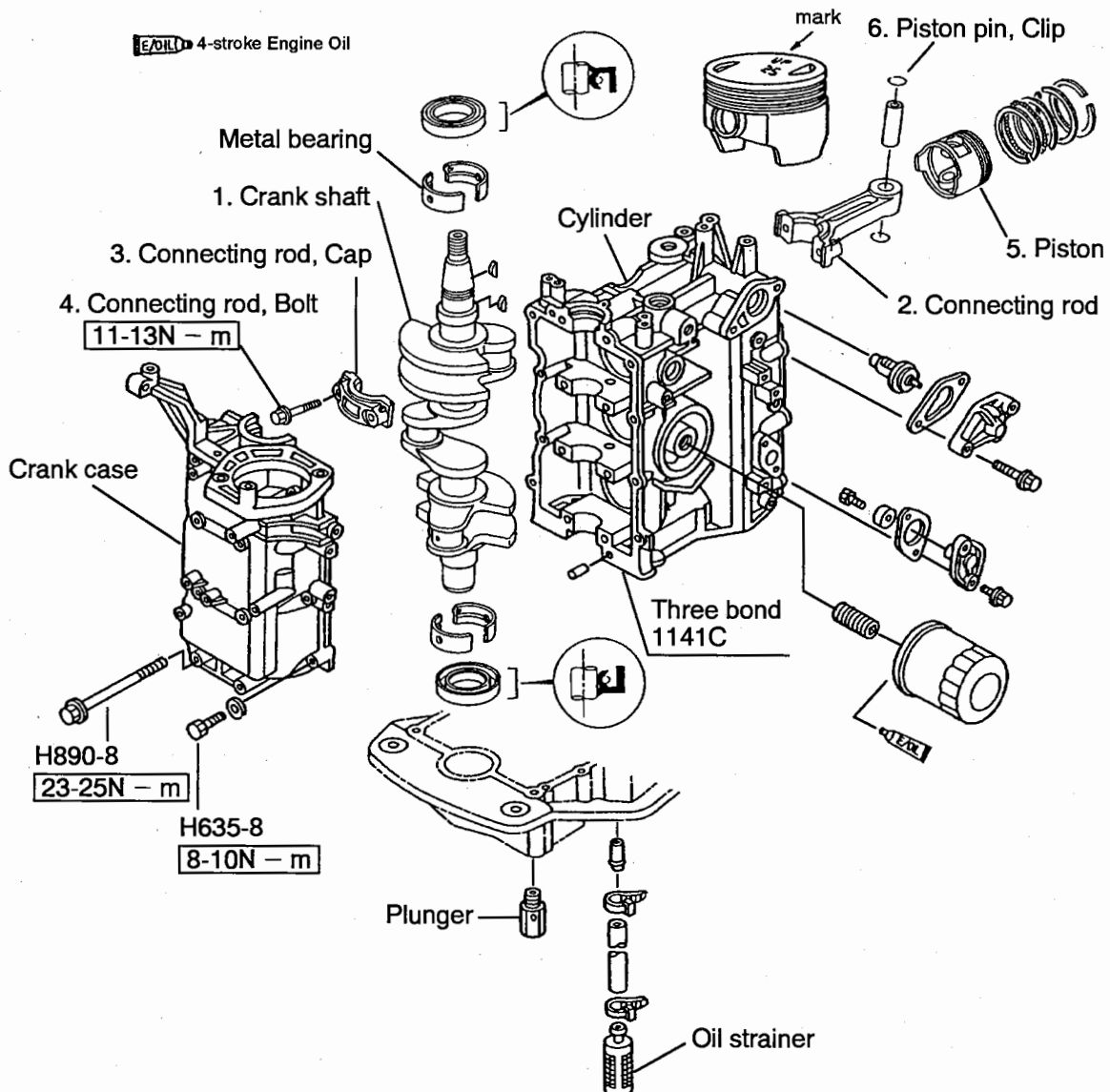
No.	Description	Check point, etc.
	Gasket & O-ring	Note: Must be replaced by new parts whenever they are once removed for disassembling.
1	Cylinder head	<ul style="list-style-type: none"> ● Carbon deposit in combustion chamber ● Surface width and roughness between valve seat and valve ● Scratch or distortion
2	Intake valve Exhaust valve	<ul style="list-style-type: none"> ● Surface width and roughness between valve seat and intake/exhaust valve ● Carbon deposit
3	Valve stem seal – IN Valve stem seal – EX	Black color: Wear of contact surface with valve stem Green color: Wear of contact surface with valve stem
4	Valve spring	● Weakness
5	Rocker arm	● Wear of three contact points: contact surface with cam, rocker arm shaft and rocker arm washer.
6	Rocker arm shaft	● Wear of contact surface with rocker arm



CHAPTER 4 POWER UNIT

2) Crank shaft, pistons, cylinder/crank case and related parts

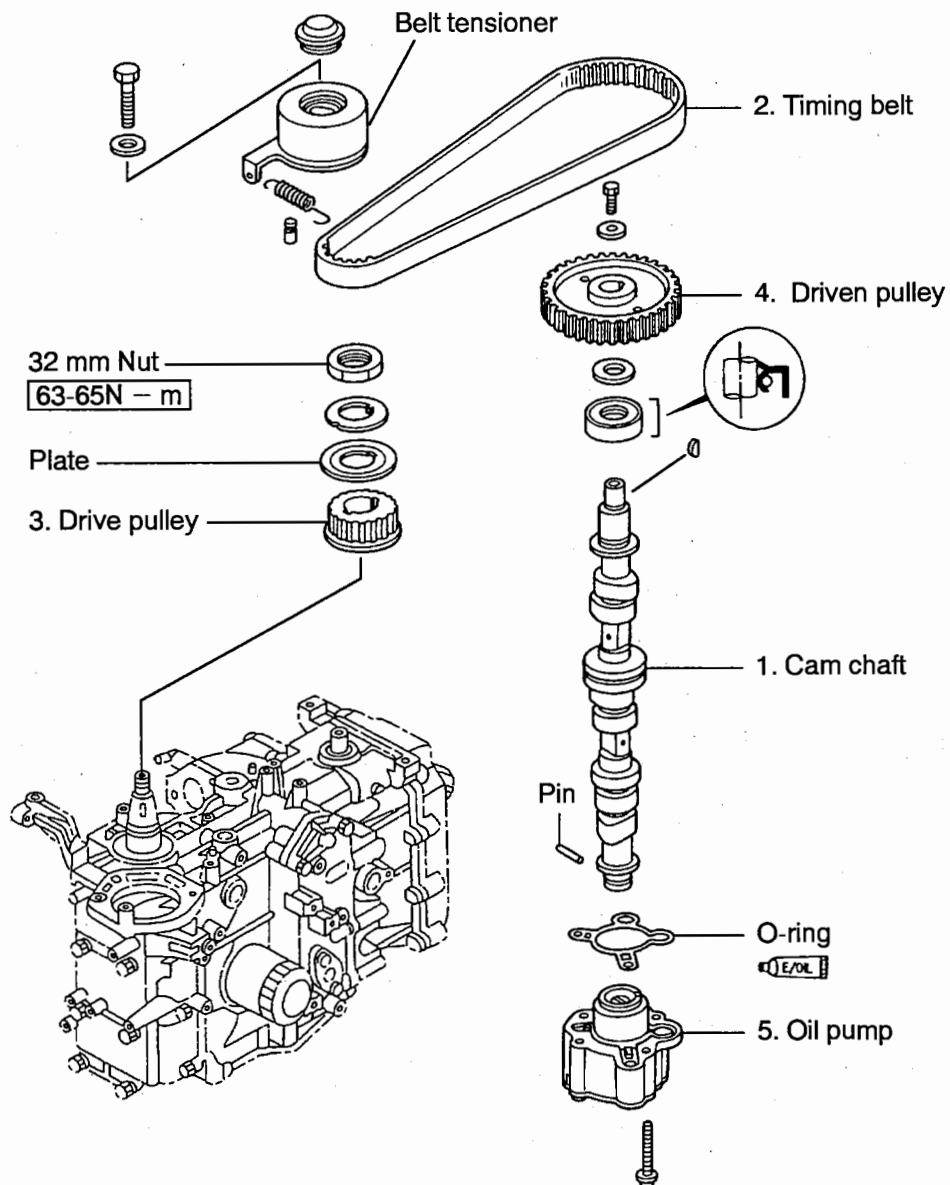
No.	Description	Check point, etc.
1	Crankshaft	<ul style="list-style-type: none"> ● Oil clearance at main bearings ● Oil clearance at big end of connecting rod Note: Align the tab of the metal bearing with the notch in the cylinder/crank case Note: There are two type of metal bearings (Thickness code: Blue color and Red color)
2	Connecting rod	Note: Pay attention to the connecting rod orientation for reassembling ("UP" mark must face the magneto side)
3	Connecting rod cap	Note: Mate the markings of the cap and connecting rod with each other ("UP" mark must face the magneto side)
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 attention to the piston direction ("UP" mark faces the magneto side)
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

3) Cam shaft, oil pump and related parts

No.	Description	Check point, etc.
1	Cam shaft	<ul style="list-style-type: none"> ● Smooth movement of decompressor weight Note: Be careful not to give any impact to cam shaft as this part is very weak against impact.
2	Timing belt	Note: Be sure to keep clean free from oil and grease
3	Drive pulley	Note: Be sure to keep clean free from oil and grease Note: Pay attention of direction ("UP" mark faces the magneto side)
4	Driven pulley	Note: Be sure to keep clean free from oil and grease Note: Pay attention of direction ("UP" mark faces the magneto side)
5	Oil pump	



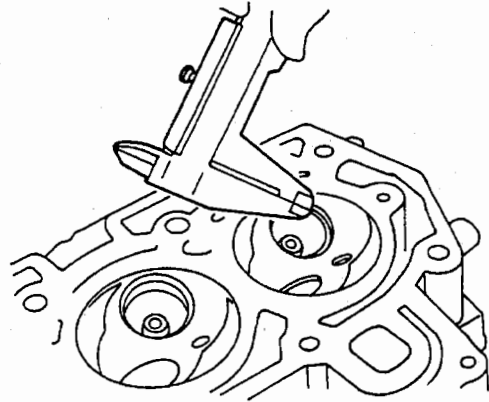
CHAPTER 4 POWER UNIT

5. Inspection and Measurement of Engine Parts

1) Measurement with vernier calipers

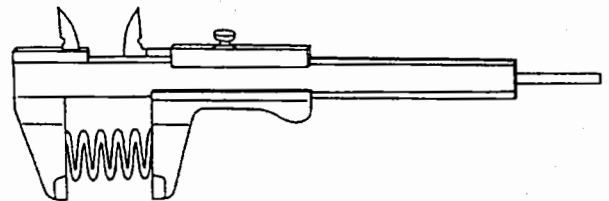
● Valve seat width

Standard value	Out of the limit to use
1.0 mm (0.0393 in)	If 2.0 mm (0.079 in) or more, it needs replacement or repair.



● Valve spring free length

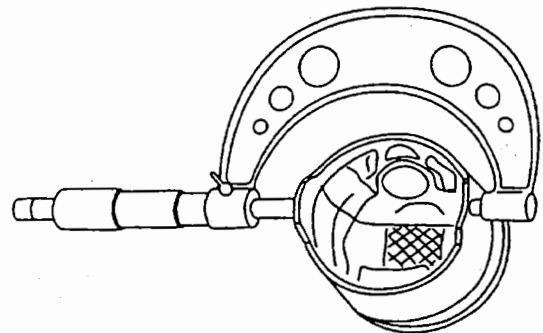
Standard value	Out of the limit to use
35 mm (1.38 in)	If 33.5 mm (1.319 in) or less, it needs replacement.



2) Measurement with micrometer

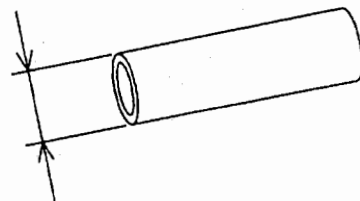
● Outer diameter of piston skirt

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.



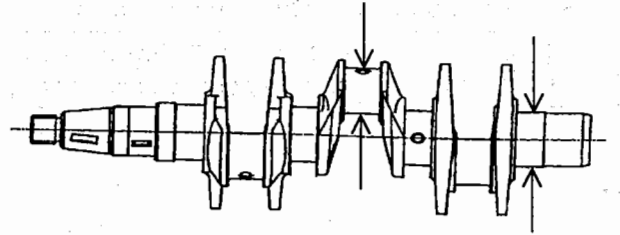
● Outer diameter of piston pin

Standard value	Out of the limit to use
16.00 mm (0.6299 in)	If 15.97 mm (0.629 in) or less, it needs replacement.

CHAPTER 4 POWER UNIT

● Outer diameter of crank pin

Standard value	Out of the limit to use
29.98 mm (1.1803 in)	If 29.95 mm (1.179 in) or less, it needs replacement.

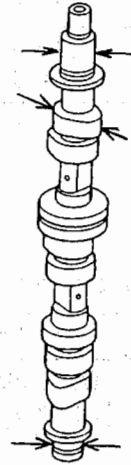


● Outer diameter of crank shaft in metal bearing

Standard value	Out of the limit to use
35.99 mm (1.4169 in)	If 35.97 mm (1.4161 in) or less, it needs replacement.

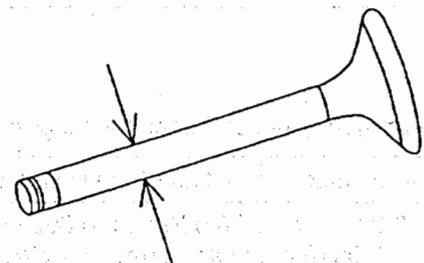
● Cam shaft

	Standard value	Out of the limit to use
Outer dia. in bearing (Upper)	17.98 mm (0.708 in)	If 17.95 mm (0.707 in) or less, it needs replacement.
Outer dia. in bearing (Lower)	15.97 mm (0.629 in)	If 15.95 mm (0.628 in) or less, it needs replacement.
Cam height IN & EX	24.15 mm (0.951 in)	If 23.9 mm (0.941 in) or less, it needs replacement.



● Valve stem

	Standard value	Out of the limit to use
IN	5.48 mm (0.216 in)	If 5.46 mm (0.215 in) or less, it needs replacement.
EX	5.46 mm (0.215 in)	If 5.44 mm (0.214 in) or less, it needs replacement.



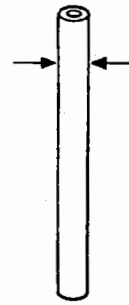
● Clearance between valve guide and valve stem

	Standard value	Out of the limit to use
IN	0.008 – 0.04 mm (0.0003 – 0.0016 in)	If 0.07 mm (0.0028 in) or more, it needs replacement.
EX	0.025 – 0.057 mm (0.0010 – 0.0022 in)	If 0.10 mm (0.004 in) or more, it needs replacement.

CHAPTER 4 POWER UNIT

● Outer diameter of rocker arm shaft

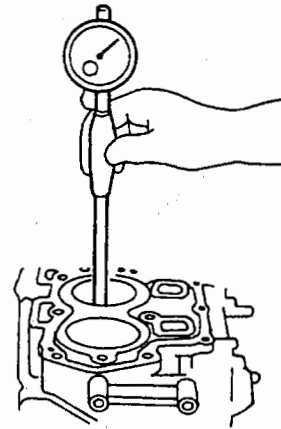
Standard value	Out of the limit to use
12.99 mm (0.511 in)	If 12.94 mm (0.509 in) or less, it needs replacement.



3) Measurement with cylinder gauge

● Inner diameter of cylinder

Standard value	Out of the limit to use
59.00 mm (2.3228 in)	If 59.06 mm (2.3252 in) or more, it needs replacement.

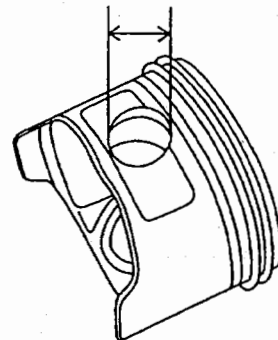


● Diameter of piston pin hole

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 – 0.0005 in)	If 0.04 mm (0.0016 in) or more, it needs replacement.

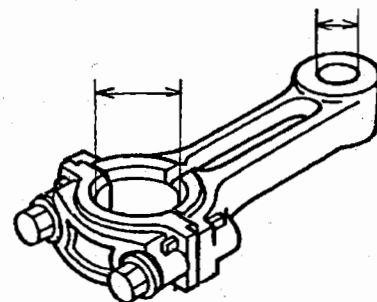


● Oil clearance at big end of connecting rod

Standard value	Out of the limit to use
0.015 – 0.041 mm (0.0006 – 0.0016 in)	If 0.060 mm (0.002 in) or more, it needs replacement.

● Inner diameter of small end of connecting rod

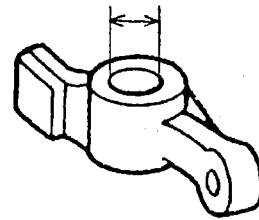
Standard value	Out of the limit to use
16.01 mm (0.630 in)	If 16.04 mm (0.631 in) or more, it needs replacement.



CHAPTER 4 POWER UNIT

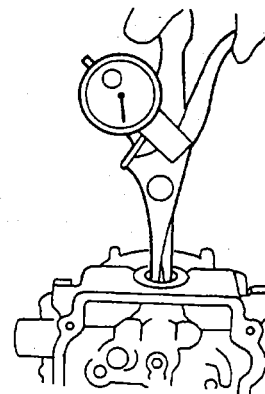
● Inner diameter of rocker arm

Standard value	Out of the limit to use
13.01 mm (0.512 in)	If 13.05 mm (0.514 in) or more, it needs replacement.



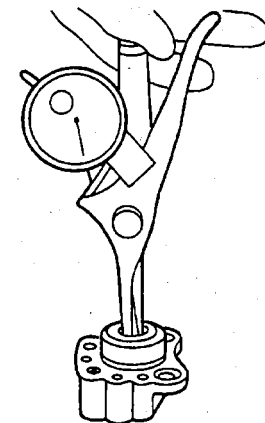
● Oil clearance between rocker arm and shaft

Standard value	Out of the limit to use
0.006 mm – 0.035 mm (0.00024 – 0.00138 in)	If 0.06 mm (0.0024 in) or more, it needs replacement.



● Inner diameter (bearing) of cam shaft holder

	Standard value
Upper (Cylinder head)	18.01-18.025 mm (0.709 – 0.710 in)
Lower (Oil pump)	



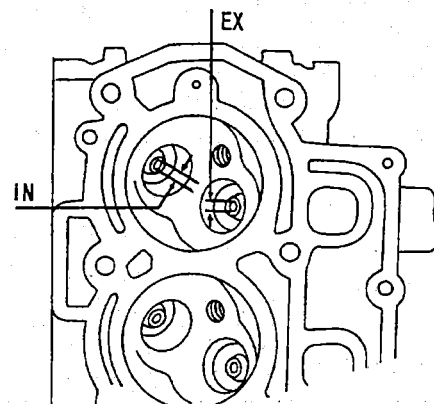
● Oil clearance between cam shaft and holder

	Standard value	Out of the limit to use
Upper	0.02 – 0.05 mm (0.0008 – 0.0020 in)	0.09 mm (0.0035 in) or more
Lower	0.02 – 0.05 mm (0.0008 – 0.0020 in)	0.09 mm (0.0035 in) or more

If the oil clearance is out of the limit, replace cylinder head and/or cam shaft and/or oil pump.

● Inner diameter of valve guide

	Standard value	Out of the limit to use
IN	5.51 mm (0.217 in)	If 5.55 mm (0.218 in) or more, it needs replacement.
EX	5.51 mm (0.217 in)	If 5.57 mm (0.219 in) or more, it needs replacement.

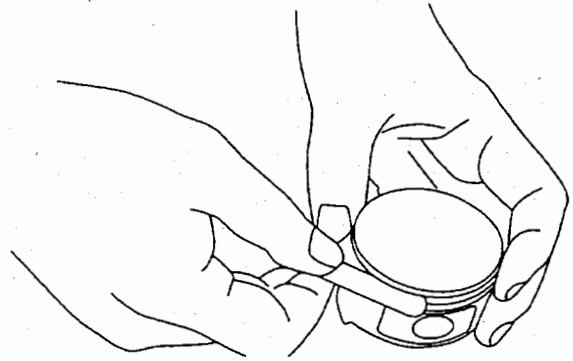


CHAPTER 4 POWER UNIT

4) Measurement with thickness gauge

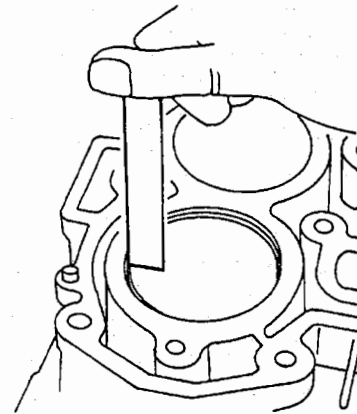
● Clearance between piston ring and ring groove

	Standard value	Out of the limit to use
Top	0.04 – 0.08 mm (0.0016 – 0.0031 in)	If 0.10 mm (0.004 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.



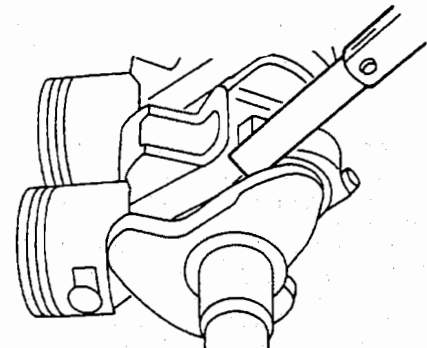
● Piston ring end gap

	Standard value	Out of the limit to use
Top	0.15 – 0.35 mm (0.006 – 0.014 in)	If 0.5 mm (0.020 in) or more, it needs replacement.
Second	0.30 – 0.50 mm (0.012 – 0.020 in)	If 0.7 mm (0.028 in) or more, it needs replacement.
Oil	0.20 – 0.70 mm (0.008 – 0.028 in)	



Notes:

- 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

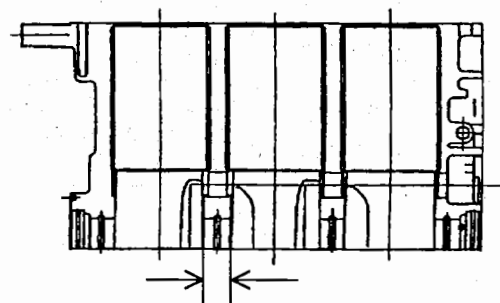
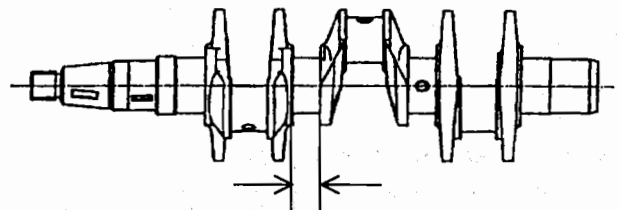
Standard value	Out of the limit to use
0.1 – 0.25 mm (0.004 – 0.01 in)	If 0.6 mm (0.024 in) or more, it needs replacement.

● Side clearance of crankshaft

Standard value	Out of the limit to use
0.05 – 0.15 mm (0.002 – 0.006 in)	0.5 mm (0.020 in) more

If the side clearance exceeds the specified limit, measure the width of the crankcase (cylinder side) and crankshaft and then replace either of the two.

	Standard value
Crankshaft width	17.05 – 17.1 mm (0.671 – 0.673 in)
Crankcase width	16.95 – 17.0 mm (0.667 – 0.669 in)



CHAPTER 4 POWER UNIT

5) Measurement with Plastigage®

● Oil clearance between crankshaft and metal bearing

- 1) Wipe oil out of:
 - Crankshaft bearing journals
 - Metal bearings (both sides)
 - Bearing portions of cylinder and crankcase

- 2) Install metal bearings into the cylinder and crankcase.

Note:

Align the tab of the bearing with the notch (a) in the cylinder and crankcase.

- 3) Install the crankshaft to cylinder.
- 4) Place a piece of the plastigage on the crankshaft main bearing journal.
- 5) Assemble the crankcase.

Tighten the crankcase bolts to the specified torque in the indicated order.

Torque: H850: 23-25 N – m (2.3-2.5 kg – m)
(17-18 lb – ft)

H630: 8-10 N – m (0.8-1.0 kg – m)
(5.8-7.2 lb – ft)

Note:

Do not rotate the crankshaft.

- 6) Disassemble the crankcase.
- 7) Measure the compressed plastigage width at its widest point.

Standard value	Out of the limit to use
0.012 – 0.044 mm (0.0005 – 0.0017 in)	0.06 mm (0.002 in) or less

If the oil clearance is out of the limit, measure inside diameter of the cylinder/crankcase bearing holders and the crankshaft bearing journals. There are within the standard value, replace metal bearings.

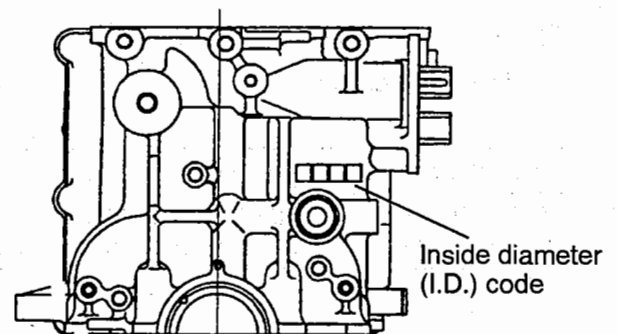
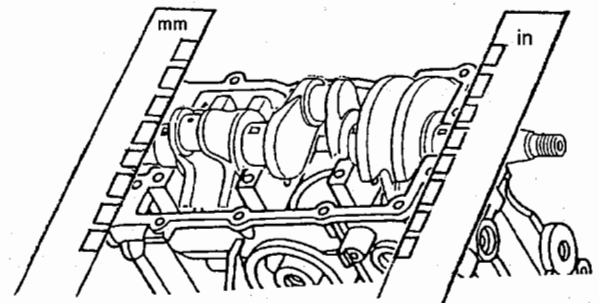
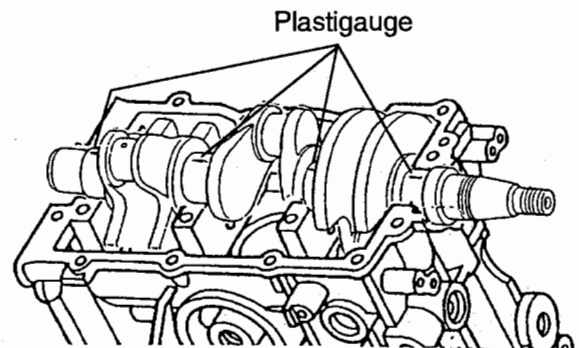
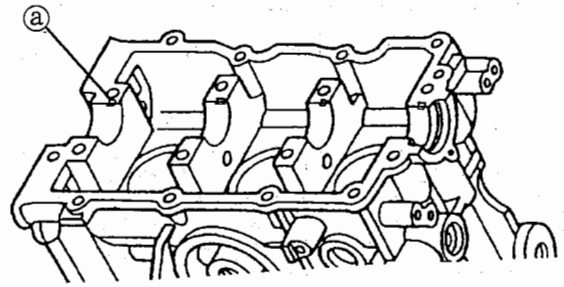
● Cylinder/Crankcase bearing holder inside diameter code

A code (I.D. code) indicating the inside diameter of the bearing holder is carved on the cylinder surface.

There are two kinds of I.D. codes that respectively indicate as follows.

I.D. code	Standard value	Applying metal bearing
A	37.000 – 39.008 mm (1.4567 – 1.5357 in)	Blue color paint
B	39.008 – 39.016 mm (1.5357 – 1.5361 in)	Red color paint

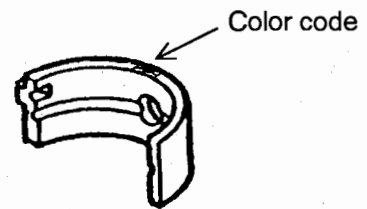
Remark: I.D. code A and B — For bearing holder



CHAPTER 4 POWER UNIT

● Metal bearing thickness code

The codes are painted on the side of the bearing.



Color code	Thickness
Blue	1.488 – 1.494 mm (0.0586 – 0.0588 in)
Red	1.494 – 1.500 mm (0.0588 – 0.0590 in)

● Oil clearance at big end of connecting rod

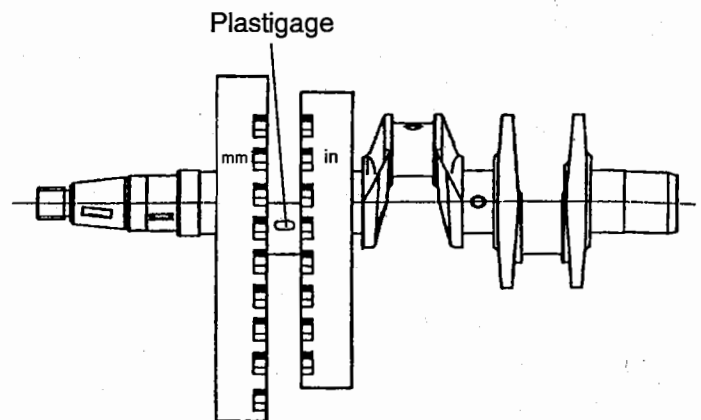
- 1) Wipe oil out of the crank pin and big end bearing of connecting rod.
- 2) Set the Plastigage to the crank pin and fit it to the connecting rod. Tighten the bolt with the specified torque.

Tightening torque: 11-13 N-m (1.1-1.3 kg-m)
(8.0-9.4 lb-ft)

Note:
Do not turn the connecting rod.

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

Standard value	Out of the limit to use
0.015 – 0.041 mm (0.0006 – 0.0016 in)	If 0.06 mm (0.002 in) or less, it needs replacement



CHAPTER 4 POWER UNIT

6) 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 – 142 psi).
- 2) Start the engine and measure oil pressure at the oil temperature of 60 °C (140 °F).

Engine speed	Oil pressure at 75 °C (167 °F) of oil temperature
950 rpm	0.15 MPa (1.5 kg/cm ² , 21 psi) or more
5,750 rpm	0.30 MPa (3.0 kg/cm ² , 42 psi) or more

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

7) Other inspections

● Clearance of ball bearing

Wash the bearing and dry it. While rotating 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.

● Oil seal and O-ring

Check to see cut, nicked and wearing, replace it with new one.

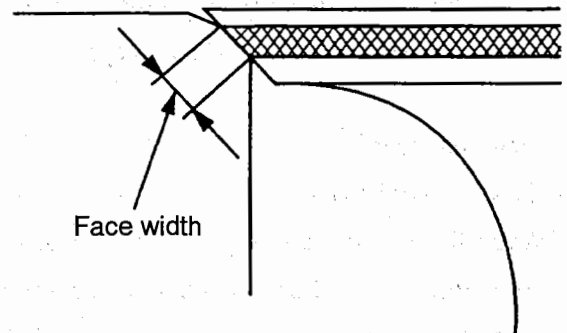
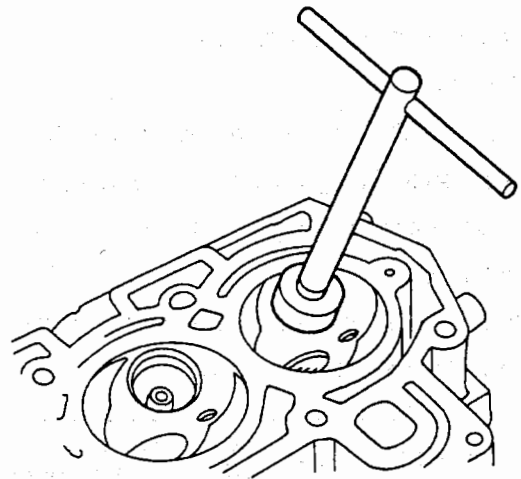
CHAPTER 4 POWER UNIT

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	1.0 mm (0.04 in)	2.0 mm or more (0.08 in)
EX	1.0 mm (0.04 in)	2.0 mm or more (0.08 in)

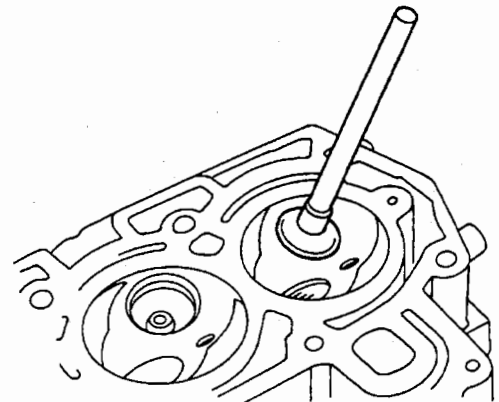
- 4) After repair of the valve seat, lap the valve for good fitting.

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.

(1) Cylinder head and related parts

● Valve stem seal

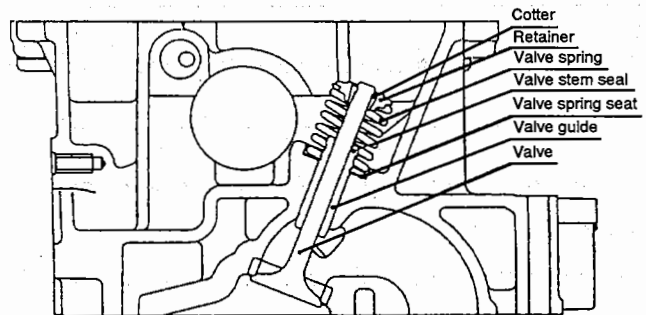
- There are two kinds of valve stem seals, namely, the valve stem seal for the intake valve is identified by the black color while the other for the exhaust valve is identified by the green color.
- On installing the valve stem seal to the cylinder head, apply the 4-stroke engine oil to the insertion point. For setting the valve stem seal, press it into the valve guide with fingers.

● Intake valve, Exhaust valve

- The intake valve and exhaust valve are different from each other, namely the intake valve is identified by the "N" mark while the exhaust valve is identified by the "X" mark.
- Apply the 4-stroke engine oil to the valve stem. Then, insert the valve into the valve guide while rotating it.
- After setting the cotter on-to the valve stem, tap the valve shaft end with a small plastic hammer several times for stabilizing the cotter in setting.
- After reassembling the valves, apply the 4-stroke engine oil to the upper side of the retainer and its periphery.

● Cam shaft

- Carefully press the oil pump pin so that it does not come out of the cam shaft.
- When reassembling the cam shaft to the cylinder head, apply the 4-stroke engine oil to the cam and bearing beforehand and then insert the cam shaft into the cylinder head from the oil pump side while rotating it with care not to turn over the oil seal lip.



CHAPTER 4 POWER UNIT

● Rocker arm

- Temporarily set the tappet adjusting screw and tappet adjusting nut to the rocker arm.

Note:

Set the nut with the chamfered side facing the rocker arm.

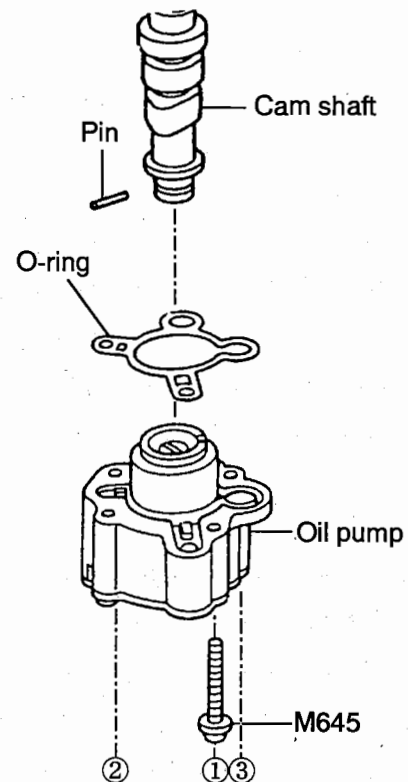
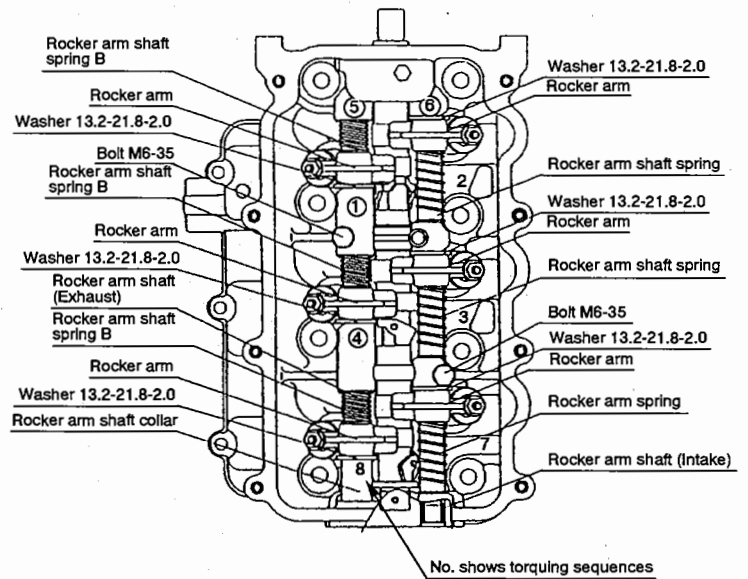
- Apply the 4-stroke engine oil to the rocker arm shaft.
- Set the rocker arm shaft from the side of the oil pump of the cylinder head. Pay heed to orientation of the rocker arm shaft so that the tapped hole side is positioned in the oil pump side.
- Assemble the parts as shown in the figure.
- When setting the above-mentioned parts, apply the engine oil to every part.
- Set the narrow part of the rocker arm shaft to meet the cylinder head hole on the boss near the rocker arm shaft and fasten the rocker arm shaft with the M6 bolt (2 bolts for the two shafts).

● Oil pump

- Pour the engine oil of approximately 2.0 ml into the oil pump through the inlet and outlet ports.
- On fitting the outer O-ring to the oil pump, apply the 4-stroke cycle engine oil to the O-ring.
- When assembling the oil pump to the cylinder head, carefully set it so that the cam shaft pin and the notch on the oil pump shaft meet each other.
- Fasten the oil pump with the three M6 bolts with the tightening torque and in the tightening order specified below.

Tightening order: ①, ② and ③ (Refer to the figure.)

Tightening torque: 5-6 N - m (0.5-0.6 kg - m)
(3.6 - 4.3 lb - ft)



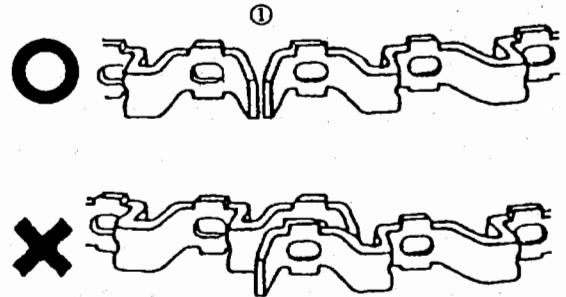
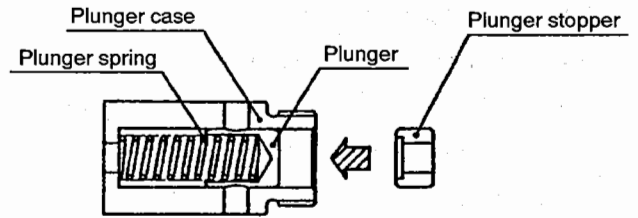
CHAPTER 4 POWER UNIT

(2) Engine Block

● Plunger

- When setting the plunger stopper into the plunger case, pay attention to the orientation of the plunger stopper so that it is set as shown in the figure.

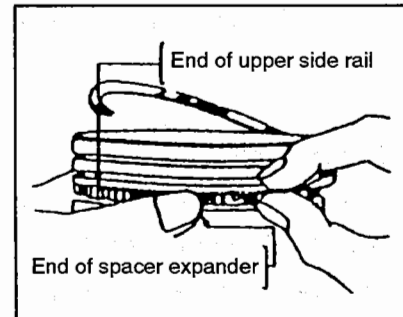
Tightening torque: 19-21 N-m (1.9-2.1 kg-m)
(13-15 lb-ft)



● Piston ring

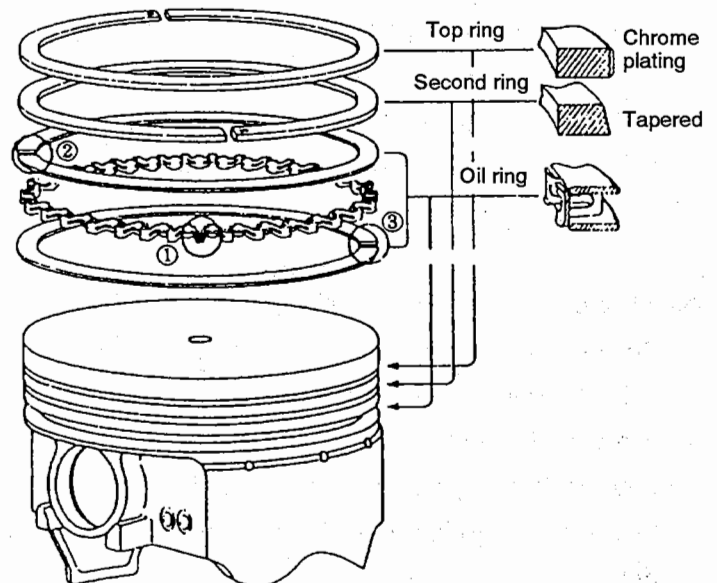
Fitting oil rings to piston

1. Set the spacer expander in the oil ring groove, and check to see if both the ends of it correctly link with each other as shown in the figure. ①
2. While holding down the slit of the spacer expander with a thumb, set the upper rail as its slit is deviated from the slit of the spacer expander at an angle of 90 in the counterclockwise direction. ②
3. In the same manner as the preceding step, set the lower rail as its slit is deviated from the slit of the spacer expander at an angle of 90 in the clockwise direction. ③



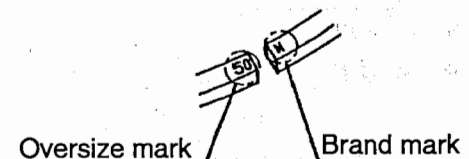
Fitting compression rings to piston

Fit the compression rings onto the piston in the correct order to start with the lower ring. Set each compression ring with the side marked with the brand and size up.



Check of correct setting of each piston ring

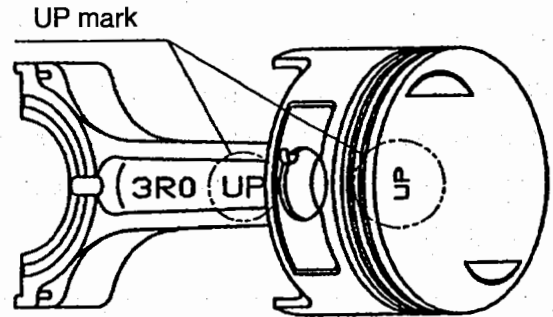
1. Check to see if the slit of each piston ring is not set in the piston thrust direction or piston pin direction.
2. After the assembling work is complete, make sure that each piston ring is set as shown in the figure once again.



CHAPTER 4 POWER UNIT

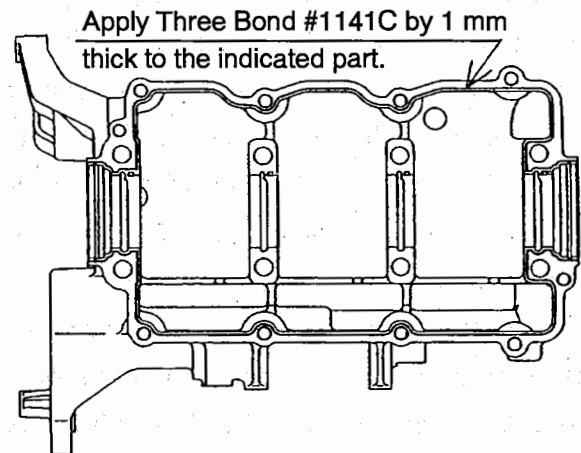
● Piston and Connecting rod

- Assemble the connecting rod and connecting rod cap to each other as they were put together before removing. (Before removing the connecting rod cap, be sure to leave a marking at a mated point between the connecting rod and connecting rod cap as a reference for reassembling.)
- The upper sides of the connecting rod cap, connecting rod and piston are identified by the "UP" mark.
- For inserting the piston and connecting rod assembly into the cylinder, use the piston slider. Apply the 4-stroke engine oil to the cylinder liner, piston rings before inserting the assembled piston.



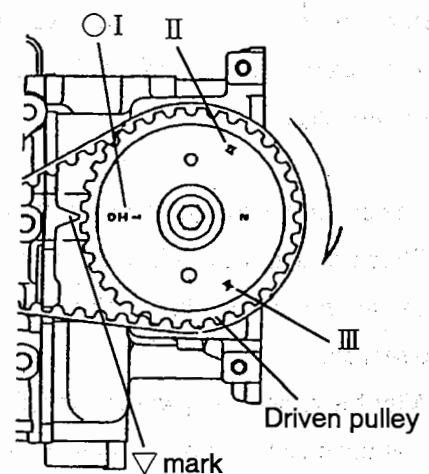
● Cylinder and Crank case

- When fitting the metal bearing to the cylinder and crank case, set the tab in the notch.
- Apply the 4-stroke engine oil to the metal bearing.
- Degrease the mating surface between the cylinder and crank case.
- Apply the Locktight #518 to either one of the cylinder and crank case with careful attention to the applying area and width so as to avoid overflow.



● Fitting cylinder head to cylinder

- Before fitting the cylinder head to the cylinder, set the piston at the top dead center of the compression stroke.
- Pay heed to tightening order and tightening torque of the cylinder head bolts. (Refer to page 56)



Tightening torque:

M8 bolt: 28-32 N - m (2.8-3.2 kg - m)
(20-22 lb - ft)

M6 bolt: 8-10 N - m (0.8-1.0 kg - m)
(5.8-7.2 lb - ft)

CHAPTER 4 POWER UNIT

● Cylinder head cover

- Apply the Three Bond #1342 to the M6 bolts (7 bolts) and fasten the breather plate to the cylinder head cover.
- When fastening the cylinder head cover with the seven bolts, pay heed to tightening order and tightening torque of the seven bolts as the sequence shown.
- One of the seven bolts shown must be tightened together with the clamp.

Tightening torque: 8-10 N-m (0.8-1.0 kg-m)
(5.8-7.2 lb-ft)

● Fuel pump

- Make sure that the marks "○ I" on the driven pulley and the mark "▽" on the cylinder head are aligned in a straight line.
- Apply the 4-stroke engine oil to the top of the plunger and O-ring of the fuel pump.

Tightening torque: 5-6 N-m (0.5-0.6 kg-m)
(3.6-4.3 lb-ft)

● Oil filter

- Apply the 4-stroke engine oil to the rubber seal of the oil filter.

Tightening torque: 18 N-m (1.8 kg-m)
(13 lb-ft)

● Oil pressure switch

- Apply the Three Bond #1342 to the screw fastening the oil pressure switch. Carefully apply the bond so that the oil pressure switch doesn't get the bond inside.

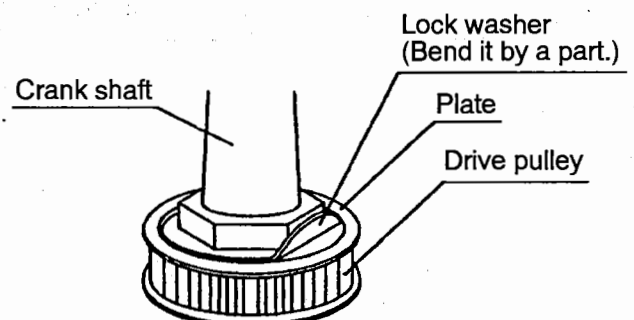
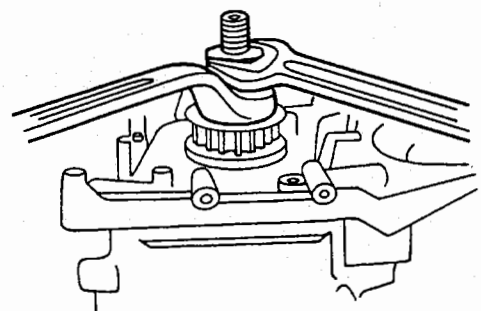
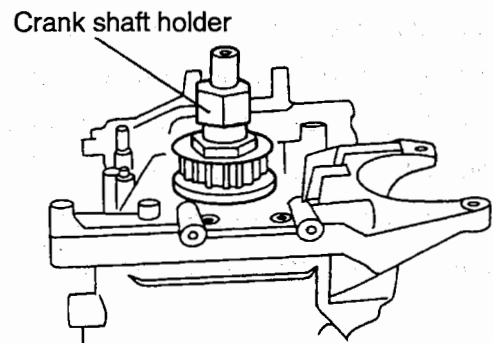
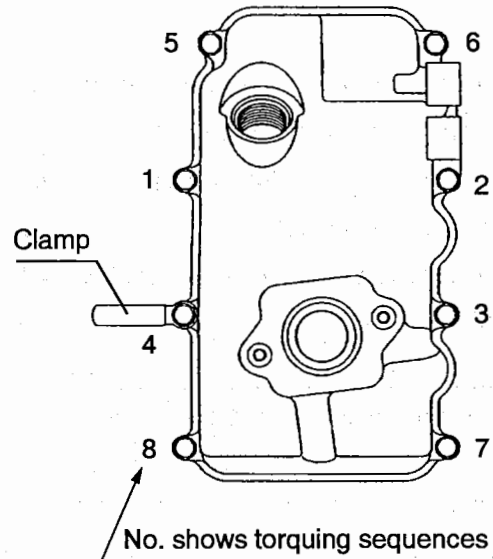
Tightening torque: 7-9 N-m (0.7-0.9 kg-m)
(5.1-6.5 lb-ft)

● Drive pulley

- For tightening the nut to fasten the drive pulley, use the crank shaft holder.

Tightening torque: 63-65 N-m (6.3-6.5 kg-m)
(46-47 lb-ft)

- After tightening the nut, bend up the lock washer by a part.



CHAPTER 4 POWER UNIT

(3) Electrical components and Piping-related parts

● Installation of coil bracket, alternate and pulser coil

- Drive the knock 6-12 ② (2 knocks) into the coil bracket ① base on the cylinder block.
- Fasten the coil bracket to the cylinder crankcase assembly with the M6 bolts ③ (3 bolts). One of the three bolts is to be tightened together with the clamp.

Tightening torque: 6 N – m (0.6 kg – m)
(4.3 lb – ft)

- When installing the alternator ④, pay heed to its positioning so that its projection meets the relief point of the coil bracket and it is not situated on the inside lower part of the coil bracket.
 - There are three types of pulser coils for the #1, #2 and #3 cylinders respectively, and they are identified by different lead wire colors.
- When connecting the pulser coils, combine the pulser coil with the coil bracket by the same color.

#1: W/R

#2: W/B

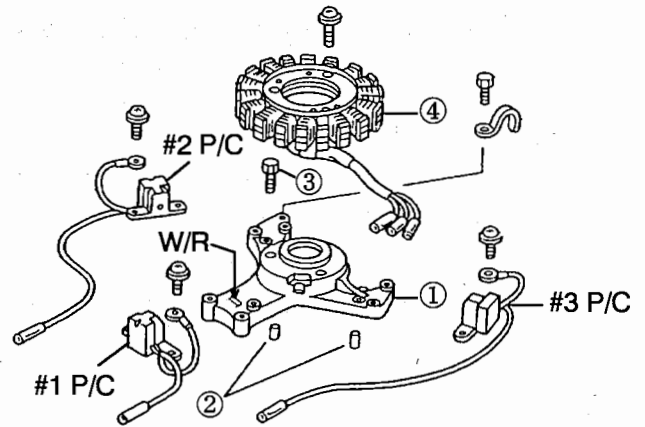
#3: W/L

- Install the wire clamp with the M6 bolt (one bolt).

● Flywheel cup

- Degrease the tapered parts of the flywheel cup and crankshaft.

Tightening torque: 110-130 N – m (11-13 kg – m)
(80-94 lb – ft)



CHAPTER 4 POWER UNIT

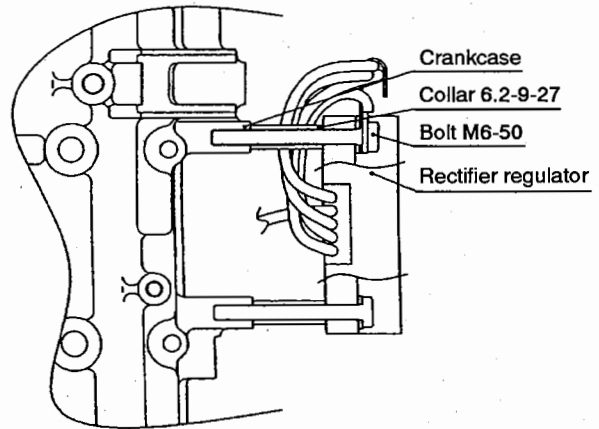
● Installation of Starter motor and Rectifier regulator

- Fit the starter motor with the starter motor rubber and mount it on the starter motor base on the crankcase. Fasten it from the upper part with the M6 bolts (2 bolts) at the tightening torque of 10.8 to 14.7 N-m (1.1 to 1.5 kg-m). Moreover fasten the starter motor by the lower part with the starter motor band and M8 bolts (2 bolts) at the tightening torque of 10.8 to 14.7 N-m (1.1 to 1.5 kg-m).

Tightening torque:

M6 bolts: 10.8-14.7 N - m (1.1-1.5 kg - m)
(8-11 lb - ft)

M8 bolts: 10.8-14.7 N - m (1.1-1.5 kg - m)
(8-11 lb - ft)

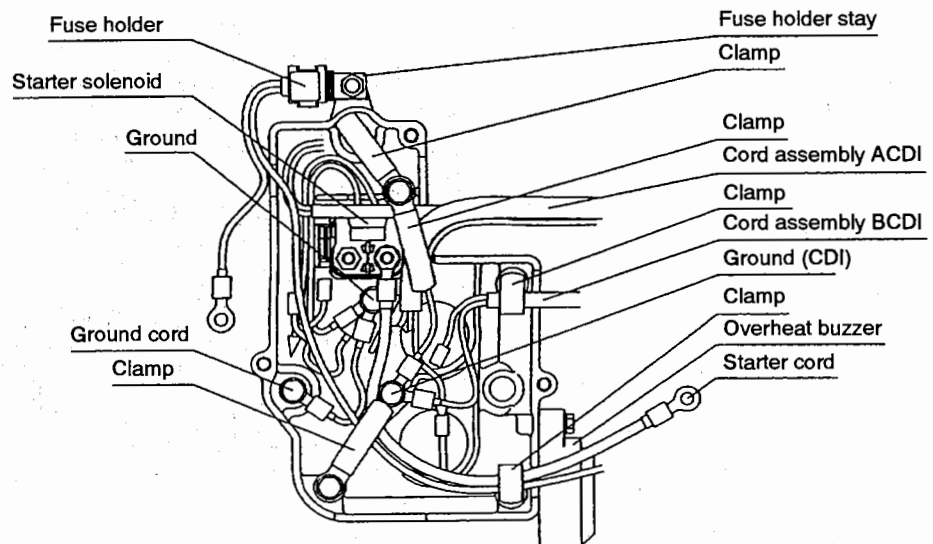


(4) Installation of rectifier regulator

- Fit the rectifier regulator to the cylinder with the M6 bolts and collars (two each). At that time, the ground cord of the rectifier regulator must be tightened together with the bolt.

● Installation of electric bracket

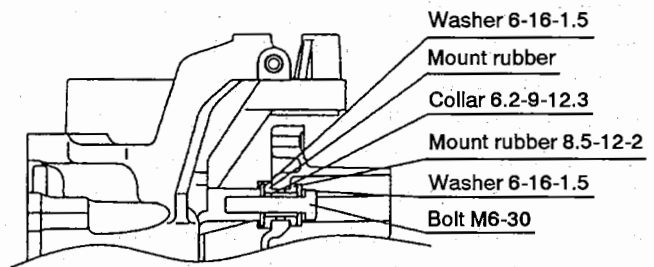
- Fit the starter solenoid to the electric bracket.
- Fasten the fuse holder stay to the electric bracket with the M6 bolt (1 bolt).
- Plug the fuse holder into the fuse holder stay.
- Arrange the wires in the electric bracket.



CHAPTER 4 POWER UNIT

- Fasten the electric bracket to the crankcase with the M6 bolts (3 bolts) together with the washer 6-16-1.5, mount rubber 8.5-12-2, collar 6.2-9-9.3, mount rubber 8.5-12-2 and washer 6-16-1.5 in this order. Tighten the bolts at the torque of 5.9 N-m (0.6 kg-m).

Tightening torque: 5.9 N – m (0.6 kg – m)
(4.3 lb – ft)



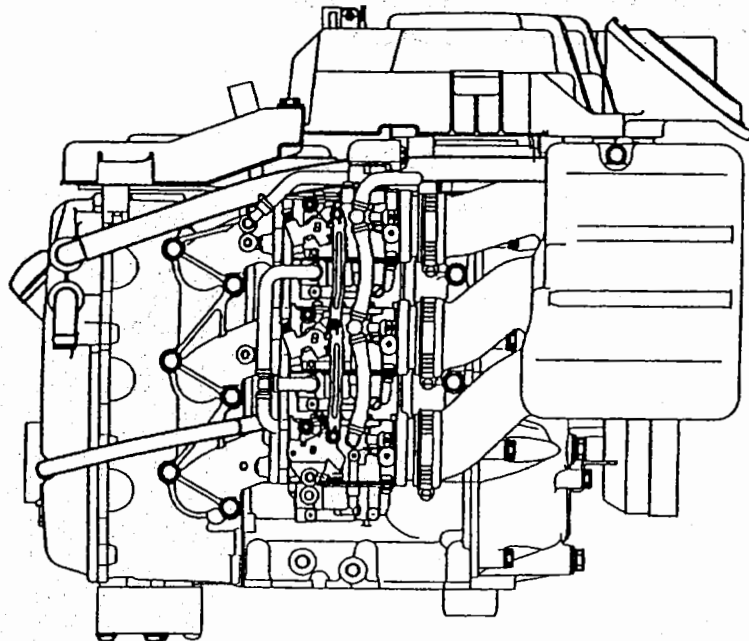
● Wire arrangement

- Connect the electrical components as specified and clamp the wires.

Pulser coil, ignition coil, oil pressure switch, buzzer overheat switch, PTC heater, rectifier regulator.

● Piping

- Lay the pipes between air silencer and crankcase, between fuel pump and carburetor respectively, and clamp the pipes.

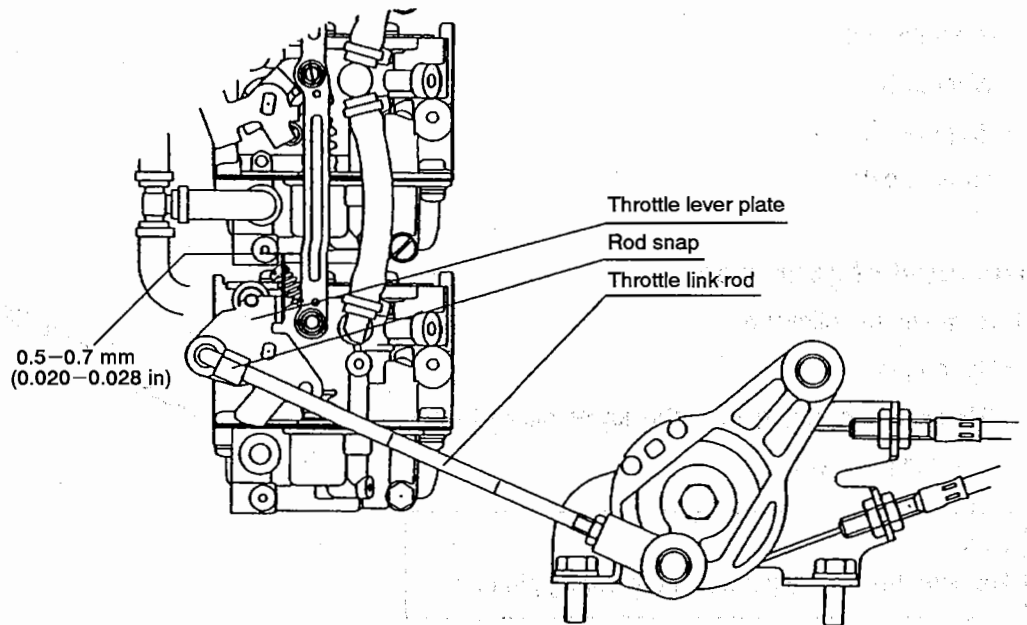


CHAPTER 4 POWER UNIT

● Throttle link

Install the throttle link and adjust the throttle operation in the following order.

1. Loosen the stop screw of the carburetor in maximum.
2. Fit the rod snap to the throttle lever plate of the carburetor and insert the throttle link rod into the rod snap. Then, lock the link rod with the rod snap.
3. Turn the throttle grip full open.
4. Shift the throttle lever to throw the throttle wide open.
5. Adjust the pitch with the rod joint of the throttle link rod so that there is 0.5 to 0.7 mm gap at the full open status as shown in the figure below.



6. After installation is complete, check to see if the throttle smoothly works between the idle and full open status.

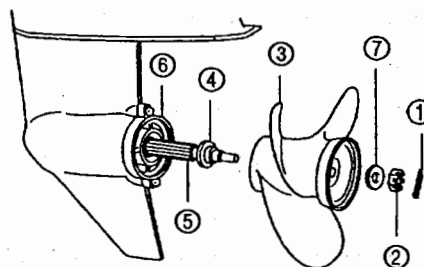
CHAPTER 5 LOWER UNIT

1. Disassembly of Gear Case

The gear case can be removed without removing the power unit from the outboard motor.

Removal of propeller

- ① Split pin
- ② propeller nut
- ③ propeller
- ④ Thrust holder
- ⑤ Propeller shaft
- ⑥ Propeller shaft housing
- ⑦ Washer



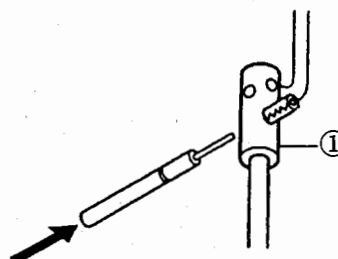
1. Remove the following:

- Split pin ①
- Propeller nut ②
- Washer ⑦
- Propeller ③
- Thrust holder ④

Removal of gear case

1. Remove the following:

- Spring pin
- (Remove the spring from the lower side of gear shift rod joint ①.)

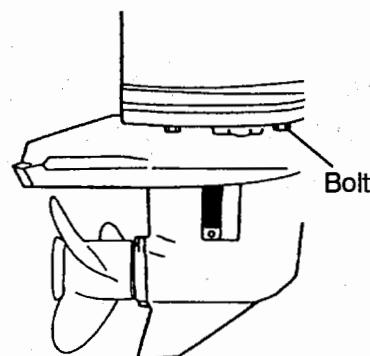


Note:

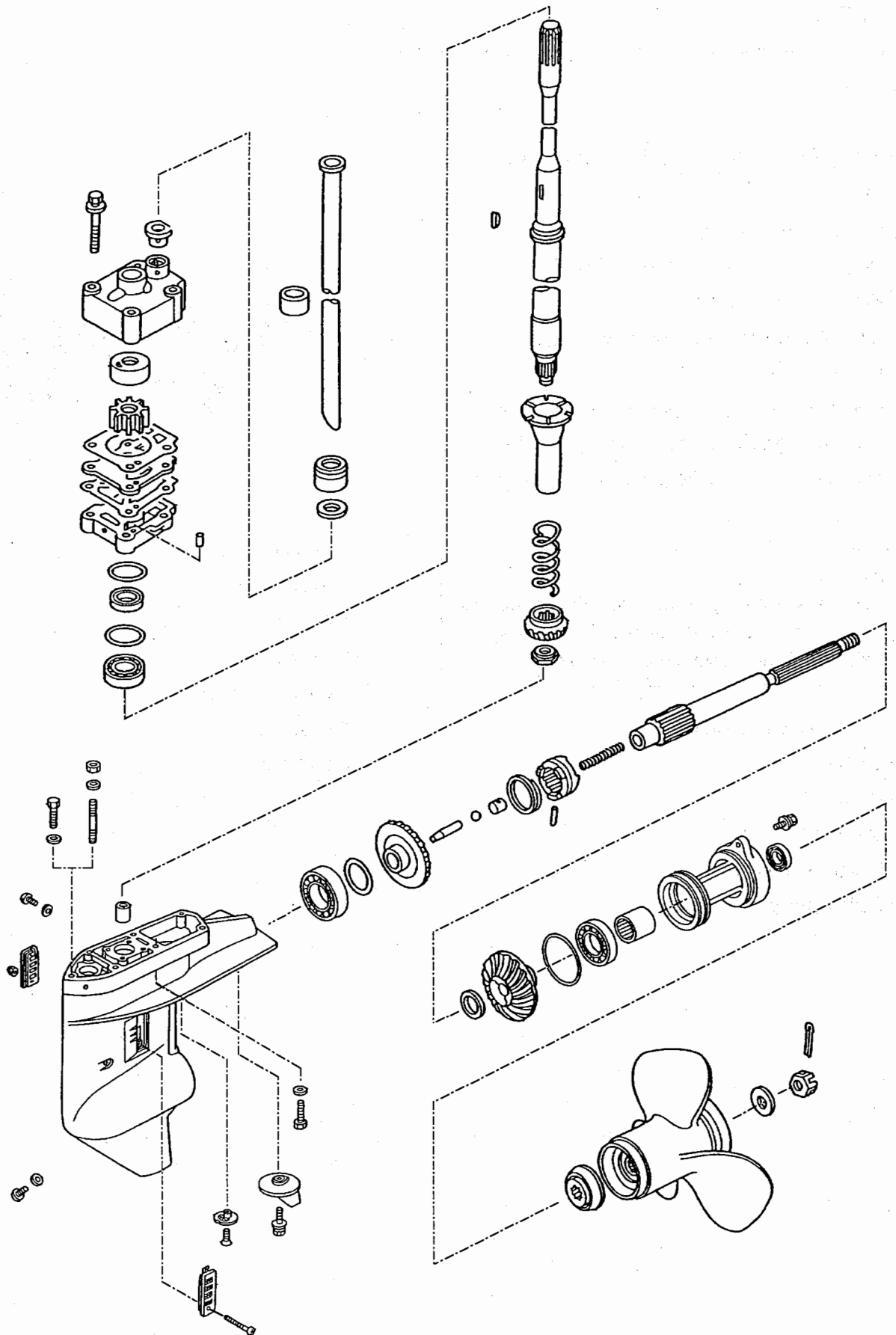
Remove the spring pin using the spring pin tool.

2. Remove the following:

- Gear case bolt (H840-4 and H845-1)
 - Gear case assembly
- (Pull out the assembly from the bottom.)



CHAPTER 5 LOWER UNIT



CHAPTER 5 LOWER UNIT

Disassembly of Water Pump, Impeller and Case

Refer to Chapter 3, 11. Inspection of Cooling System.

Disassembly of propeller shaft and clutch

1. Remove the following:

- Propeller shaft housing bolts (H830-2)
- Propeller shaft housing (propeller shaft ① with bevel gear C ②)
- Propeller shaft

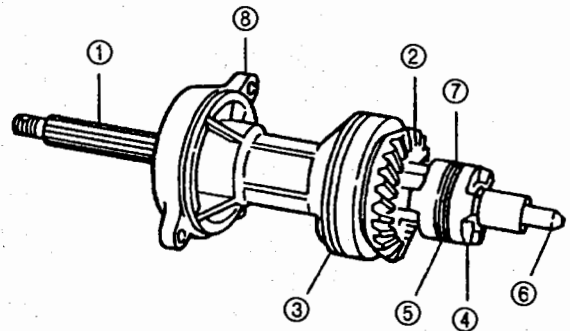
2. Remove the clutch pin snap ⑤ from the peripheral groove of the clutch ④, and pull out the clutch pin ⑦ while pushing the push rod ⑥ lightly.

Note:

Take care when you pull out the clutch pin because the push rod, steel ball, clutch spring holder, and clutch spring are likely to fly out.

3. Remove the following:

- Clutch
- Push rod
- Steel ball
- Clutch spring holder
- Clutch spring



- ① Propeller shaft
- ② Bevel gear C
- ③ O-ring
- ④ Clutch
- ⑤ Clutch pin snap
- ⑥ Push rod
- ⑦ Clutch pin
- ⑧ Pull-out groove

CHAPTER 5 LOWER UNIT

Removal of clutch cam and cam rod

- ① Cam rod push stopper bolt
- ② Cam rod

1. Remove the following:

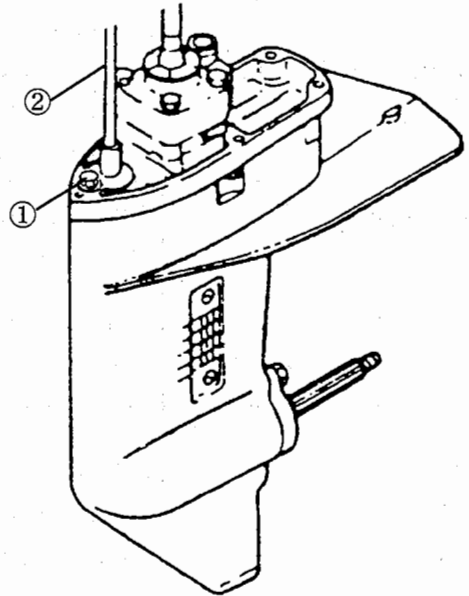
- Cam rod push stopper bolt ① (H612)
- Cam rod ② (Pull out from the top.)

2. Remove the following:

- Clutch cam spring pin
- Cam rod spring pin
- Clutch cam
- Cam rod bush (Remove from the cam rod.)

Note:

Use the spring pin tool to remove the spring pin.



Removal of bevel gear and drive shaft

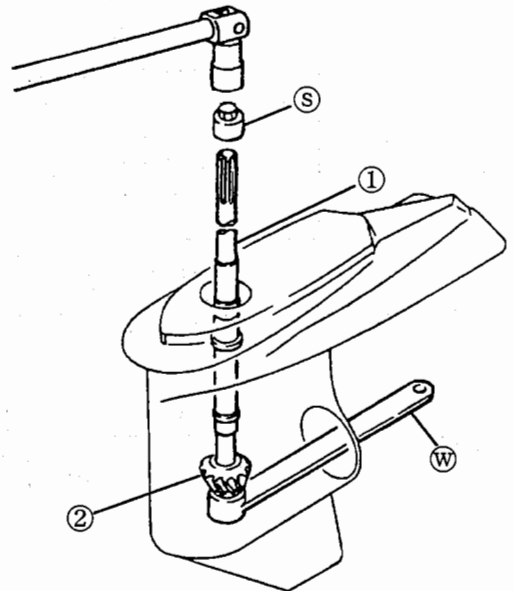
- ① Drive shaft
- Ⓢ Bevel gear B nut socket
- ② Bevel gear B
- Ⓜ Bevel gear B nut wrench

1. Remove the following:

- Bevel gear B nut
- Bevel gear B
- Drive shaft
- Bevel gear A
- Bevel gear A bearing
- Bevel gear C

Removal procedure:

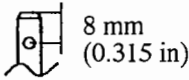
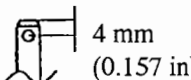
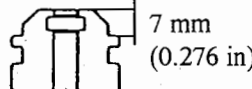
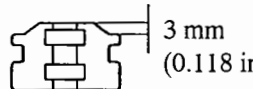
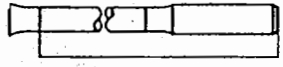

- Insert the bevel gear B socket nut Ⓢ in the spline of the drive shaft ①.
- Set the bevel gear B nut wrench Ⓜ on the bevel gear B ② nut.
- Secure the bevel gear B nut, loosen the bevel gear B nut socket, then remove the bevel gear B nut and bevel gear B.
- Hold the drive shaft, tap the gear case flange surface lightly with a plastic hammer, pull out the drive shaft, and then remove the bevel gear A.
- Remove the bevel gear A bearing using the bevel gear A bearing puller.
- Remove the bevel gear C from the propeller shaft housing.



CHAPTER 5 LOWER UNIT

Inspection items		
Bevel gears A, B, C and clutch	<ul style="list-style-type: none"> • Wear and damage to pawls of bevel gears A and C • Wear and damage to clutch pawl • Contact of tooth faces of bevel gears A, B and C • Wear in bearings for bevel gears A and C 	Replace Replace Replace if necessary Replace if necessary
Propeller shaft	<ul style="list-style-type: none"> • Play between the clutch and meshing part (spline) 	Replace if necessary
Drive shaft	<ul style="list-style-type: none"> • Drive shaft run-out • Wear in spline • Wear in contact part with needle roller bearing 	Repair or replace Replace if necessary Replace if necessary
Water pump	<ul style="list-style-type: none"> • Wear in pump impeller • Wear and deformation of pump case liner • Wear in pump guide plate • Wear and crack in the rib of pump case lower oil seal 	Replace Replace Replace if necessary Replace if necessary

Reference: Different points between the 2-stroke engine 25C3/30A4 and the 4-stroke engine 25/30.

	2-stroke 25C3/30A4 engine	4-stroke 25/30 engine
Cam rod		
Cam rod bushing		
Drive shaft S		

CHAPTER 5 LOWER UNIT

2. Gear case assembly

Take the precautions described below and reverse the procedure for disassembly.

Installation of bevel gear and drive shaft

- ① Drive shaft
- ② Bevel gear B
- ③ Bevel gear B nut

1. Install the following:
 - Bevel gear A bearing

Note:

To press-fit the bearing, press the outer race.

2. Assemble the following:
 - Bevel gear B nut

Tightening torque:

30-35 N – m (3.0-3.5 kg – m)
(22-25 lb – ft)

Notes:

- Make sure completely to degrease the threaded part of the bevel gear B nut and drive shaft, apply Three Bond 1373-B and then tighten the nut.
- To tighten the nut, use the bevel gear B nut socket and bevel gear B nut wrench.

Installation of clutch cam and cam rod

- ① Clutch cam
- ② Clutch cam rod
- ③ Clutch cam spring pin

1. Install the following:
 - Cam rod O-ring A and B
 - Cam rod bush
 - Clutch cam ①
(Install the cam on the clutch cam rod ②.)
 - Clutch cam spring pin ③ ($\varnothing 3 \times 12 \ell$)

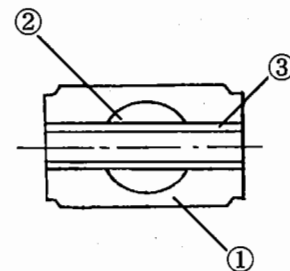
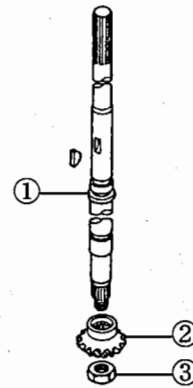
Notes:

- Apply gear oil to the O-rings inside and outside the cam rod bush before installation.
- Do not re-use the spring pin.
- Press-fit the spring pin using the spring pin tool and make sure it does not protrude from the clutch cam periphery.

2. Install the following:
 - Cam rod
 - Cam rod bush stopper bolt (H612)
(Apply the specified grease.)

Note:

After installation, check that the cam rod moves up and down smoothly.



CHAPTER 5 LOWER UNIT

Assembly of water pump case

- ① Pump case liner
- ② Pump case protrusion

1. Install the following:

1) Parts to be set in the lower pump case:

Oil seal (17-30-9)

O-ring (3.5-36)

2) Lower gasket

3) Guide plate

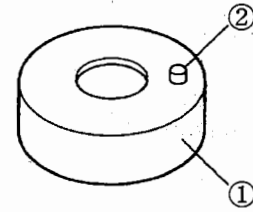
4) Upper gasket

5) Key to be pressed into Drive shaft

6) Pump impeller

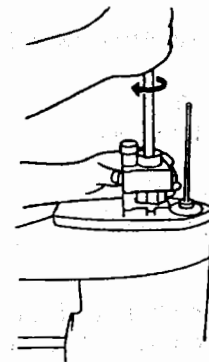
7) Upper pump case

8) Bolt (H652-4) to be tightened for fastening the assembly



Notes:

- On setting the oil seal and O-ring in the lower pump case, apply the specified gear oil to them.
- When fitting the lower pump case to the drive shaft, pay careful attention to the oil seal not to damage it.
- Install the pump impeller key with the large chamfer directed upward.
- Install the pump case liner onto the pump impeller while rotating the drive shaft clockwise when looking from the engine side and install the pump case.
(Make sure that the blades of the pump impeller are not reversed.)



CHAPTER 5 LOWER UNIT

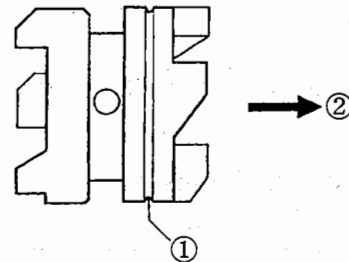
Assembly of propeller shaft and clutch

1. Fit the propeller shaft with the following parts:

- Clutch
- Clutch pin
- Clutch pin snap

Notes:

- Install the clutch so that the side with the groove ① faces the side with bevel gear A ②.
- Do no re-use the clutch pin snap.
Also, assemble the clutch pin snap using the clutch pin snap tool.



2. Fit the propeller shaft housing with the following parts:

- Needle bearing (18-25-2.5)
- Ball bearing (#6205)
- Oil seal (18-28-8)
- O-ring (3-62.5)

Notes:

- On fitting the bearing, oil seal and O-ring to the propeller shaft housing, apply the specified gear oil to them.
- Press-fit the needle bearing using the needle roller bearing tool.
- Install the propeller housing after applying gear oil on the O-ring and cavity surfaces.
- Before tightening the propeller shaft housing bolt (H830-2), apply the Three Bond #1342 to it.

3. Fill gearcase with specified gear oil.

Gear oil: Approx. 280 ml (9.5 US fl. oz)

Installation of gear case

1. Fit the drive shaft housing with the following parts assembly.

- Gear case assembly

Notes:

- On fitting the gear case assembly to the drive shaft housing, apply the specified oil to the lower water pipe seal.
- Take care to insert the water pipe into the water pipe seal.

CHAPTER 5 LOWER UNIT

3. Installation of Bracket and Throttle/Shift parts

● Engine base

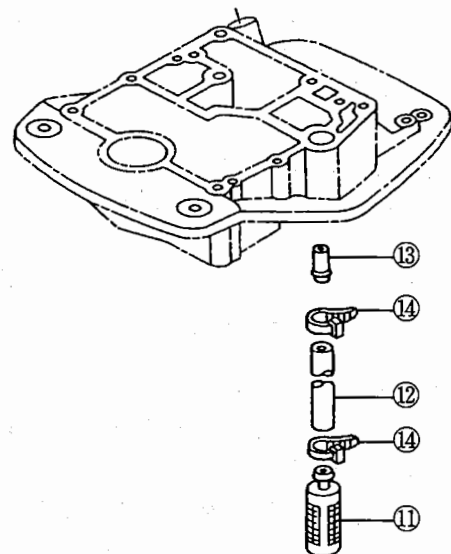
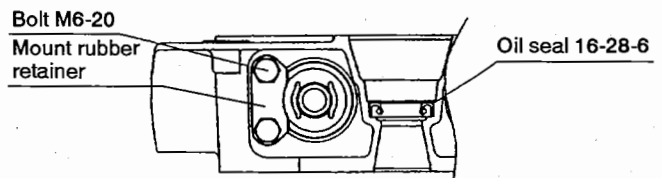
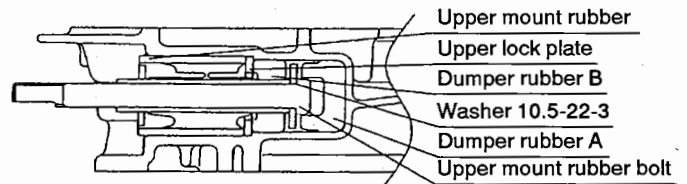
- Drive the knock 6-12 (2 knocks) into the engine block side.
- Press in the oil seal 16-28-6 with attention to its orientation.
- Fasten the plunger assembly to the engine base

Tightening torque: 17.6-21.6 N – m
(1.8-2.2 kg – m)
(13-16 ft – lb)

- Fit the upper dumper rubber A and upper lock plate to the engine base.
- Assemble the upper mount rubber bolt, washer 10.5-22-3, upper dumper rubber B, and upper mount rubber to the engine base in this order.

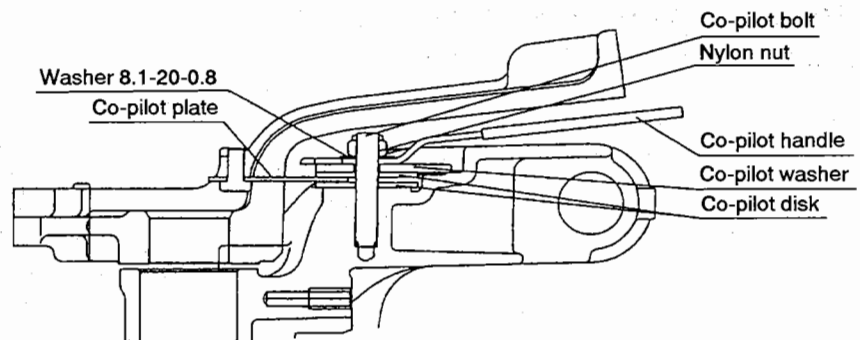
- While matching the gap of the upper mount rubber with the retainer, fasten the above assembly to the engine base with the M6 bolts (2 bolts).

- Connect the oil strainer ⑪ to the oil pipe ⑫. Insert the pipe with the strainer into the oil pump nipple ⑬ on the underside of the engine base. Fasten the pipe by both the strainer side and nipple side with the band lead wire 150 ⑭.

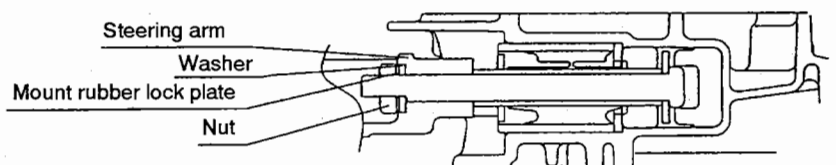


CHAPTER 5 LOWER UNIT

- Attach the engine base seal rubber to the engine base with the bond.
 - Fit the engine base to the drive shaft housing with the three M8 bolts while inserting the drive shaft housing gasket between them. Take care that one of the three bolts is to be screwed in from the drive shaft housing side.
- Installation of bracket assembly
- The bracket bolt assembly, swivel bracket, steering shaft arm, lower mount bracket, steering bracket, steering handle are different from those of the 2-stroke engine 25C3/30A4. Therefore, the bracket structure of the 25/30 engine differs from the 25C3/30A4 engine in the co-pilot only though different parts are used in the two engines.
 - Set the co-pilot bolt into the swivel bracket after assembling the co-pilot disk, co-pilot plate (steering arm), co-pilot washer, co-pilot disk, co-pilot handle, washer 8.1-20-0.8, lock nut to it in this order.

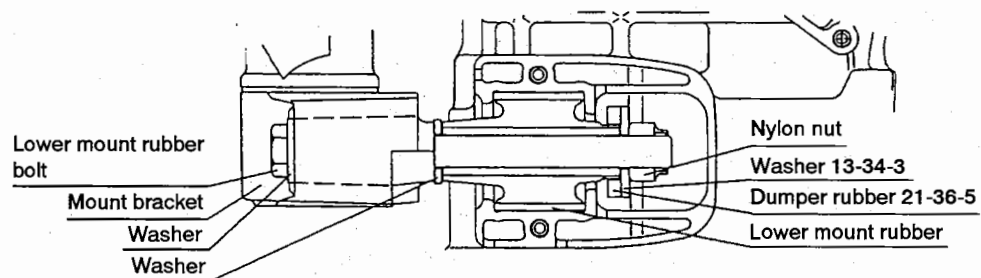


- For the upper side, insert the upper mount rubber bolt fitted to the engine base into the steering shaft arm and set the washer, mount rubber lock plate and nut in this order. Finally, fasten the bolt with the nut.



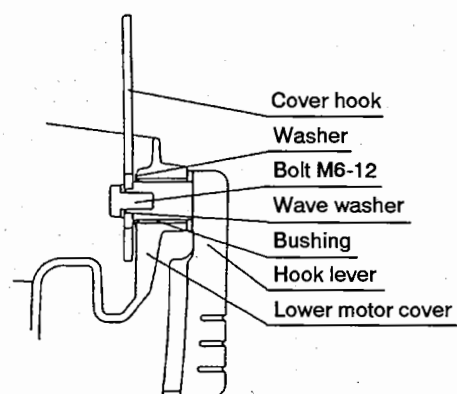
CHAPTER 5 LOWER UNIT

- For the lower side, put the mount rubber on the drive shaft housing and assemble the lower mount rubber bolt, washer, mount bracket, washer, lower mount rubber, dumper rubber 21-36-5, washer 13-34-3, nylon nut in this order starting from the mount bracket side attached to the steering shaft. Finally, fit the lower mount rubber cap to the assembly with the M6 bolts (2 bolts).



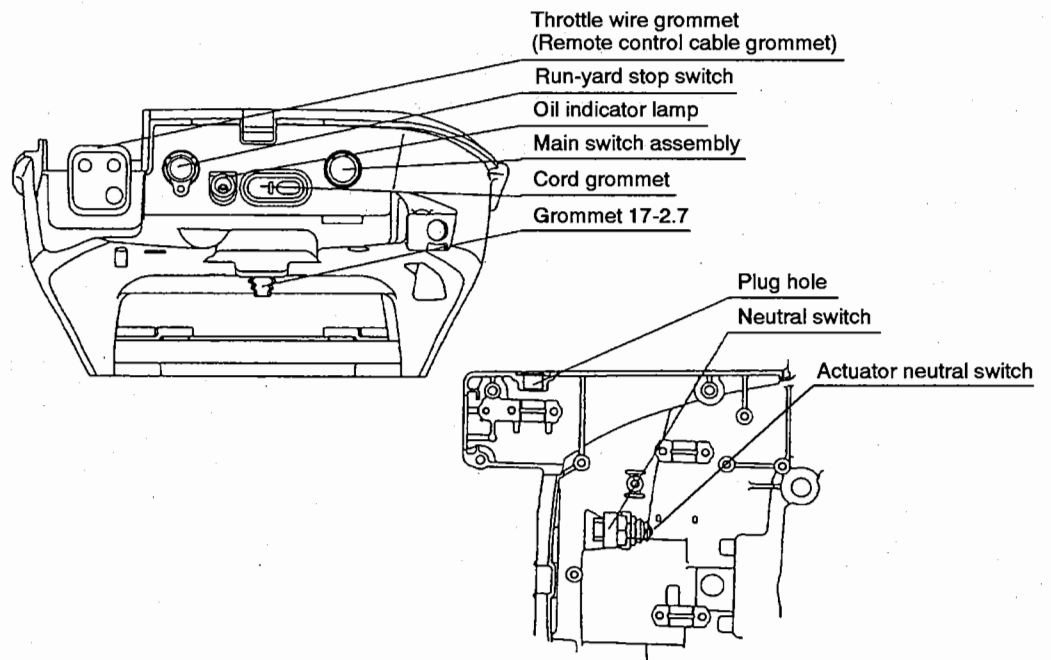
● Assembling lower motor cover

- Assemble the hook lever, seal ring, bushing, wave washer, cover hook and bolt to the lower motor cover in this order.

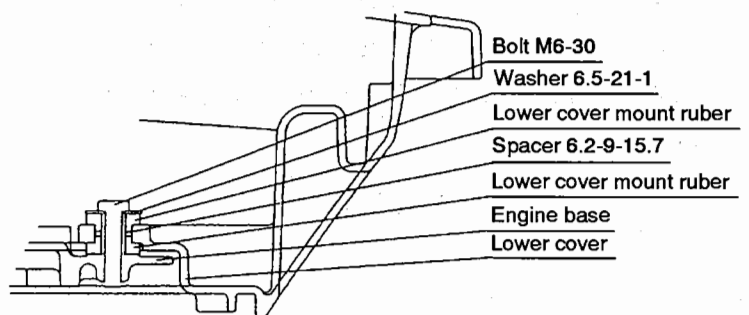


CHAPTER 5 LOWER UNIT

- Fit the fuel connector to the lower cover with the M6 bolt (1 bolt). Install the pipe to the fuel connector and fuel filter respectively and fasten the pipes with the clamps. Connect the pipe to the fuel filter only without connecting the fuel pump.
- Fit the water nipple to the outside of the cover and pipe the water nipple.
- Install the grommet 17-2.7, cord grommet, throttle wire grommet (remote control cable grommet), run-yard stop switch, lamp assembly (main switch assembly, neutral switch, throttle shaft grommet) at the fixed places. The term in parentheses is for the model with the electric starter.



- Fit the lower cover to the engine base with the M6 bolt inserted into the washer 6.5-21-1, spacer 6.2-9-15.7, lower cover mount rubber in this order as an assembly. (The lower cover is fastened by the four same M6 bolts.)

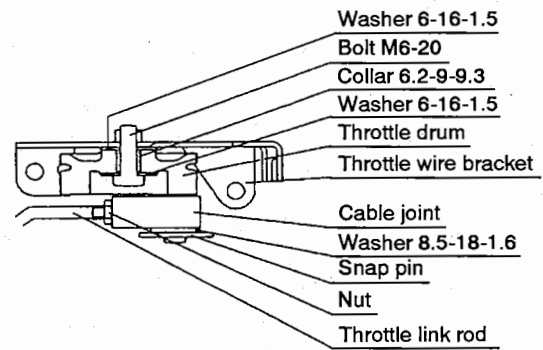


CHAPTER 5 LOWER UNIT

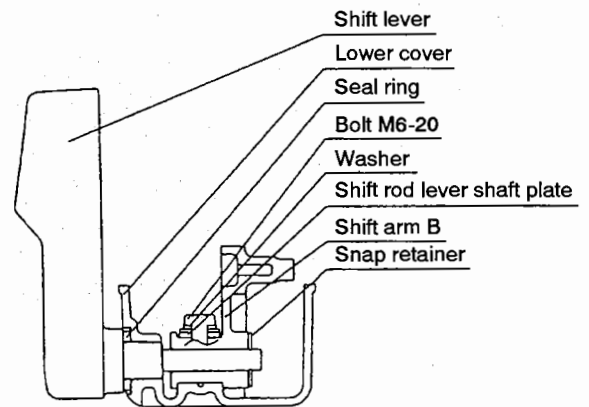
● Assembling throttle, shift parts

- Put the throttle wire bracket, washer 6-16-1.5, throttle drum, collar 6.2-9-9.3, washer 6-16-1.5 on the bolt in this order, and fit the throttle wire bracket to the lower motor cover with the M6 bolt (2 bolts).

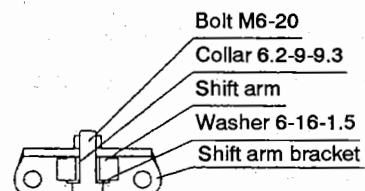
- Assemble the throttle link rod, nut to the cable joint, and the assembled cable joint to the boss of the throttle drum and fasten it with the washer 8.5-18-1.6 and snap pin.



- Install the shift lever, seal ring, shift arm B, snap retainer in this order, and fit the shift rod lever shaft plate with the M6 bolt (2 bolts). (Model with the manual starter)

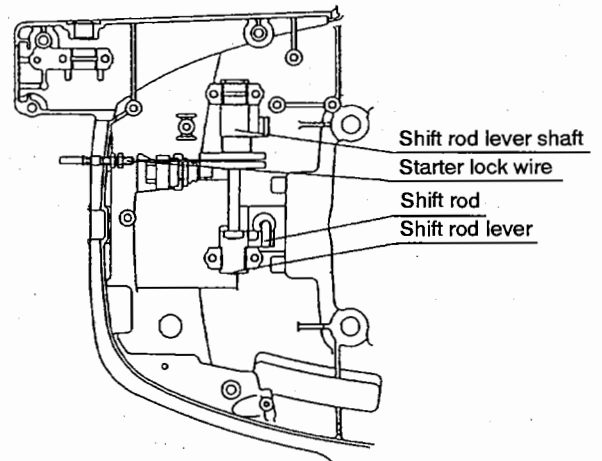


- Install the shift arm assembled with the shift arm bracket, shift arm, collar 6.2-9-9.3, washer 6-16-1.5 and bolt in this order to the lower cover with the M6 bolt (2 bolts). (Model with the electric starter)

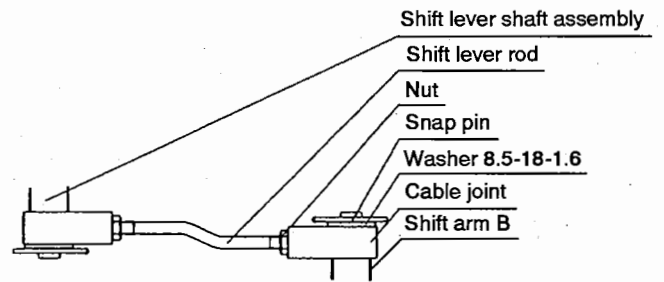


CHAPTER 5 LOWER UNIT

- Fit the shift rod lever to the lower cover and connect the shift rod to the shift rod lever. Install the wave washer, shift rod lever, shift lever shaft assembly in this order and finally fit the shift rod lever shaft plate with the M6 bolt (2 bolts for both ends).
- Connect the starter lock wire to the shift lever shaft assembly.
- Install the shift lever stopper plate, shift lever stopper and M6 bolt in this order.



- Install the cable joint, nut, shift lever rod, nut, cable joint in this order, and set the cable joint in the boss of the shift arm B and shift lever shaft assembly and fasten it with the washer 8.5-18-1.6 and snap pin. (Model with the manual starter)



CHAPTER 5 LOWER UNIT

● Assembling engine block and lower unit

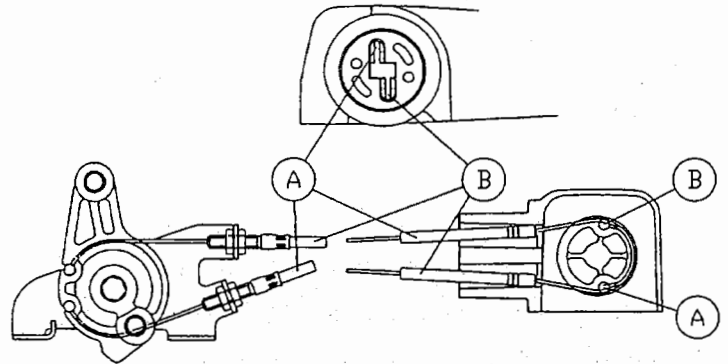
- Apply the specified grease to the spline of the drive shaft.
- Mount the engine block on the engine base with the engine base gasket sandwiched between them and fasten it.

Tightening torque: 27.4-31.4 N – m

(2.8-3.2 kg – m)

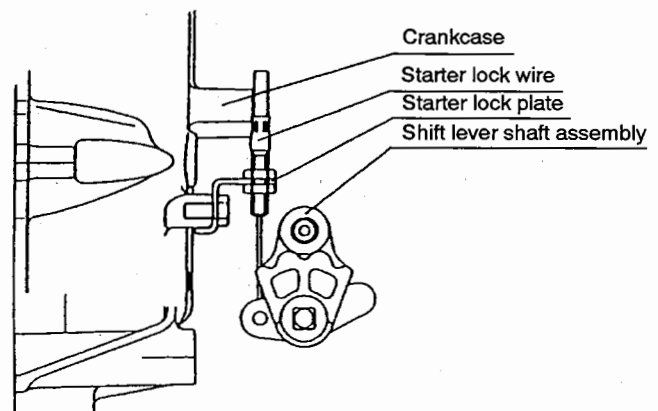
(20-23 lb – ft)

- Install the steering bracket.
- Engage the throttle wire with the throttle drum and secure the wire on the throttle wire bracket.
- Adjust the throttle wire so that the throttle grip smoothly works to throw the throttle full open and to close it for idle.

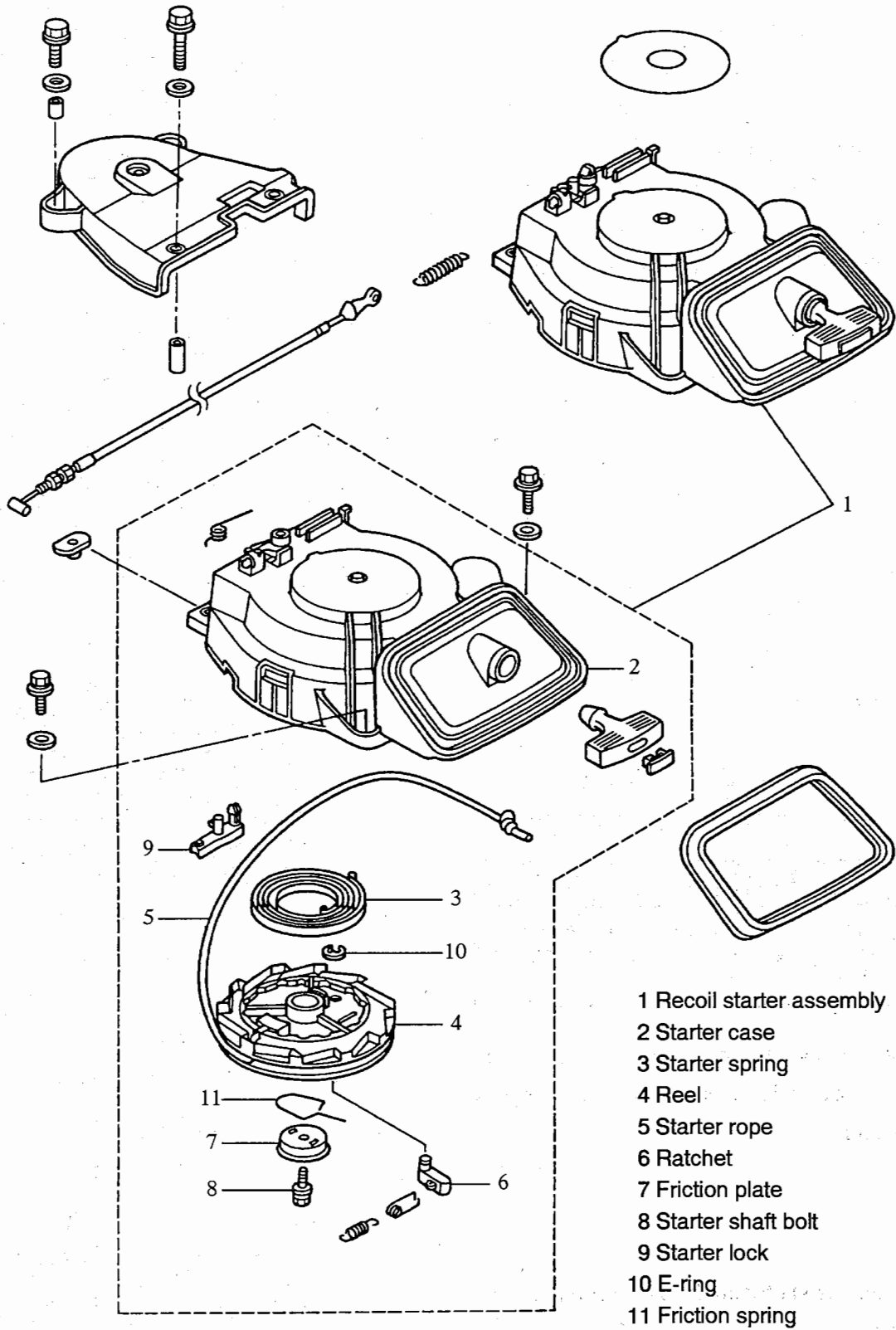


- Connect the fuel pipe to the fuel pump.
- Connect the pipe to the cylinder head and engine base.

- Properly arrange the location of the starter lock wire with the starter lock plate fitted to the crankcase, and connect it to the starter case.



CHAPTER 6 RECOIL STARTER

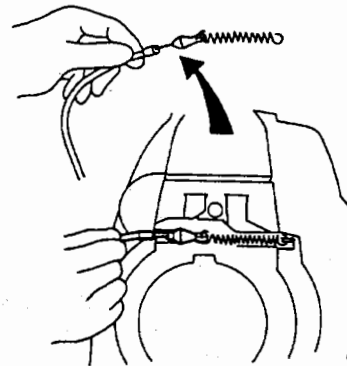
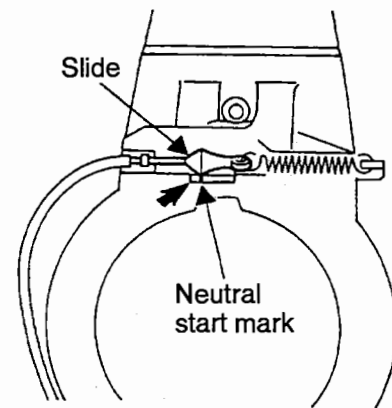


- 1 Recoil starter assembly
- 2 Starter case
- 3 Starter spring
- 4 Reel
- 5 Starter rope
- 6 Ratchet
- 7 Friction plate
- 8 Starter shaft bolt
- 9 Starter lock
- 10 E-ring
- 11 Friction spring

CHAPTER 6 RECOIL STARTER

1. Neutral Interlock Adjustment

- ① Place shift lever in neutral position.
- ② The largest diameter of the slide on the end of the cable should line-up with the neutral start mark on the cover as shown.
- ③ If adjustment is required, adjust the cable to obtain the correct adjustment.
- ④ Check the operation of the neutral interlock. The starter rope must not be pulled out when the shift handle is in forward or reverse position.



2. Disassembly

- ① Disengage the neutral interlock cable.
- ② Remove bolts and then remove the starter.

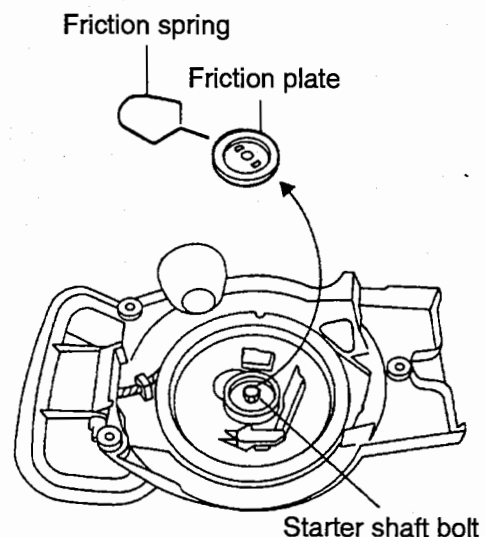
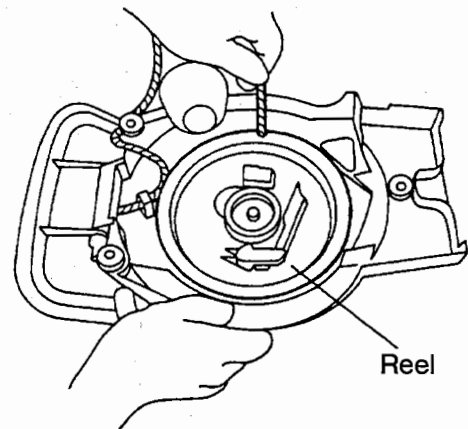
▲ WARNING

Safety glasses should be worn to prevent eye injury caused by the rewind spring uncoiling out of the housing.

- ③ Place the looped rope in the cutaway and turn the reel clockwise until rewind spring is fully unwound.

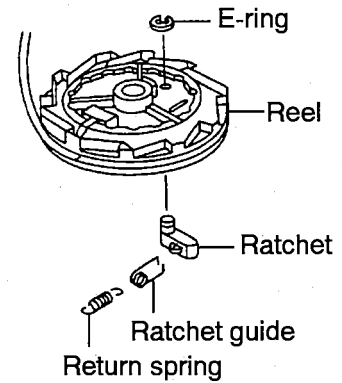
- ④ Remove the starter shaft bolt, friction plate and spring.

- ⑤ Remove the reel.



CHAPTER 6 RECOIL STARTER

- ⑥ Remove the E-ring and then remove the ratchet, guide and spring.

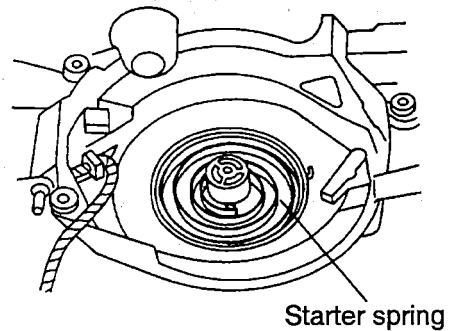


- ⑦ Remove the starter spring.

Notes:

Starter spring is not required to be removed from starter case unless it requires to change.

The spring can be inspected without removal from the starter case.



3. Inspection

- Ratchet, starter lock, All springs: Deformation, wear, crack and damage.
- Reel, starter case: Crack and damage.
- Starter rope: Wear, fraying and damage.

CHAPTER 6 RECOIL STARTER

4. Reassembly

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



CAUTION

Wear safety glasses for eye protection in case spring should uncoil out of starter case.

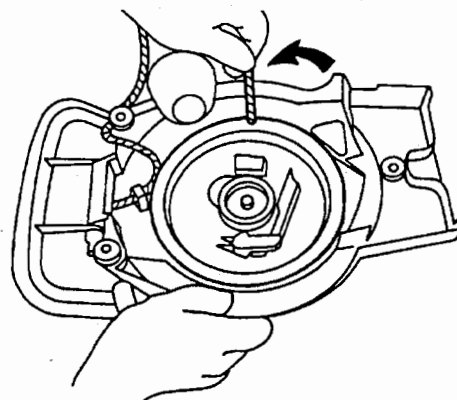
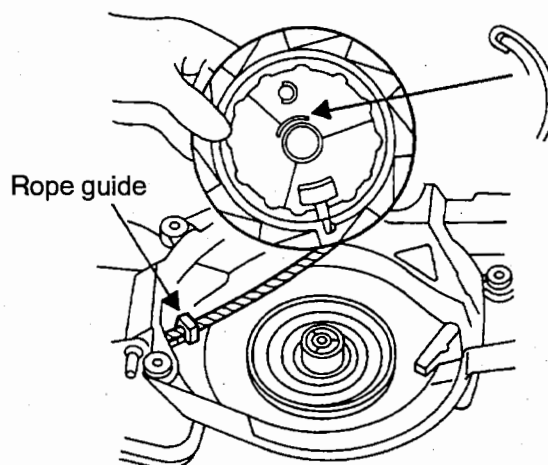
- When install the starter spring to starter case, place outer hook of the spring to right and set it in the outer slot of starter case.
- Insert the starter rope through the rope guide.
- Install the reel. Engage the tab on the back side of the reel into the inside hook of the starter spring as shown.
- Apply cold-resistant lithium grease to both ends of the starter spring, center hole of reel, ratchet, starter lock and friction plate.
- Apply Three Bond 1342 to the thread of the starter shaft bolt.
- Tighten the starter shaft bolt with the specified torque.

Tightening torque: 5-6 N – m (0.5-0.6 kg – m)
(3.6-4.3 lb – ft)

● ADJUSTING STARTER SPRING TENSION:

Place rope in the cutout and pre-load the spring tension by rotating the drum counterclockwise three turns.

- After re-installed the recoil starter to the outboard motor, operate the shifting lever to check to see if the shifting lever is locked at all positions except the neutral position.



CHAPTER 7 CARBURETOR AND FUEL PUMP

1. Carburetor

⚠ CAUTION

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

Cleaning: After washing the carburetor with solvent, dry it by compression air.

Pilot screw

Note: Unadjustable because it is fixed.

Throttle stop screw

Adjustment:

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

Carburetor body

Inspection: Clogging the fuel hole for Auto-By-Starter.
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.

Slow jet

Inspection:

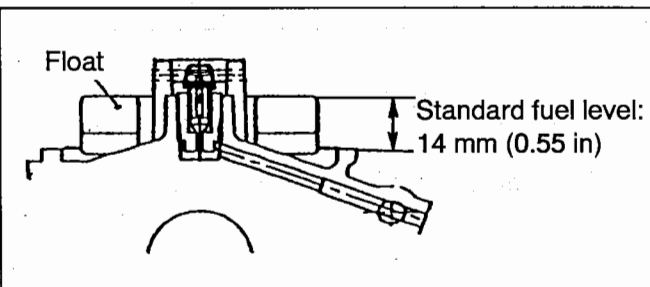
- Check to see if there is any clogging in the jet hole.

Accelerator pump parts

Inspection:

- Operating condition
- Crack of the rubber boot

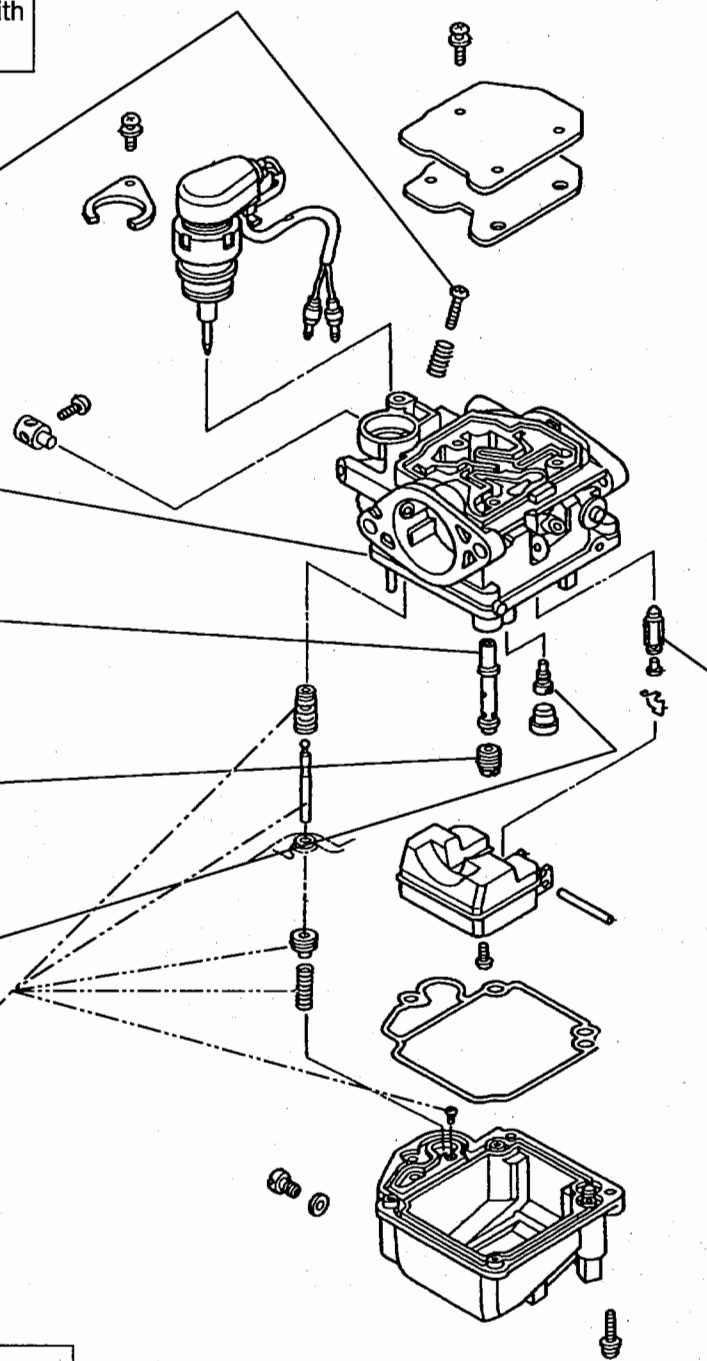
Fuel level



Float valve

Inspection:

- Wear of the float valve in the contact area to the seat.
- Wear in the float arm that contacts the float valve.



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.

DISASSEMBLY

Before disassembly, make an aligning line on the out side of fuel pump for easier reassembling.

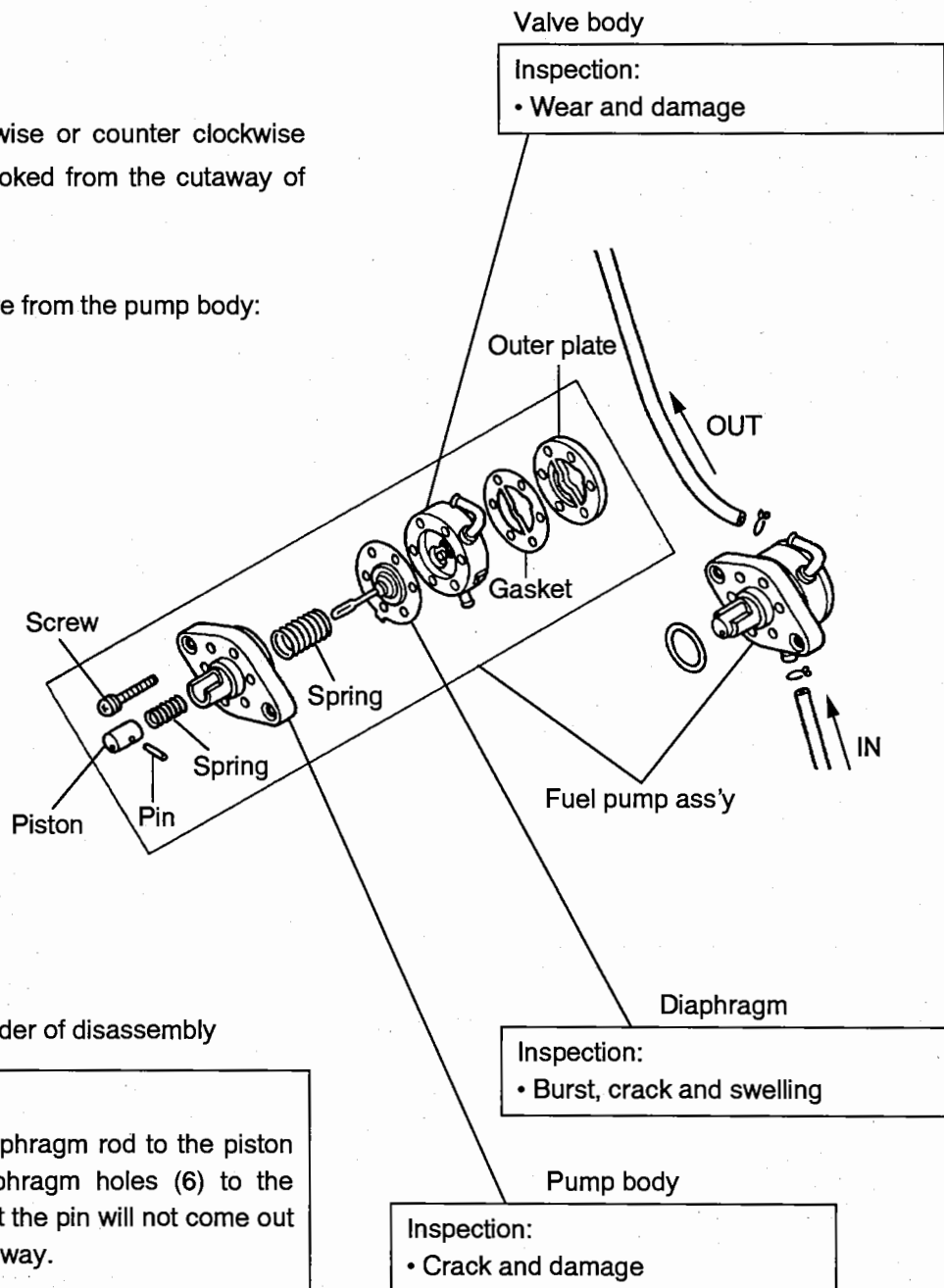
① Remove screw, and take off:

- Outer plate
- Gasket
- Valve body

② Turn the piston clockwise or counter clockwise until the pin can be looked from the cutaway of the pump body.

③ Pull the pin, and remove from the pump body:

- Piston
- Spring
- Diaphragm
- Spring



REASSEMBLY

Reassembly is reverse order of disassembly

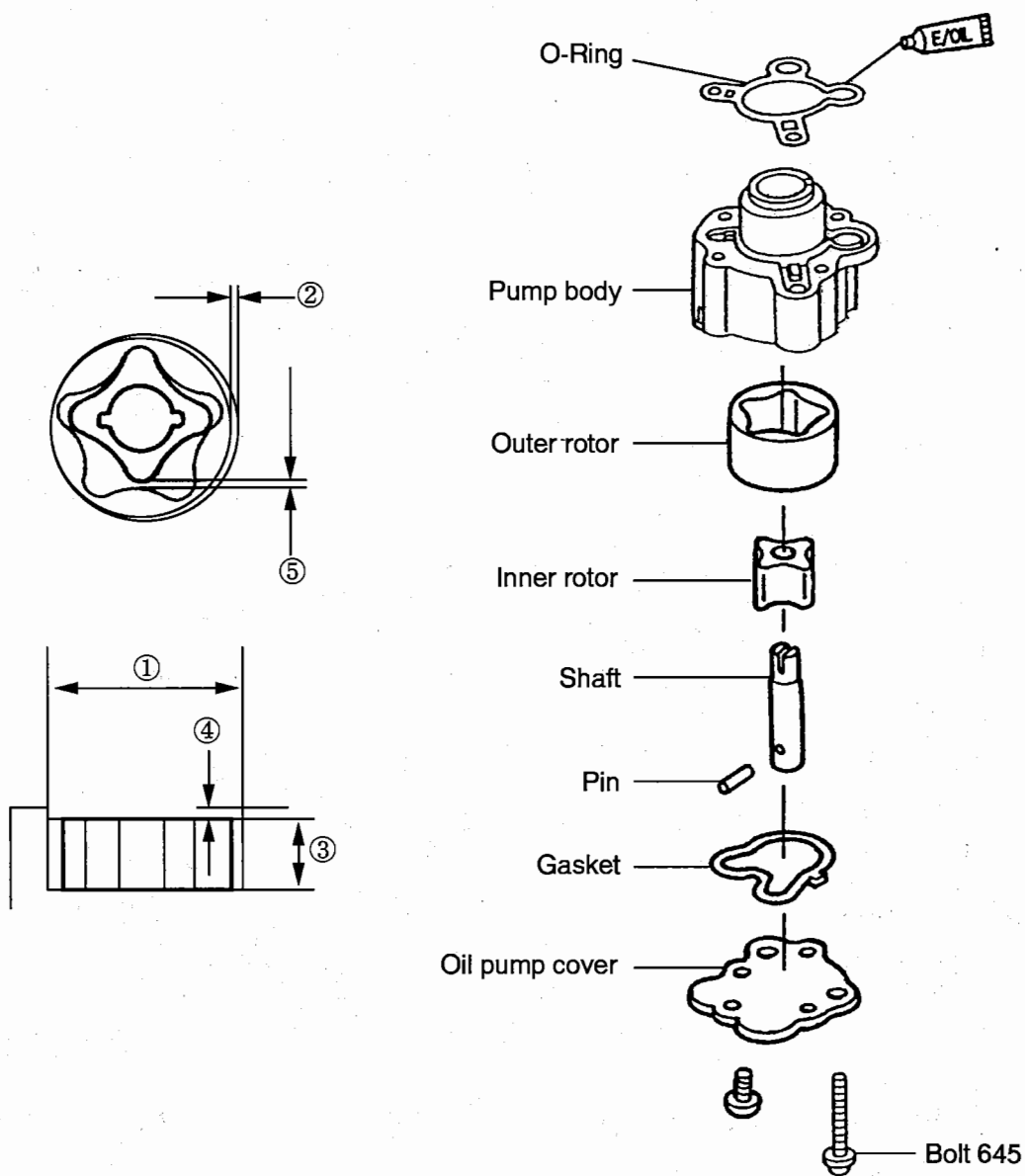
Note:

After connecting the diaphragm rod to the piston with pin, align the diaphragm holes (6) to the pump body holes so that the pin will not come out through pump body cutaway.

CHAPTER 8 OIL PUMP

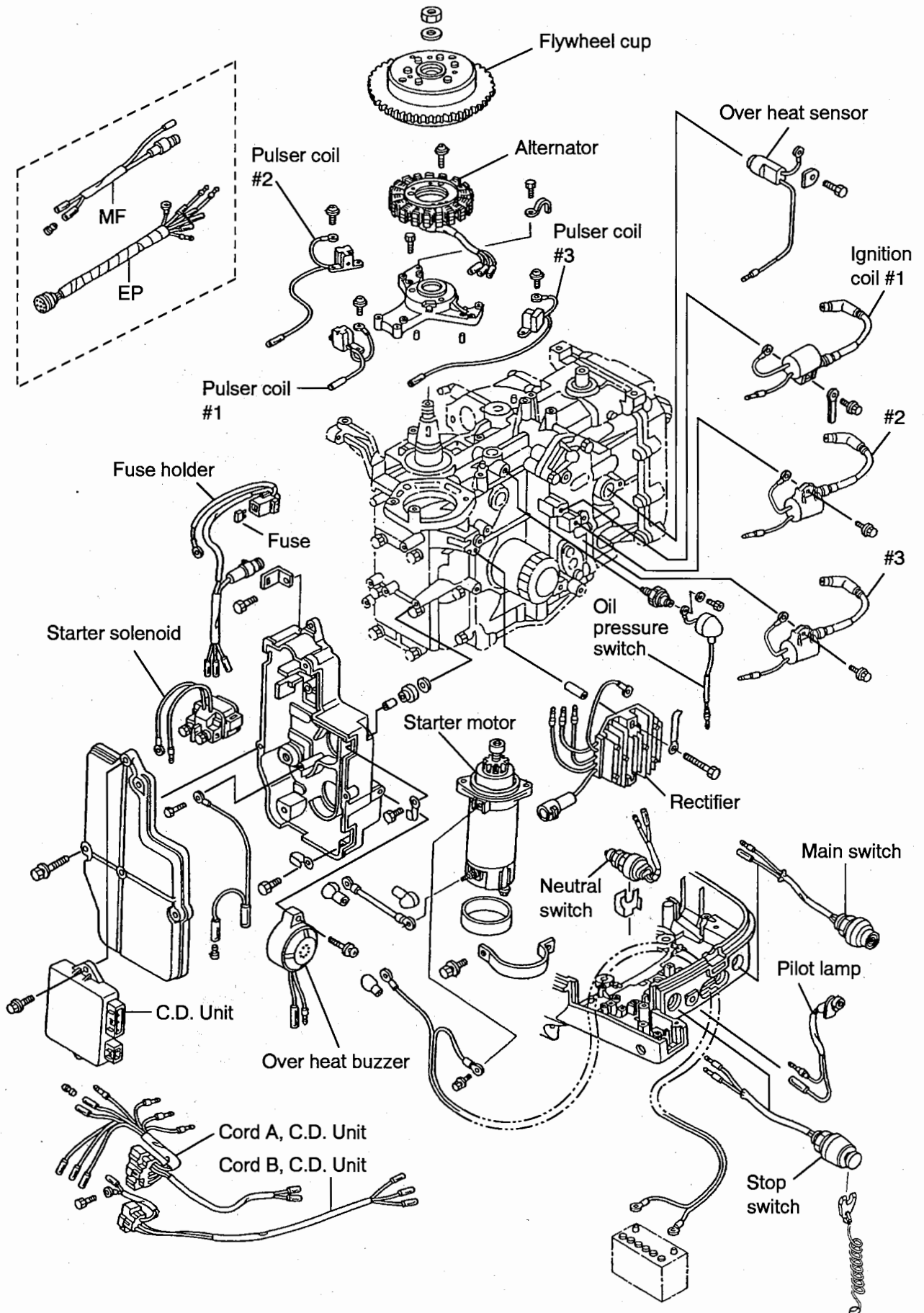
Using a micrometer, cylinder gauge, depth gauge and feeler gauge, measure the following oil pump clearances. Replace if worn or out of specification.

① Inner diameter of pump body	40.8 mm (1.606 in) or more
② Clearance between outer rotor and body	0.25 mm (0.01 in) or more
③ Height of outer rotor	14.96 mm (0.589 in) or less
④ Side clearance between rotor and body	0.11 mm (0.0043 in) or more (incl. wear of the pump cover)
⑤ Clearance between outer rotor and inner rotor	0.16 mm (0.006 in) or more



CHAPTER 9 ELECTRICAL SYSTEM

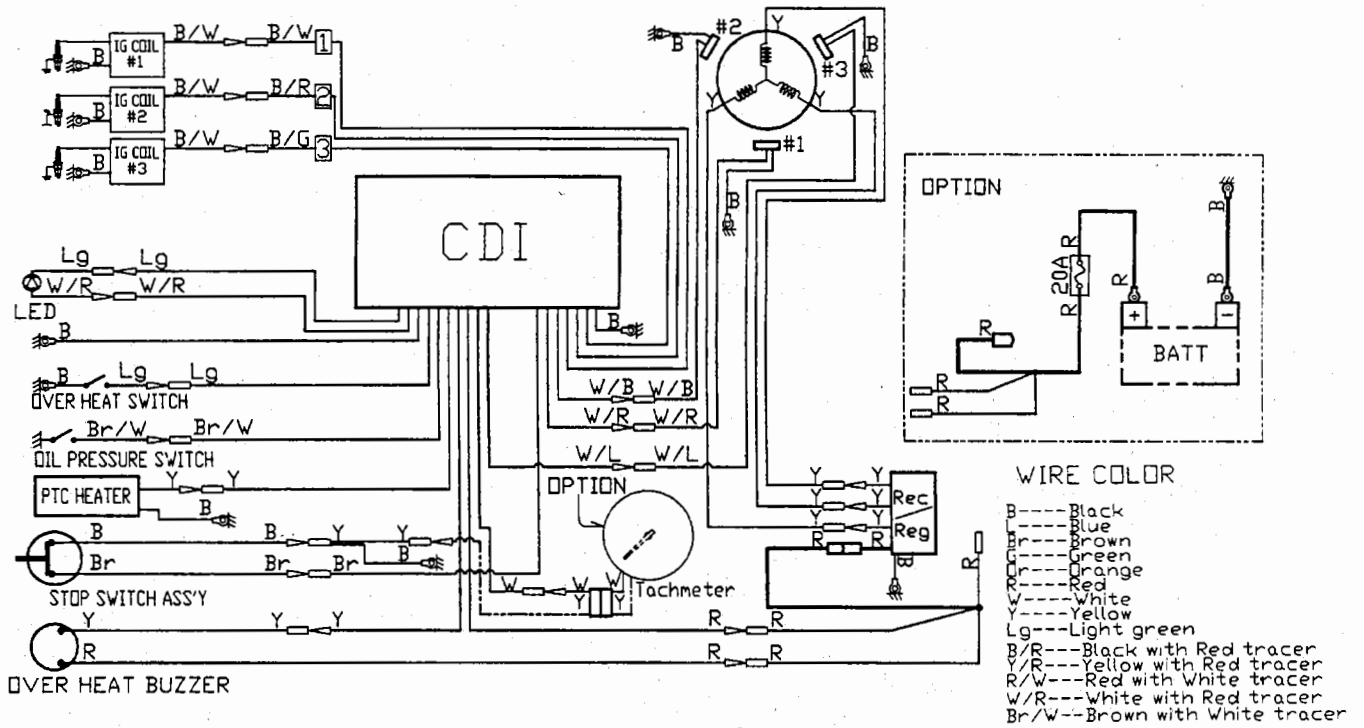
1. Component Parts



CHAPTER 9 ELECTRICAL SYSTEM

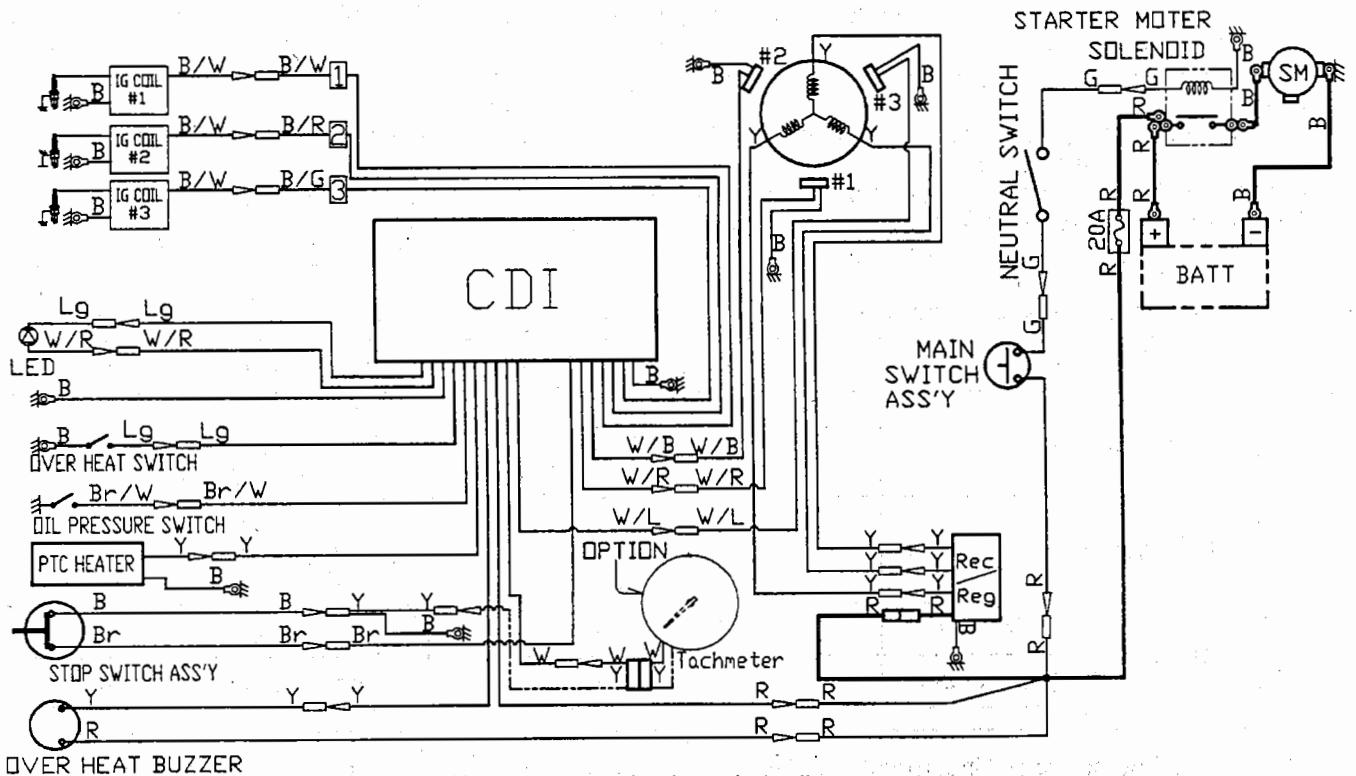
2. Wiring Diagram

MF type



Note: Including optional parts in the diagram.

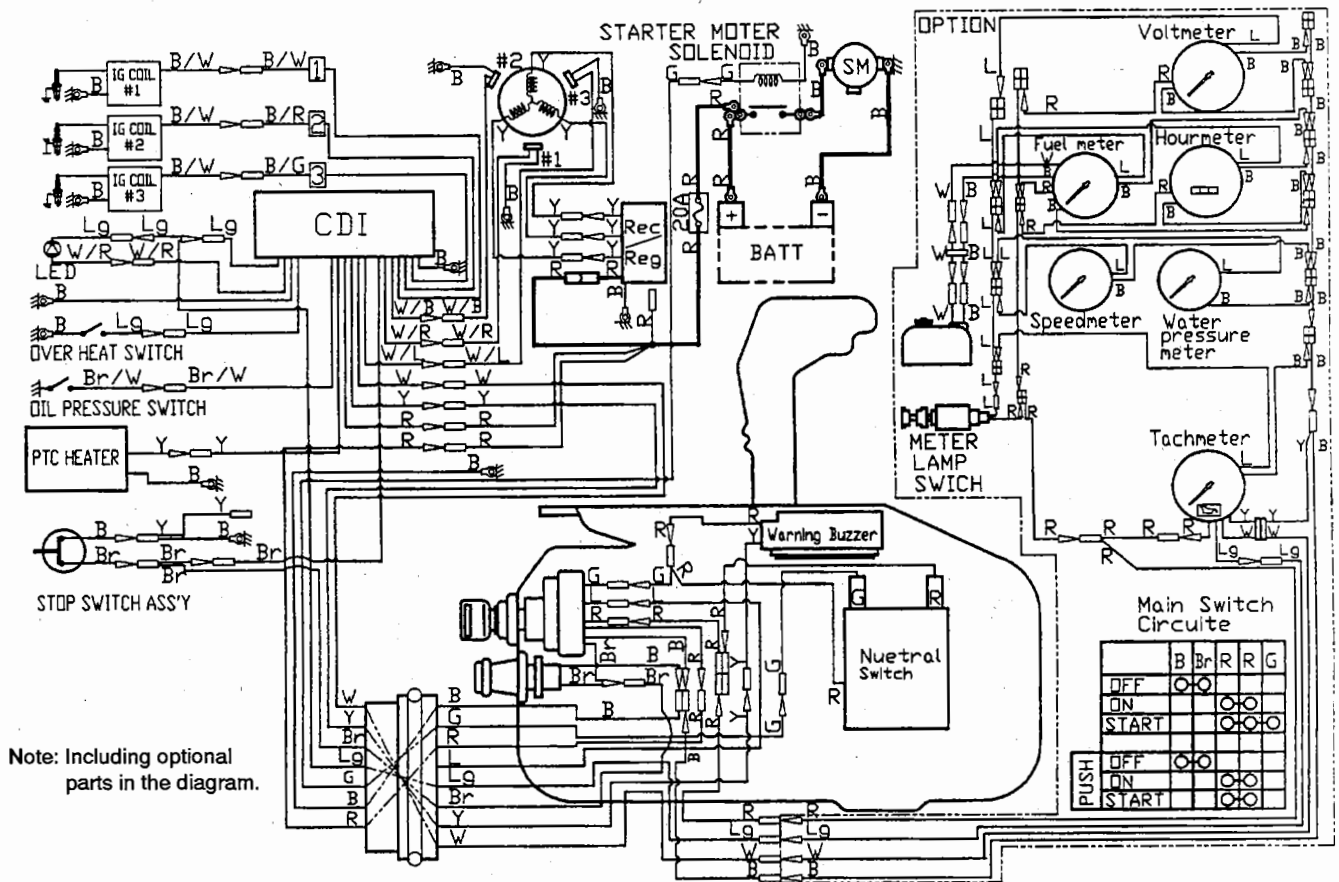
EF type



Note: Including optional parts in the diagram.

CHAPTER 9 ELECTRICAL SYSTEM

EP type



3. Inspection

1) Flywheel

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

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 dismounting the flywheel from the engine, never use any tool other than the specified tool.
- Be careful not to drop the flywheel. If it is dropped, to be changed new one.

2) Resistance for pulser coil, alternator coil and ignition coil

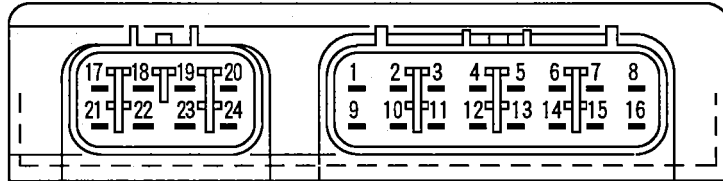
		Normal resistance R (Ω)	Terminals to connect tester
Pulser coil		180 – 240	White/Red – Black, White/Black – Black, White/Blue – Black
Alternator coil		0.6 – 0.9	Yellow – Yellow, Yellow – Yellow, Yellow – Yellow
Ignition coil	Primary	0.18 – 0.24	Black – Orange
	Secondary	2,700 – 3,700	High tension cord – Core

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

CHAPTER 9 ELECTRICAL SYSTEM

3) C.D. unit

- Check to see if there is no breakdown in the wire harness and nothing abnormal in connection of terminals.
- Check connections and resistances referring to the tester check data table on the next page. The values shown in the table are standards.
- The tester needle may considerably shake because of the effects of the internal capacitor. If it occurs, read the tester when the needle is stabilized.
- "k" appearing in the table represents "k Ω".
- Location of terminals is shown below by terminal number.



- Names and lead wire colors of the terminals are shown in numerical order in the following table.

No.	Name	Color of lead wire	
1	LED power	W/R	White/Red
2	Buzzer	Y	Yellow
3	LED (lamp)	Lg	Light green
4	PTC heater	Y	Yellow
5	– (for communication)	–	
6	Overheat SW	Lg	Light green
7	– (for communication)	–	
8	Pulser (#2)	W/B	White/Black
9	Ground (main)	B	Black
10	Tachometer	W	White
11	Power (battery)	R	Red
12	– (for communication)	–	
13	Oil pressure SW	Br/W	Brown/White
14	– (for communication)	–	
15	Pulser (#3)	W/L	White/Blue
16	Pulser (#1)	W/R	White/Red
17	Ignition coil (#2)	B/R	Black/Red
18	–	–	
19	–	–	
20	Stop SW	Br	Brown
21	Ignition coil (#1)	B/W	Black/White
22	Ignition coil (#3)	B/G	Black/Green
23	–	–	
24	Ground (ignition coil)	B	Black

CHAPTER 9 ELECTRICAL SYSTEM

Tester Check Data Table

		Tester probe: Red, Tester indication: + (positive)																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	80k~300k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
2	36k~110k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
3	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
4	36k~110k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
5	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
6	36k~110k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
7	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
8	25k~90k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
9	15k~50k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
10	15k~50k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
11	50k~200k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
12	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
13	36k~110k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
14	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
15	25k~90k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
16	25k~90k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
17	50k~200k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
18	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
19	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
20	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
21	50k~200k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
22	50k~200k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
23	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
24	15k~50k	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞

Tester probe: Black, Tester indication: - (negative)

CHAPTER 9 ELECTRICAL SYSTEM

4) Rectifier/Regulator

- 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.
- Disconnect all wire connection from rectifier/regulator before proceeding tester check.

Rectifier – Tester Check Table

		Tester probe: + (Red)				
		Red	Yellow	Black	Yellow	Yellow
Tester probe: - (Black)	Red		OFF	OFF	OFF	OFF
	Yellow	ON (4kΩ)		OFF	OFF	OFF
	Black	ON (5kΩ)	ON (4kΩ)		ON (4kΩ)	ON (4kΩ)
	Yellow	ON (4kΩ)	OFF	OFF		OFF
	Yellow	ON (4kΩ)	OFF	OFF	OFF	
	Yellow					

Notes:

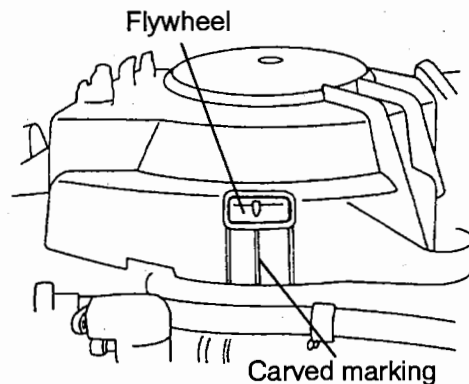
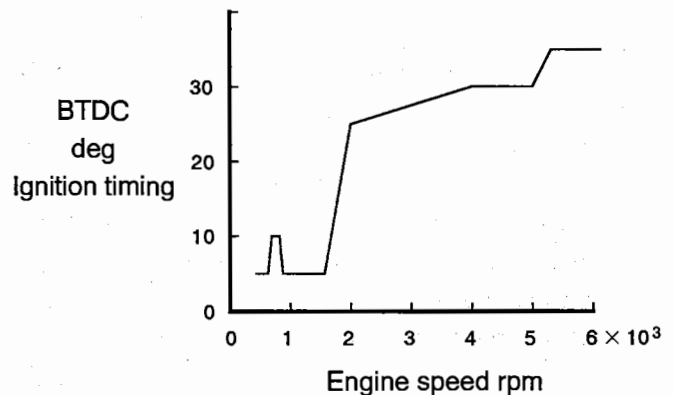
- Measuring condition: Tester used — Hioki 3030, Range 1kΩ
- Tolerance of resistans: ± 20%
- The values shown in the table are just standards, and it is difficult to obtain accurate values.

5) Manner to check ignition timing

The magneto employs the electric ignition advance system that advances ignition timing with increase of engine speed.

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

Since eleven marking lines (top dead center, 5° and 10° behind top dead center, 5°, 10°, 15°, 20°, 25°, 30°, 35°, 40°, ahead of top dead center) are carved on the side of the flywheel, ignition timing can be checked by the carved marking line and reference marking located at the center of the starter case window.



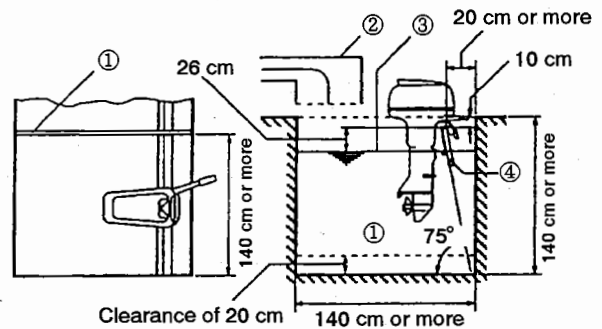
CHAPTER 10 TEST RUN AND INSPECTION AFTER COMPLETE ASSEMBLY

1. Test Tank and Test Propeller

● Requirements for the test tank

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

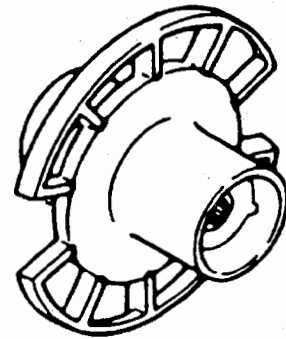
- The test tank must have the measurements specified in the figure at least.
- If two outboard motors are set in the test tank for two or more motors, the minimum measurements required for a motor must be secured by a fixed partition.



● Test propeller

Outer diameter: 223 mm

Width: 11.5 mm



Model	Engine speed at full throttle r/m
25	Approx. 5,200
30	Approx. 5,700

● Notes on test 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 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.

CHAPTER 10 TEST RUN AND INSPECTION AFTER COMPLETE ASSEMBLY

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

- 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	



Address: 5-4, 3-chome, Azusawa, Itabashi-ku, TOKYO 174-0051, Japan
Facsimile: (03) 3966-2951
Phone: (03) 3966-3117

No. 003-21053-0
01-06-MH2800
Printed in Japan