Paper book Part no. 66ZV400

PREFACE

This manual covers the construction, function and servicing procedure of the Honda BF9.9A, BF15A outboard motors. Careful observance of these instructions will result in better, safer service work.
Illustrations in this manual are based primarily on the BF15A LCS.

HONDA MOTOR CO., LTD.
SERVICE PUBLICATIONS OFFICE

CONTENTS

Date of Issue: FEB, 1988

SPECIFICATIONS

SPECIFICATIONS

DIMENSIONS AND WEIGHTS

Model	BF9.9A				BF15A			
Description code	BABS		BABL		BAAS		BAAL	
Item / Type	SC, SD	SCS, SDS	LC, LD	LCS, LDS	SC, SD	SCS, SDS	LC, LD	LCS, LDS
Overall length Overall width	550 mm (21.7 in) 320 mm (12.6 in)							
Overall height	1,050 mm (41.3 in)		1,180 mm (46.5 in)		1,050 mm (41.3 in)		1,180 mm (46.5 in)	
Dry weight	42 kg (92.6 lb)	46 kg (101.4 lb)	43 kg (94.8 lb)	47 kg (103.6 lb)	42 kg (92.6 lb)	46 kg (101.4 lb)	43 kg (94.8 lb)	47 kg (103.6 lb)
Operating weight (incld. oil)	43 kg (94.8 lb)	47 kg (103.6 lb)	44 kg (97.0 lb)	48 kg (105.8 lb)	43 kg (94.8 lb)	47 kg (103.6 lb)	44 kg (97.0 lb)	48 kg (105.8 lb)
Transom height	440 mm (17.3 in)		570 mm (22.4 in)		440 mm (17.3 in)		570 mm (22.4 in)	
Transom angle Tilting Swivel angle	5 stage adjustment (4°–8°–12°–16°–20°) 3 stage adjustment (30°, 45° and 70°) 40° (Right, Left)							

ENGINE

Type Total piston displacement Bore x stroke	2 cylinder, in-line, 4 stroke, water-cooled, OHC 280 cm³ (17.1 cu in) 58 x 53 mm (2.3 x 2.1 in)	
Maximum horsepower	7.28 kw (9.9HP) 5,500 rpm (Propeller shaft)	11.03 kw (15HP) 6,200 rpm (Propeller shaft)
Maximum torque	17.4 N·m (1.74 kg-m, 12.66 ft-lb) (Propeller shaft)	19.8 N·m (1.98 kg-m, 14.32 ft-lb) (Propeller shaft)
Compression ratio	8.6 : 1	
Fuel consumption ratio	270 g/PSh (0.60 lb/hp·h)	264 g/PSh (0.58 lb/hp·h)
Cooling system Ignition system Ignition timing	Forced water circulation by impeller pump with thermostat CDI 5°–35° B.T.D.C	
Spark plug	DR-5HS (NGK), X16FSR-U (ND)	DR-6HS (NGK), X20FSR-U (ND)
Carburetor Lubrication system Lubricant capacity Starting system Stopping system Fuel Fuel tank capacity Fuel pump Exhaust system	Horizontal type, butterfly valves Pressure lubrication by trochoid pump 1.1 ℓ (2.33 US pt, 1.94 Imp pt) Recoil starter (SC, SD, LC, LD Type) recoil starter and electric starter (SCS, SDS, LCS, LDS Type) Grounding of primary circuit Regular automotive gasoline (86 pump octane; unleaded preferred) 13.0 ℓ (3.43 US gal, 2.86 Imp gal) Mechanical plunger type Underwater type	

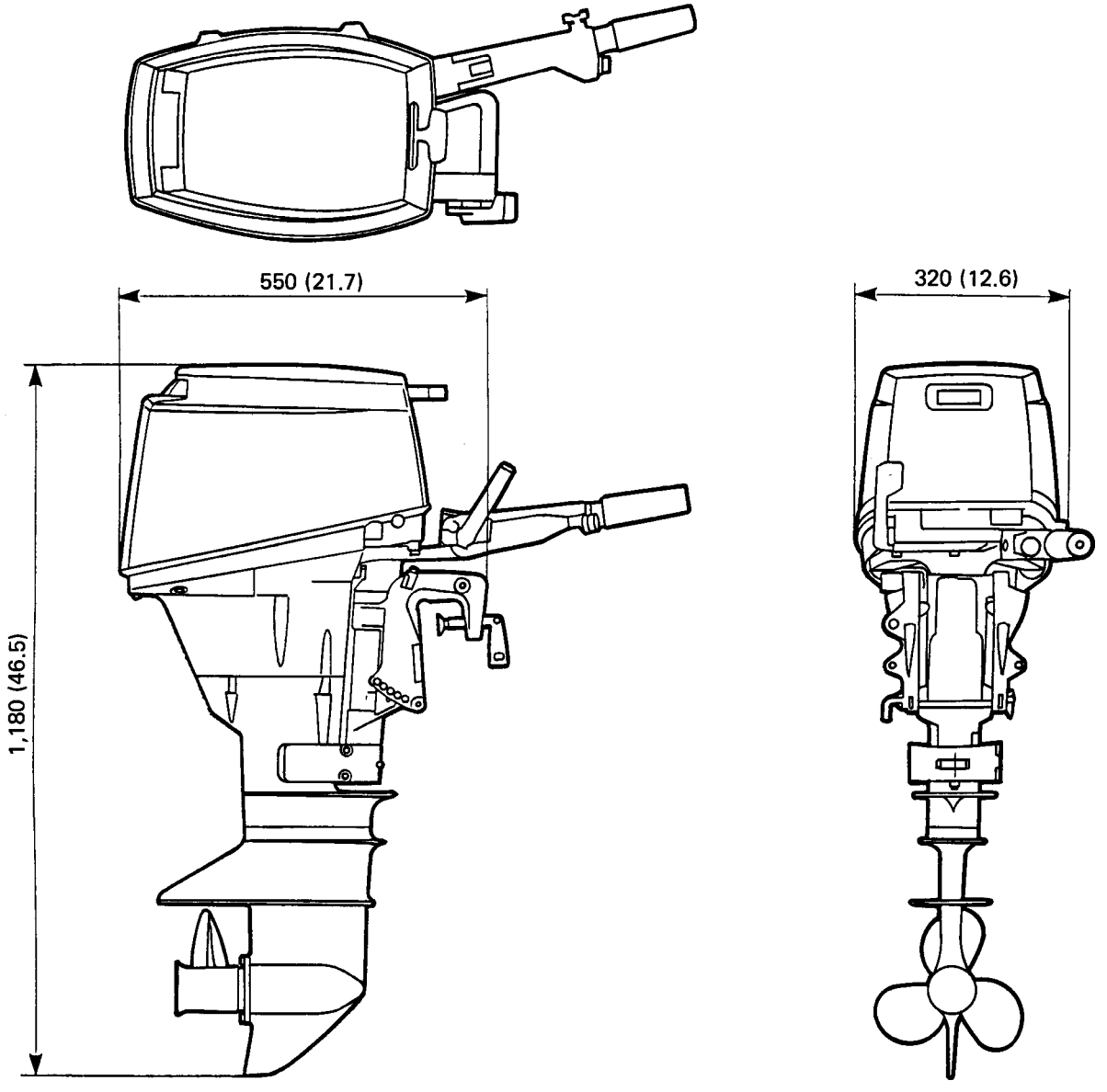
LOWER UNIT

Clutch Gear ratio Gear case oil capacity Propeller No. of blades-Dia. x Pitch Rotating direction	Dog clutch (Forward — Neutral — Reverse) 0.48 (13/27) 0.24 ℓ (0.254 US qt, 0.211 Imp qt.) 3–240 mm x 240 mm (S), 3–240 mm x 220 mm (L) Clockwise (viewed from rear)

DIMENSIONAL DRAWINGS

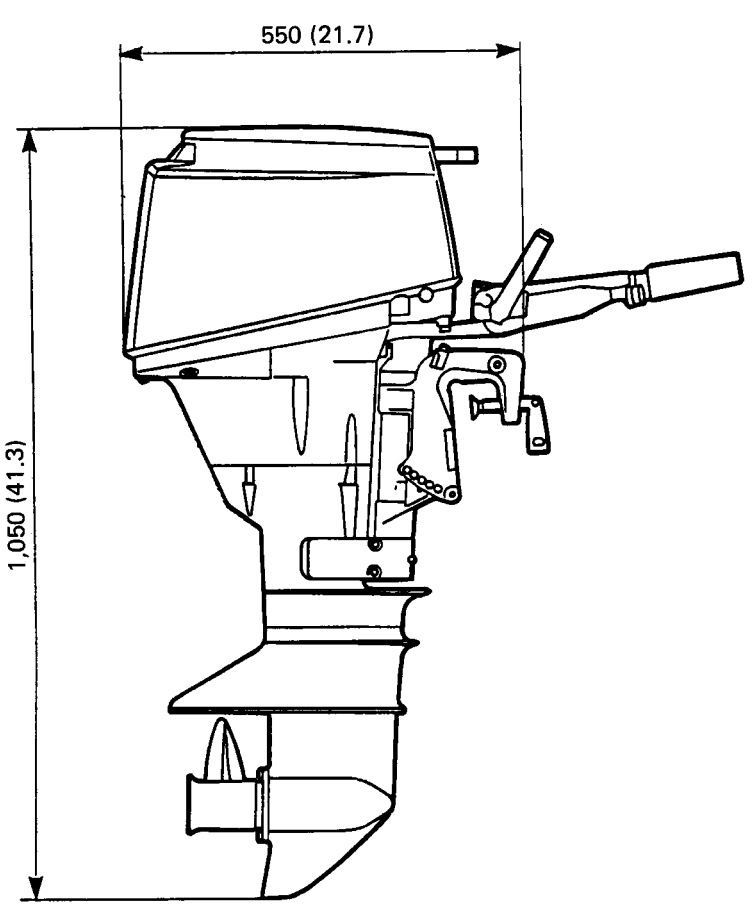
Unit: mm (in)

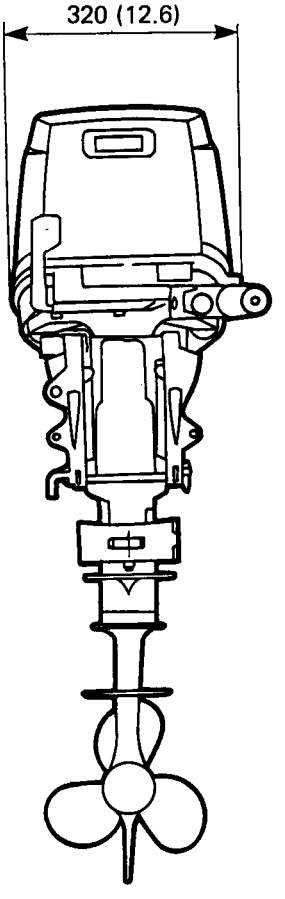
L Type Type L



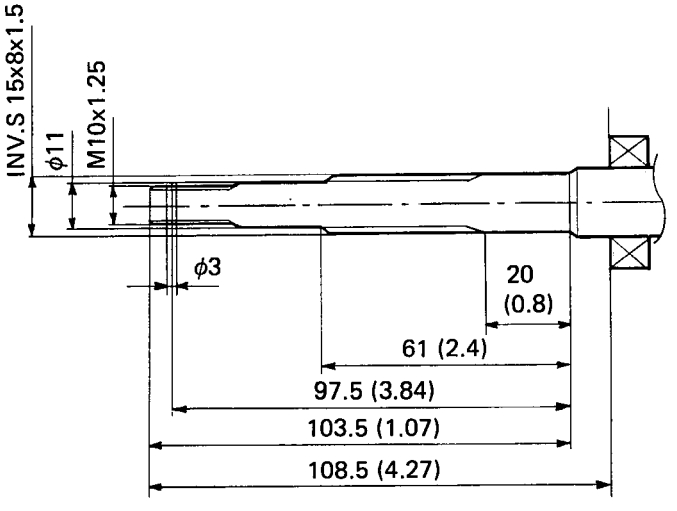
S Type

Unit: mm (in)



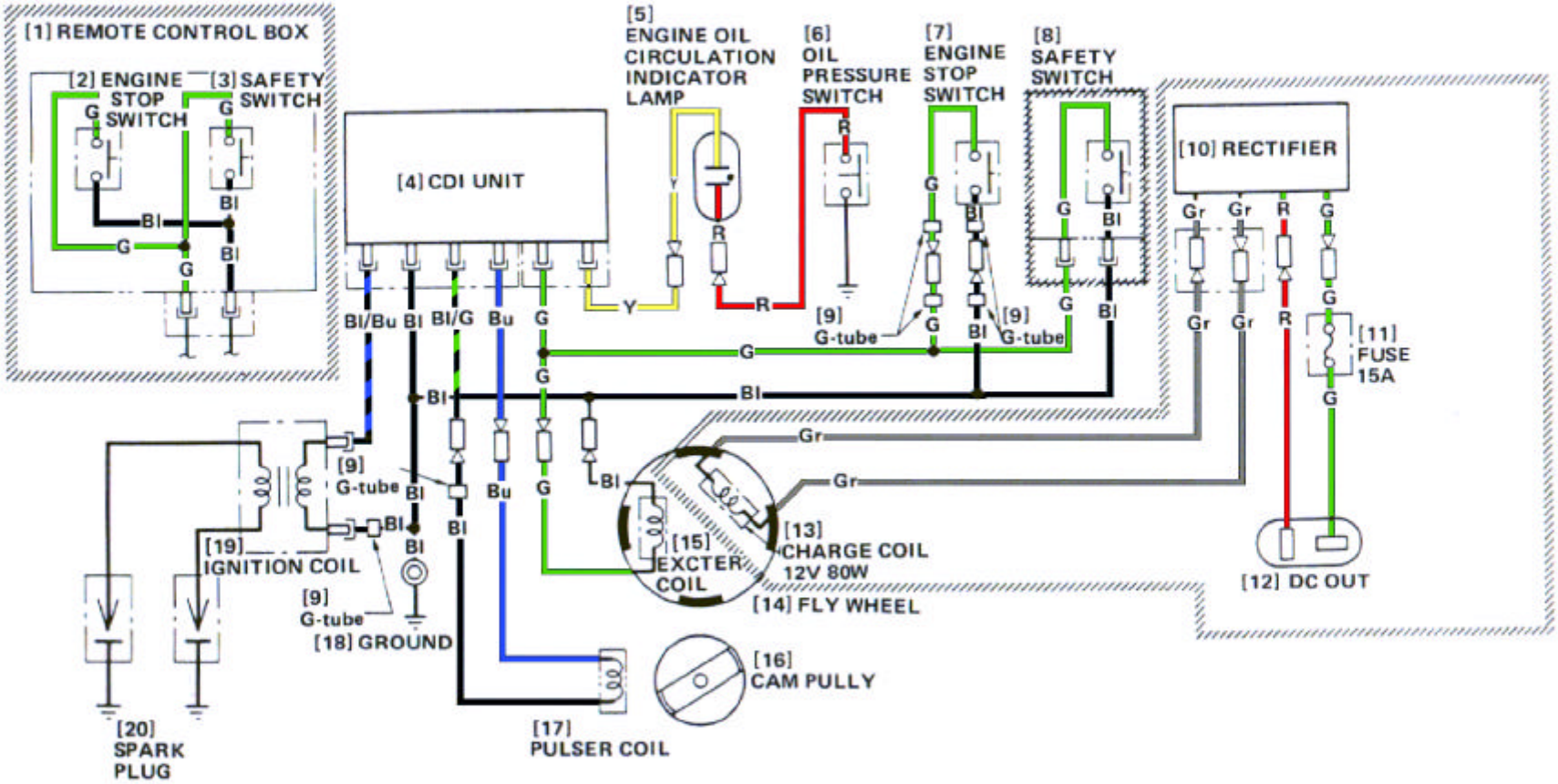


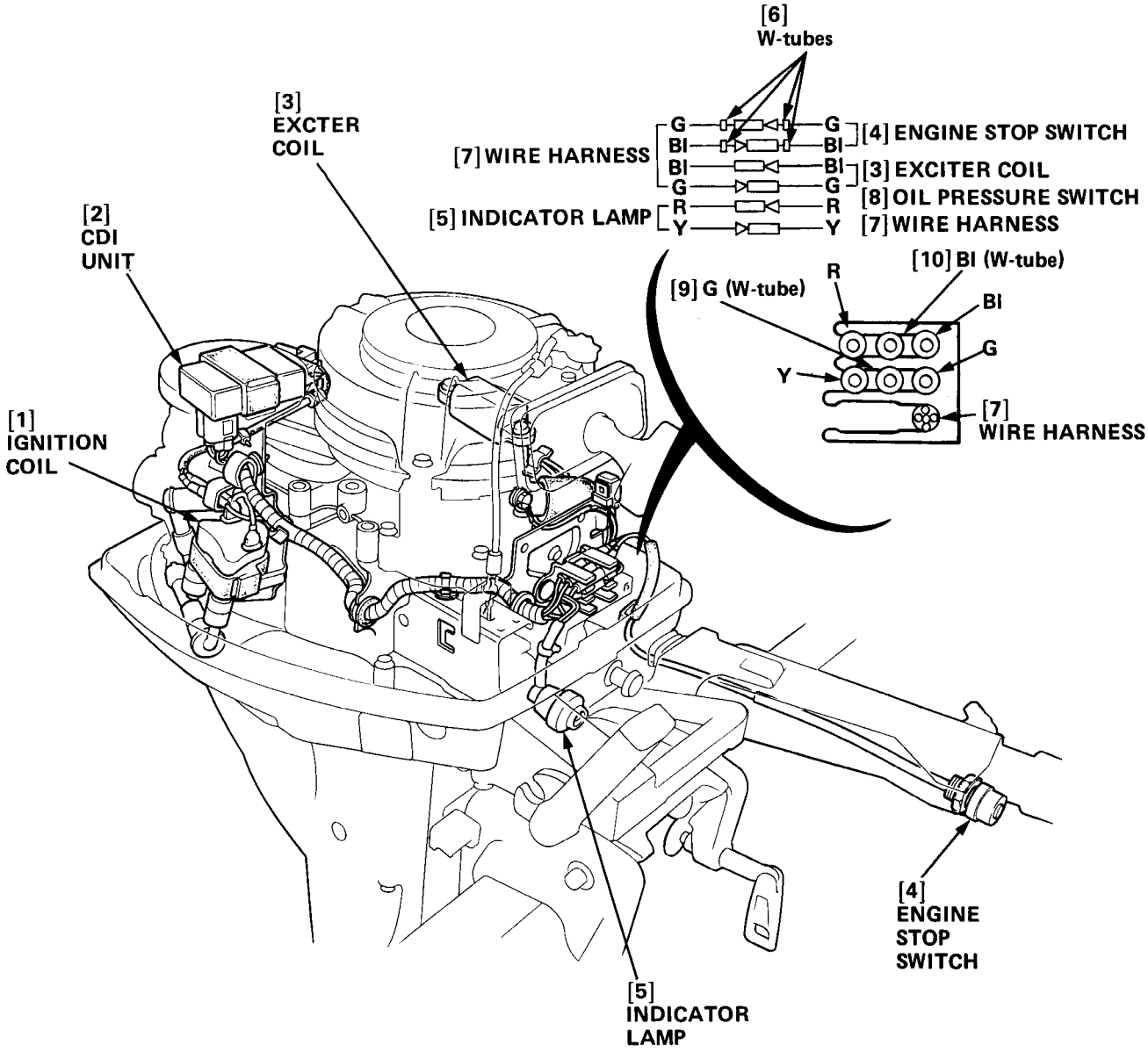
• PROPELLER SHAFT



WIRING DIAGRAM

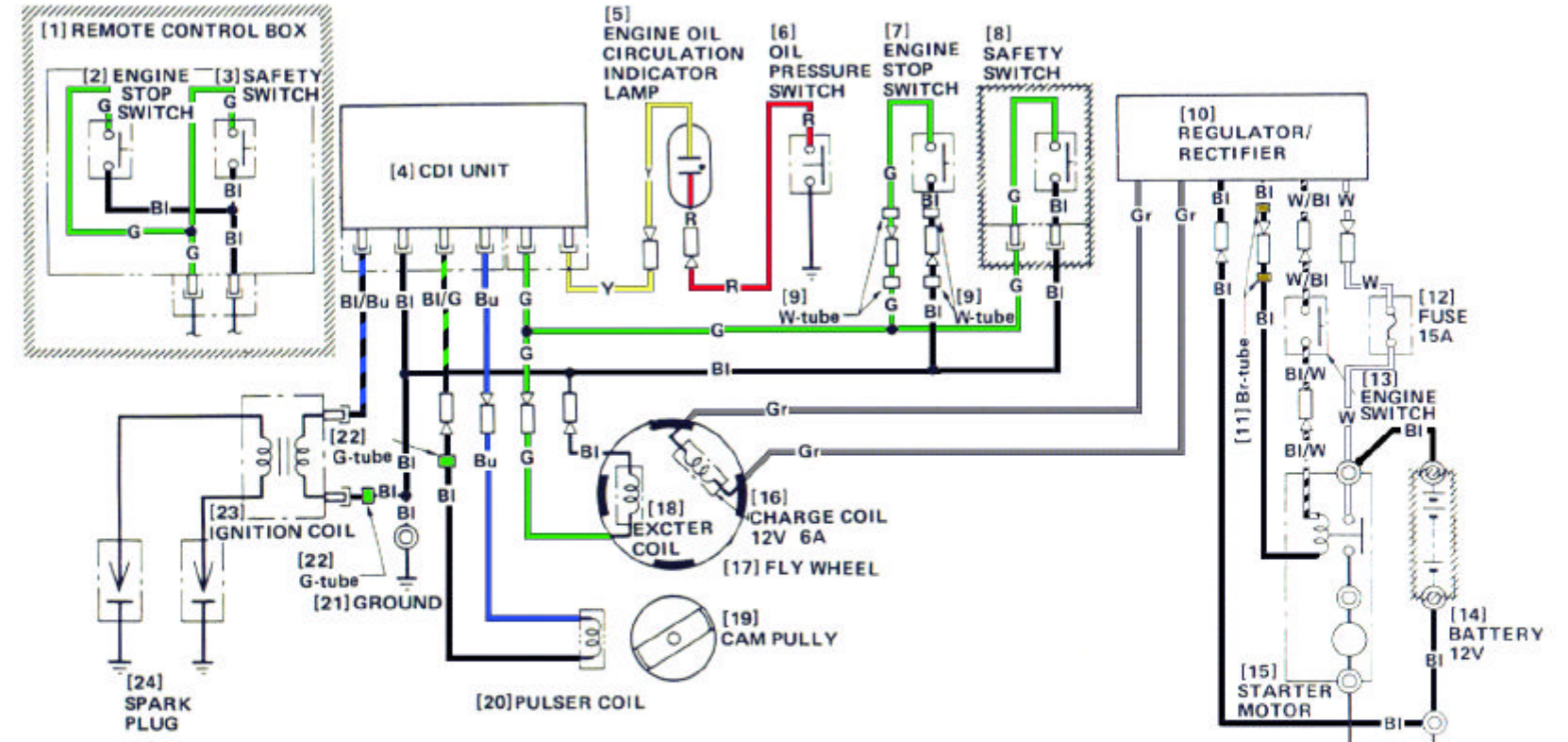
SC, SD, LC, LD Type

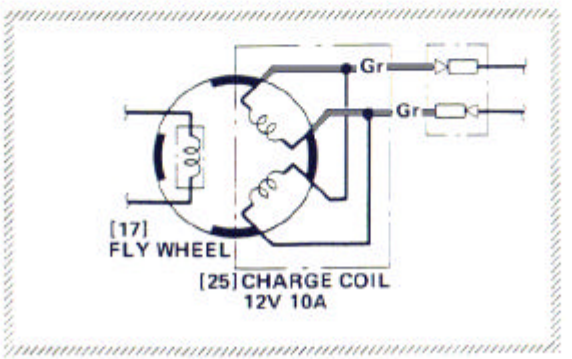



[6]
W-tubes
[3]
EXCTER
COIL
[7] WIRE HARNESS
G
BI
BI
G
G
BI
BI
G
[4] ENGINE STOP SWITCH
[3] EXCITER COIL
[8] OIL PRESSURE SWITCH
[7] WIRE HARNESS
[5] INDICATOR LAMP
R
Y
R
Y
[2]
CDI
UNIT
[10] BI (W-tube)
[9] G (W-tube)
R
BI
G
Y
[7]
WIRE HARNESS
[1]
IGNITION
COIL
[4]
ENGINE
STOP
SWITCH
[5]
INDICATOR
LAMP

WIRING DIAGRAM

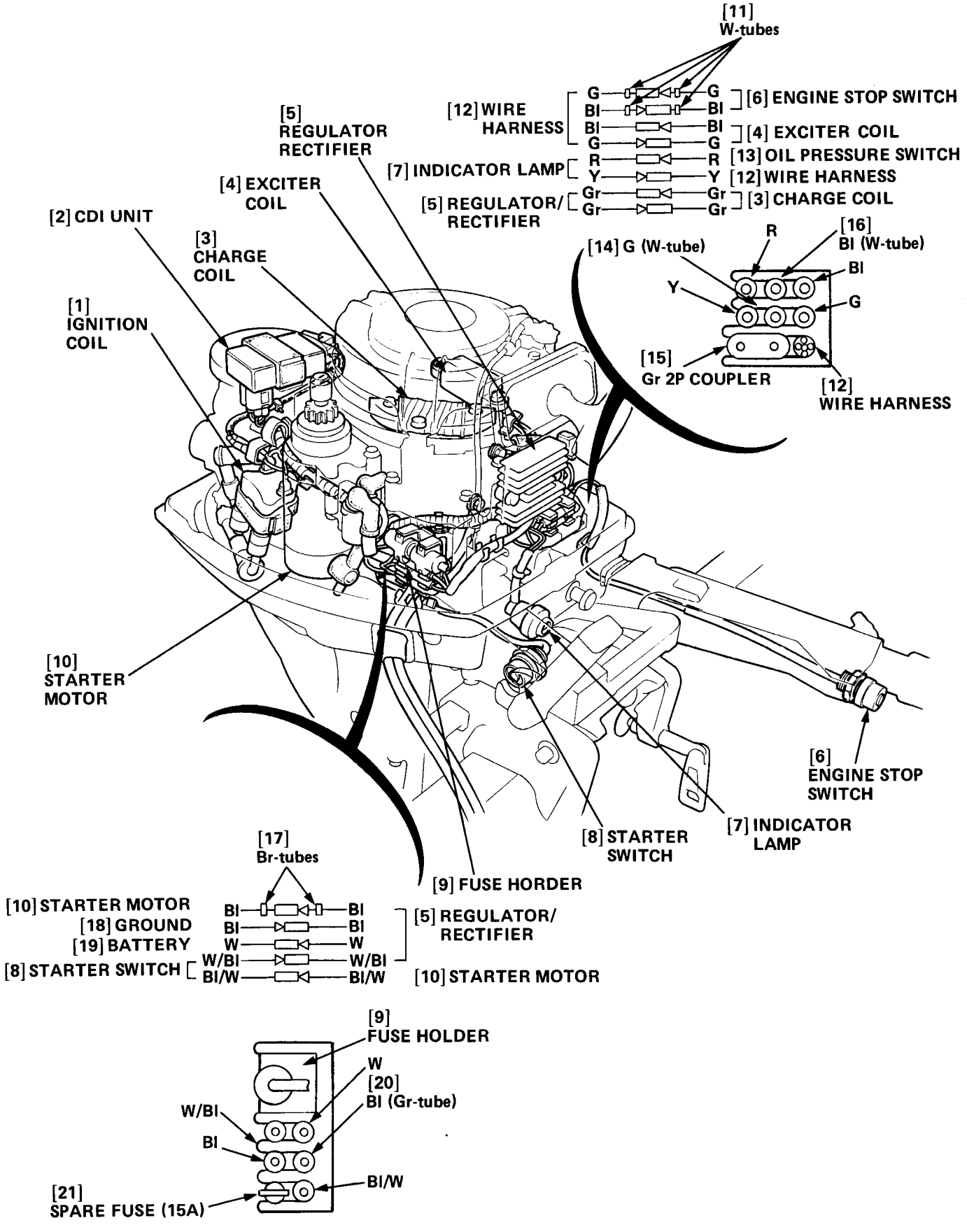
SCS, SDS, LCS, LDS Type

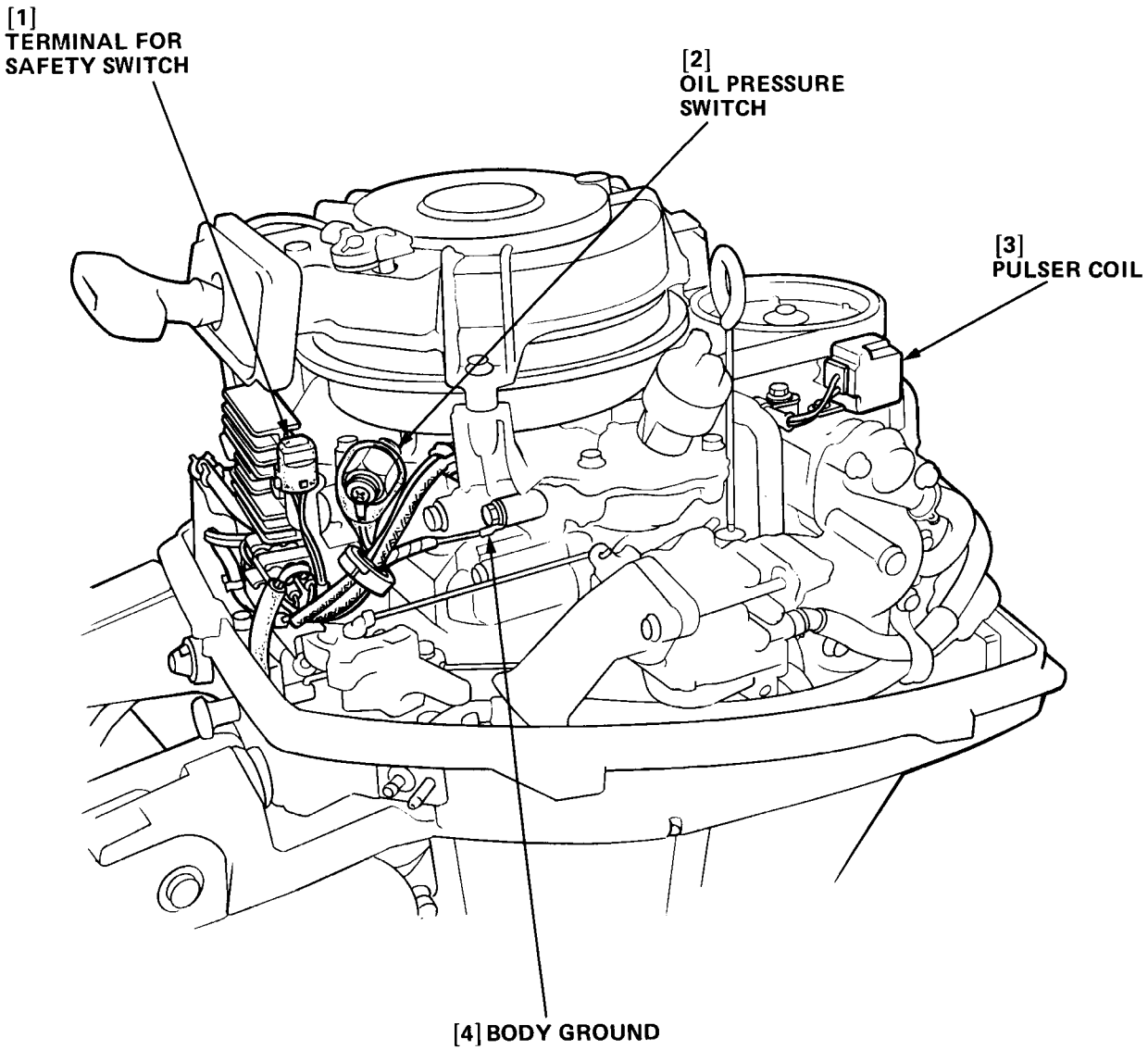




Bl	BLACK	Br	BROWN
Y	YELLOW	O	ORANGE
Bu	BLUE	Lb	LIGHT BLUE
G	GREEN	Lg	LIGHT GREEN
R	RED	P	PINK
W	WHITE	Gr	GRAY

[26] OPTIONAL PART


[11]
W-tubes
[12] WIRE HARNESS
G
Bl
Bl
G
G
Bl
Bl
G
[6] ENGINE STOP SWITCH
[4] EXCITER COIL
[13] OIL PRESSURE SWITCH
[12] WIRE HARNESS
[3] CHARGE COIL
[7] INDICATOR LAMP
R
Y
Gr
Gr
R
Y
Gr
Gr
[5] REGULATOR/ RECTIFIER
[5] REGULATOR RECTIFIER
[4] EXCITER COIL
[2] CDI UNIT
[3] CHARGE COIL
[1] IGNITION COIL
[14] G (W-tube)
[16] Bl (W-tube)
R
Bl
Y
G
[15] Gr 2P COUPLER
[12] WIRE HARNESS
[10] STARTER MOTOR
[6] ENGINE STOP SWITCH
[8] STARTER SWITCH
[7] INDICATOR LAMP
[9] FUSE HORDER
[17] Br-tubes
[10] STARTER MOTOR
[18] GROUND
[19] BATTERY
[8] STARTER SWITCH
Bl
Bl
W
W/Bl
Bl/W
Bl
Bl
W
W/Bl
Bl/W
[5] REGULATOR/ RECTIFIER
[10] STARTER MOTOR
[9] FUSE HOLDER
W
[20] Bl (Gr-tube)
W/Bl
Bl
Bl/W
[21] SPARE FUSE (15A)


[1]
TERMINAL FOR
SAFETY SWITCH
[2]
OIL PRESSURE
SWITCH
[3]
PULSER COIL
[4] BODY GROUND

SERVICE INFORMATION

GENERAL SAFETY

Pay attention to these symbols and their meanings:

WARNING **Indicates a strong possibility of severe personal injury or death if instructions are not followed.**

CAUTION: Indicates a possibility of personal injury or equipment damage if instructions are not followed.

WARNING

- **Stop the engine, and remove the spark plug caps before servicing the outboard motor.**
- **If the engine must be running to do some work, make sure the area is well ventilated. Never run the engine in a closed area; the exhaust contains poisonous carbon monoxide gas.**
- **Gasoline is extremely flammable and is explosive under certain conditions. Do not smoke or allow flames or sparks in your working area.**

CAUTION: Keep away from rotating or hot parts and high voltage wires when the engine is running.

SERVICE RULES

1. Use genuine Honda or Honda-recommended parts and lubricants or their equivalents. Parts that do not meet Honda's design specifications may damage the unit.
2. Use the special tools designed for the product.
3. Install new gaskets, O-rings, etc. when reassembling.
4. When torquing a series of bolts or nuts, begin with larger-diameter or inner bolts first and tighten to the specified torque diagonally, unless a particular sequence is specified.
5. Clean parts in cleaning solvent upon disassembly. Lubricate any sliding surfaces before reassembly.
6. After reassembly, check all parts for proper installation and operation.
7. Many screws used in this machine are self-tapping. Be aware that cross-threading or overightening these screws will strip the female threads and ruin the hole.
8. Use only metric tools when servicing this unit. Metric bolts, nuts and screws are not interchangeable with nonmetric fasteners. The use of incorrect tools and fasteners may damage the unit.
9. Follow the instructions represented by these symbols when they are used:

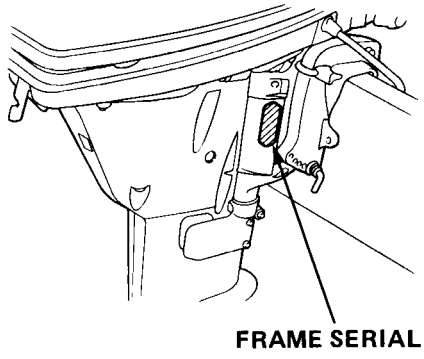
P — Indicates the reference page

0 x 0 (O): Indicates the type, length, and number of the flange bolt used.

OIL : Apply grease S TOOL : Use special tool GREASE : Apply oil

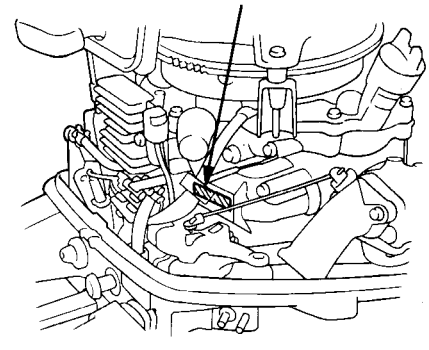
SERIAL NUMBER LOCATION

The frame serial number is stamped on the side of the swivel case while the engine serial number is on the cylinder barrel. Refer to these numbers when ordering parts or making technical inquiries.



FRAME SERIAL NUMBER

ENGINE SERIAL NUMBER



MAINTENANCE STANDARDS

BF9.9A

ENGINE

Part	Item	Standard	Service limit
Engine	Idle rpm	1,100 ± 50 min^{-1} (rpm) (in neutral)	————
	Cylinder compression	11 ± 1 kg/cm^2 (156 ± 14 psi) at 1,000 min^{-1} (rpm)	————
Cylinder	Sleeve I.D.	58.0 mm (2.28 in)	58.055 mm (2.2856 in)
Piston	Skirt O.D.	57.985 mm (2.2829 in)	57.92 mm (2.280 in)
	Piston-to-cylinder clearance	0.015–0.050 mm (0.0006–0.0020 in)	0.1 mm (0.0039 in)
	Piston pin bore I.D.	14.002 mm (0.5513 in)	14.02 mm (0.552 in)
	Piston pin O.D.	14.0 mm (0.55 in)	13.97 mm (0.550 in)
	Pin-to-pin bore clearance	0.002–0.014 mm (0.00007–0.00055 in)	0.04 mm (0.002 in)
Piston ring	Ring side clearance (top/second)	0.025–0.055 mm (0.00098–0.00217 in)	0.1 mm (0.0039 in)
	(oil)	0.055–0.140 mm (0.00217–0.00551 in)	0.2 mm (0.0079 in)
	Ring end gap (top)	0.15–0.30 mm (0.0059–0.0118 in)	0.5 mm (0.0197 in)
	(second)	0.35–0.50 mm (0.0138–0.0197 in)	0.7 mm (0.0276 in)
	(oil)	0.2–0.8 mm (0.0079–0.0315 in)	1.0 mm (0.039 in)
	Ring width (top/second)	1.2 mm (0.047 in)	1.08 mm (0.043 in)
Connecting rod	Small end I.D.	14.005 mm (0.5514 in)	14.04 mm (0.5528 in)
	Big end oil clearance	0.040–0.066 mm (0.0016–0.0026 in)	0.08 mm (0.0031 in)
	Big end side clearance	0.15–0.35 mm (0.0059–0.0138 in)	0.7 mm (0.0276 in)
Crankshaft	Crankpin O.D.	29.98 mm (1.180 in)	29.95 mm (1.179 in)
	Main journal O.D.	33.0 mm (1.299 in)	32.98 mm (1.298 in)
	Side clearance	0.10–0.30 mm (0.0039–0.0118 in)	0.6 mm (0.0236 in)
	Oil clearance	0.021–0.040 mm (0.0008–0.0016 in)	0.05 mm (0.0020 in)
Valves	Valve clearance IN.	0.12 ± 0.02 mm (0.005 ± 0.001 in)	————
	EX.	0.20 ± 0.02 mm (0.008 ± 0.001 in)	————
	Stem O.D. IN.	5.49 mm (0.2161 in)	5.47 mm (0.2153 in)
	EX.	5.47 mm (0.2153 in)	5.45 mm (0.2145 in)
	Guide I.D. IN.	5.5 mm (0.2165 in)	5.54 mm (0.2181 in)
	EX.	5.5 mm (0.2165 in)	5.57 mm (0.2192 in)
	Stem-to-guide clearance IN.	0.010–0.037 mm (0.00039–0.00145 in)	0.07 mm (0.00275 in)
	EX.	0.030–0.057 mm (0.00118–0.00224 in)	0.12 mm (0.00472 in)
	Seat width	1.0 mm (0.04 in)	2.0 mm (0.078 in)
	Spring free length	36.8 mm (1.45 in)	35.3 mm (1.39 in)
Rocker arm	Rocker arm I.D.	13.0 mm (0.5118 in)	13.04 mm (0.5133 in)
	Rocker arm shaft O.D.	12.968 mm (0.5106 in)	12.92 mm (0.5087 in)
Camshaft	Cam lobe height IN.	23.89 mm (0.9405 in)	23.64 mm (0.9307 in)
	EX.	23.94 mm (0.9425 in)	23.69 mm (0.9326 in)
	Journal O.D. Oil pump side	15.984 mm (0.6292 in)	15.95 mm (0.6279 in)
	Pulley side	17.984 mm (0.7080 in)	17.95 mm (0.7066 in)
Carburetor	Main jet	#102	————
	Float height	13.0–15.0 mm (0.51–0.59 in)	————
	Pilot screw opening	2-3/4 turns out	————
Spark plug	Gap	0.6–0.7 mm (0.024–0.028 in)	————
Ignition coil	Resistance Primary	0.35–0.43 Ω	————
	Secondary	8.01–9.79 Ω	————

FRAME

Part	Item	Standard	Service limit
Pulser coil	Resistance	351–429 Ω	———
Exciter coil	Resistance	207–253 Ω	———
Oil pump	Body I.D.	29.10 mm (1.146 in)	29.30 mm (1.154 in)
	Inner rotor-to-outer rotor clearance	0.15 mm (0.0059 in)	0.20 mm (0.0079 in)
	Outer rotor-to-body clearance	0.10–0.21 mm (0.0039–0.0083 in)	0.26 mm (0.0102 in)
	Outer rotor height	13.0 mm (0.51 in)	12.95 mm (0.509 in)
	Pump body depth	13.02 mm (0.513 in)	13.08 mm (0.515 in)
	Rotor-to-body side clearance	0.02–0.09 mm (0.00079–0.00354 in)	0.11 mm (0.0043 in)
Pinion shaft	Shaft O.D.	14.994 mm (0.5903 in)	14.96 mm (0.5890 in)
Propeller shaft	Shaft O.D. (at bevel gear) Front	16.984 mm (0.66866 in)	16.95 mm (0.66732 in)
Bevel gear	Gear I.D. Front	17.000 mm (0.66929 in)	17.04 mm (0.67086 in)

BF15A
ENGINE

Part	Item	Standard	Service limit
Engine	Idle rpm	1,100 ± 50 min^{-1} (rpm) (in neutral)	———
	Cylinder compression	11 ± 1 kg/cm^2 (156 ± 14 psi) at 1,000 min^{-1} (rpm)	———
Cylinder	Sleeve I.D.	58.0 mm (2.28 in)	58.055 mm (2.2856 in)
Piston	Skirt O.D.	57.985 mm (2.2829 in)	57.92 mm (2.280 in)
	Piston-to-cylinder clearance	0.015–0.050 mm (0.0006–0.0020 in)	0.1 mm (0.0039 in)
	Piston pin bore I.D.	14.002 mm (0.5513 in)	14.02 mm (0.552 in)
	Piston pin O.D.	14.0 mm (0.55 in)	13.97 mm (0.550 in)
	Pin-to-pin bore clearance	0.002–0.014 mm (0.00007–0.00055 in)	0.04 mm (0.002 in)
Piston ring	Ring side clearance (top/second)	0.025–0.055 mm (0.00098–0.00217 in)	0.1 mm (0.0039 in)
	Ring side clearance (oil)	0.055–0.140 mm (0.00217–0.00551 in)	0.2 mm (0.0079 in)
	Ring end gap (top)	0.15–0.30 mm (0.0059–0.0118 in)	0.5 mm (0.0197 in)
	Ring end gap (second)	0.35–0.50 mm (0.0138–0.0197 in)	0.7 mm (0.0276 in)
	Ring end gap (oil)	0.2–0.8 mm (0.0079–0.0315 in)	1.0 mm (0.039 in)
	Ring width (top/second)	1.2 mm (0.047 in)	1.08 mm (0.043 in)
Connecting rod	Small end I.D.	14.005 mm (0.5514 in)	14.04 mm (0.5528 in)
	Big end oil clearance	0.040–0.066 mm (0.0016–0.0026 in)	0.08 mm (0.0031 in)
	Big end side clearance	0.15–0.35 mm (0.0059–0.0138 in)	0.7 mm (0.0276 in)
Crankshaft	Crankpin O.D.	29.98 mm (1.180 in)	29.95 mm (1.179 in)
	Main journal O.D.	33.0 mm (1.299 in)	32.98 mm (1.298 in)
	Side clearance	0.10–0.30 mm (0.0039–0.0118 in)	0.6 mm (0.0236 in)
	Oil clearance	0.021–0.040 mm (0.0008–0.0016 in)	0.05 mm (0.0020 in)
Valves	Valve clearance IN.	0.12 ± 0.02 mm (0.005 ± 0.001 in)	———
	Valve clearance EX.	0.20 ± 0.02 mm (0.008 ± 0.001 in)	———
	Stem O.D. IN.	5.49 mm (0.2161 in)	5.47 mm (0.2153 in)
	Stem O.D. EX.	5.47 mm (0.2153 in)	5.45 mm (0.2145 in)
	Guide I.D. IN.	5.5 mm (0.2165 in)	5.54 mm (0.2181 in)
	Guide I.D. EX.	5.5 mm (0.2165 in)	5.57 mm (0.2192 in)
	Stem-to-guide clearance IN.	0.010–0.037 mm (0.00039–0.00145 in)	0.07 mm (0.00275 in)
	Stem-to-guide clearance EX.	0.030–0.057 mm (0.00118–0.00224 in)	0.12 mm (0.00472 in)
	Seat width	1.0 mm (0.04 in)	2.0 mm (0.078 in)
	Spring free length	36.8 mm (1.45 in)	35.3 mm (1.39 in)
Rocker arm	Rocker arm I.D.	13.0 mm (0.5118 in)	13.04 mm (0.5133 in)
	Rocker arm shaft O.D.	12.968 mm (0.5106 in)	12.92 mm (0.5087 in)
Camshaft	Cam lobe height IN.	24.47 mm (0.9634 in)	24.22 mm (0.9535 in)
	Cam lobe height EX.	24.52 mm (0.9654 in)	24.27 mm (0.9555 in)
	Journal O.D. Oil pump side	15.984 mm (0.6292 in)	15.95 mm (0.6279 in)
	Journal O.D. Pulley side	17.984 mm (0.7080 in)	17.95 mm (0.7066 in)
Carburetor	Main jet	#108	———
	Float height	13.0–15.0 mm (0.51–0.59 in)	———
	Pilot screw opening	1-5/8 turns out	———
Spark plug	Gap	0.6–0.7 mm (0.024–0.028 in)	———
Ignition coil	Resistance Primary	0.35–0.43 Ω	———
	Resistance Secondary	8.01–9.79 Ω	———

FRAME

Part	Item	Standard	Service limit
Pulser coil	Resistance	351–429 Ω	———
Exciter coil	Resistance	207–253 Ω	———
Oil pump	Body I.D.	29.10 mm (1.146 in)	29.30 mm (1.154 in)
	Inner rotor-to-outer rotor clearance	0.15 mm (0.0059 in)	0.20 mm (0.0079 in)
	Outer rotor-to-body clearance	0.10–0.21 mm (0.0039–0.0083 in)	0.26 mm (0.0102 in)
	Outer rotor height	13.0 mm (0.51 in)	12.95 mm (0.509 in)
	Pump body depth	13.02 mm (0.513 in)	13.08 mm (0.515 in)
	Rotor-to-body side clearance	0.02–0.09 mm (0.00079–0.00354 in)	0.11 mm (0.0043 in)
Pinion shaft	Shaft O.D.	14.994 mm (0.5903 in)	14.96 mm (0.5890 in)
Propeller shaft	Shaft O.D. (at bevel gear) Front	16.984 mm (0.66866 in)	16.95 mm (0.66732 in)
Bevel gear	Gear I.D. Front	17.000 mm (0.66929 in)	17.04 mm (0.67086 in)

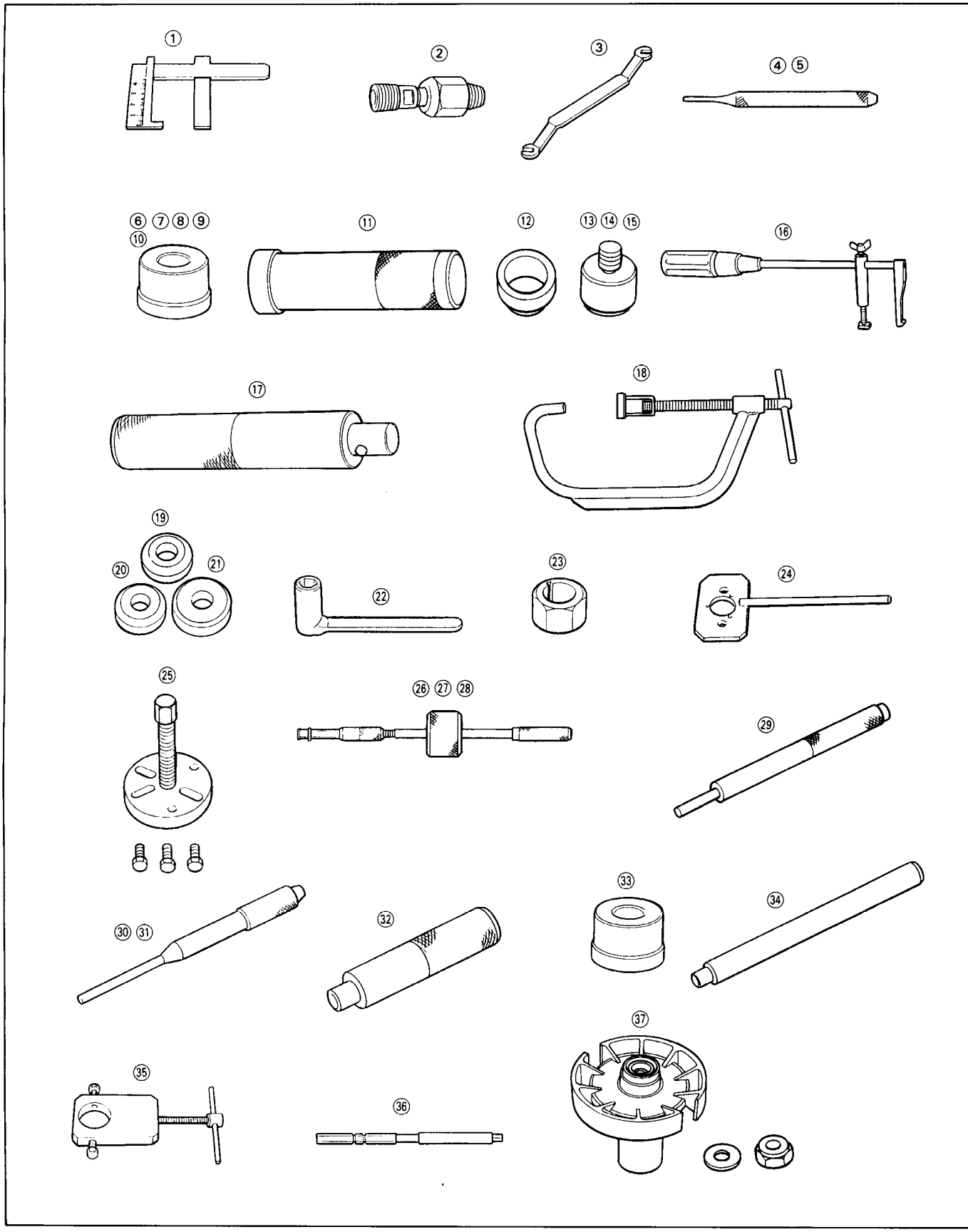
TORQUE VALUES

Item	Thread dia. (mm)	Torque		
		N·m	kg-cm	ft-lb
• **ENGINE**				
Flywheel	M16 x 1.5 (Special nut)	115	1,150	83.2
Timing pulley	M27 x 1.0	27.5	275	19.9
Connecting rod	M7 x 1.0 (Special bolt)	12	120	8.7
Cylinder head	M8 x 1.25	26	260	18.8
Cylinder barrel	M6 x 1.0	11	110	8.0
	M8 x 1.25	22	220	15.9
Oil pressure switch	PT1/8	8.5	85	6.1
Oil pressure switch lead	M4 x 0.7	1.5	15	1.1
Tappet adjusting nut	M5 x 0.5	8	80	5.2
Fuel pump	M6 x 1.0	5	50	3.6
Pulser coil	M5 x 0.8	3.5	35	2.5
Starting switch terminal nut	M6 x 1.0	5	50	3.6
• **FRAME**				
Starter switch	M16 x 1.0	1	10	0.7
Engine stop switch	M16 x 1.0	1	10	0.7
Pinion gear	M8 x 1.0 (Special nut)	26	260	18.8
Steering handle	M8 x 1.25 (Handle pivot screw)	24	240	17.4
Choke guide knob	M16 x 1.0	3	30	2.2
Fuel meter	M5 x 0.8	3.5	35	2.5
Oil check bolt	M8 x 1.25 (Special bolt)	6.5	65	4.7
Standard torque values	5 mm screw, bolt, nut	5	50	3.6
	6 mm screw	9	90	6.5
	6 mm bolt, nut	10	100	7.2
	6 mm flange bolt, nut	11	110	8.0
	8 mm bolt, nut	21	210	15.2
	8 mm flange bolt, nut	22	220	15.9
	10 mm bolt, nut	35	350	25.3
	10 mm flange bolt, nut	40	400	28.9

NOTE: Use standard torque values for fasteners that are not listed in this table.

SPECIAL TOOLS

Tool name	Tool number	Application
1. Float level gauge	07401–0010000	Inspection for carburetor float level
2. Pressure gauge attachment	07406–0030000	Inspection for oil pressure
3. Valve adjusting wrench or	07908–KE90000	Valve adjuster
Adjusting wrench B	07708–0030400	Valve adjuster
4. Pin driver, 2.5 mm	07744–0010100	2.5 mm spring pin removal/installation
5. Pin driver, 3 mm	07744–0010200	3 mm spring pin removal/installation
6. Attachment, 32 x 35 mm	07746–0010100	17 mm water seal installation
7. Attachment, 37 x 40 mm	07746–0010200	25 x 40 x 8 mm coupling seal installation
8. Attachment, 42 x 47 mm	07746–0010300	6005 ball bearing installation
9. Attachment, 52 x 55 mm	07746–0010400	6205 ball bearing installation
10. Attachment, 24 x 26 mm	07746–0010700	17 x 23 x 12 mm needle bearing installation
11. Driver, 40 mm I.D.	07746–0030100	For tool number 6–10
12. Attachment, 35 mm I.D.	07746–0030400	Balancer drive gear installation
13. Pilot, 15 mm	07746–0040300	6302 ball bearing installation
14. Pilot, 17 mm	07746–0040400	17 x 23 x 12 mm needle bearing installation
15. Pilot, 25 mm	07746–0040600	6205, 6005 ball bearing installation
16. Seal remover	07748–0010000	Water seal and coupling seal removal
17. Driver	07749–0010000	For tools number 6–9
18. Valve spring compressor	07757–0010000	Valve cotter removal/installation
19. Valve seat cutter 60°ϕ26.0	07780–0014500	Valve seat refacing IN.
Valve seat cutter 60°ϕ22.0	07780–0014202	Valve seat refacing EX.
20. Valve seat cutter 45°ϕ29.0	07780–0010300	Valve seat refacing IN.
Valve seat cutter 45°ϕ24.5	07780–0010100	Valve seat refacing EX.
21. Valve seat cutter 32°ϕ30.0	07780–0012200	Valve seat refacing IN.
Valve seat cutter 32°ϕ25.0	07780–0012000	Valve seat refacing EX.
22. Adjusting wrench	07908–3570000	Hold for 8 mm self-locking nut of pinion shaft
23. Crankshaft holder	07923–ZA00000	27 mm lock nut removal/installation
24. Pully holder	07925–8930000	Flywheel nut removal/installation
25. Flywheel puller	07935–8050002 or 07935–8050003	Flywheel removal/installation
26. Bearing remover, 12 mm	07936–1660001	6001 ball bearing removal
27. Bearing remover, 15 mm	07936–9350001	6302 ball bearing removal
28. Bearing remover, 25 mm	07936–ZV10000	6105, 6005 ball bearing removal
29. Valve guide driver	07942–8920000	Valve guide removal/installation
30. Pin driver, 2 mm	07944–9350100	2 mm spring pin removal/installation
31. Pin driver, 4 mm	07944–9350200	3 mm spring pin removal/installation
32. Bearing driver	07945–GG00000	17 x 23 x 12 mm needle bearing removal
33. Attachment, 28 x 30 mm	07946–1870100	6001 ball bearing installation
34. Bearing remover	07946–MJ00100	15 x 21 x 12 mm needle bearing removal/installation
35. Pin flare tool, 4 mm	07968–9350000	Shifter pin of propeller shaft removal/installation
36. Valve guide reamer	07984–2000001	Valve guide I.D. reaming
37. Test propeller	07HPZ–ZV40100	For test operation in water tank (BF15A)
	07HPZ–ZV60100	For test operation in water tank (BF9.9A)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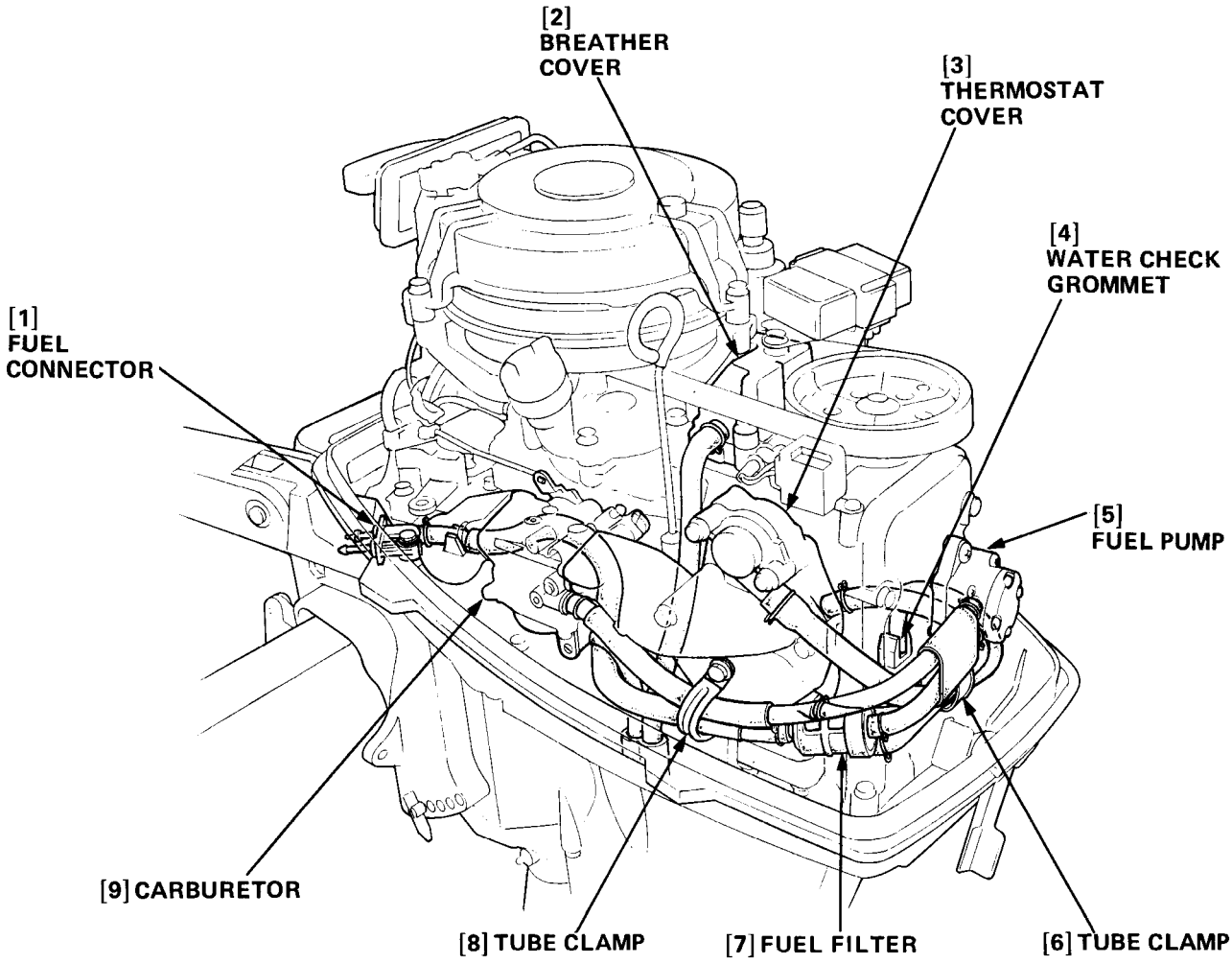
TUBE ROUTING



TROUBLESHOOTING

ENGINE

a. HARD STARTING

Check the fuel level in the fuel tank.
- No fuel in the tank → • Add fuel and restart the engine.
- Fuel OK →

Remove the carburetor drain screw to see if there is fuel in the float bowl.
- Fuel flow restricted → • Check for collapsed or prinched fuel line. • Check for clogged fuel tank breather hole: Close the tank vent knob, shake the tank, and open the vent knob, listen for hiss. • Check for air leaks past the primer bulb. • Squeeze the primer bulb and be sure that the fuel is reaching the carburetor. • Check for clogged fuel filter and connector. • Check fuel connectors.
- Fuel flows freely. →

Remove the spark plug and check for wet fouled electrod.
- Dry → • Fuel pump faulty • Check for clogged carburetor port/nozzle.
- Wet with fuel → • Clean and reinstall the plug, then restart the engine. • If excessively wet, check the carburetor for flooding.

Attach the plug cap and ground the electrode.
Pull the recoil starter and check for sparks (P.2-12).
CAUTION: Do not check near the plug hole.
- No or weak spark → • Ignition system faulty (P.2-12).
- Good spark →

Attach the compression gauge to the plug hole.
Turn the starter switch on or pull the recoil starter and check for cylinder compression.
- Low compression → • Check for valve clearance. • Check for loose cylinder head. • Check for damaged cylinder head gasket, valve, or valve seat. • Check for worn piston ring, piston, or cylinder.
- Compression OK →

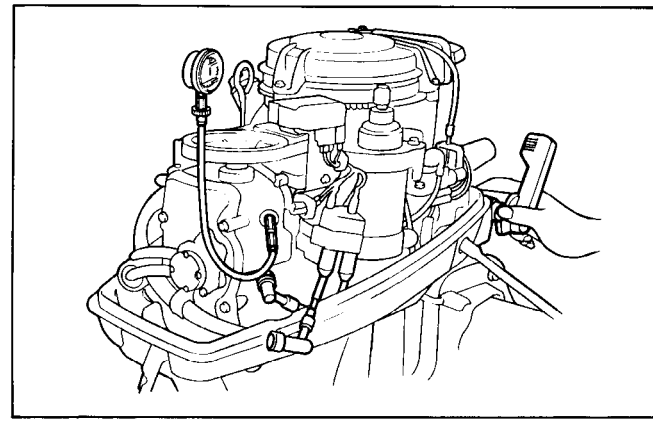
Reinstall the spark plug and restart the engine.

• CYLINDER COMPRESSION

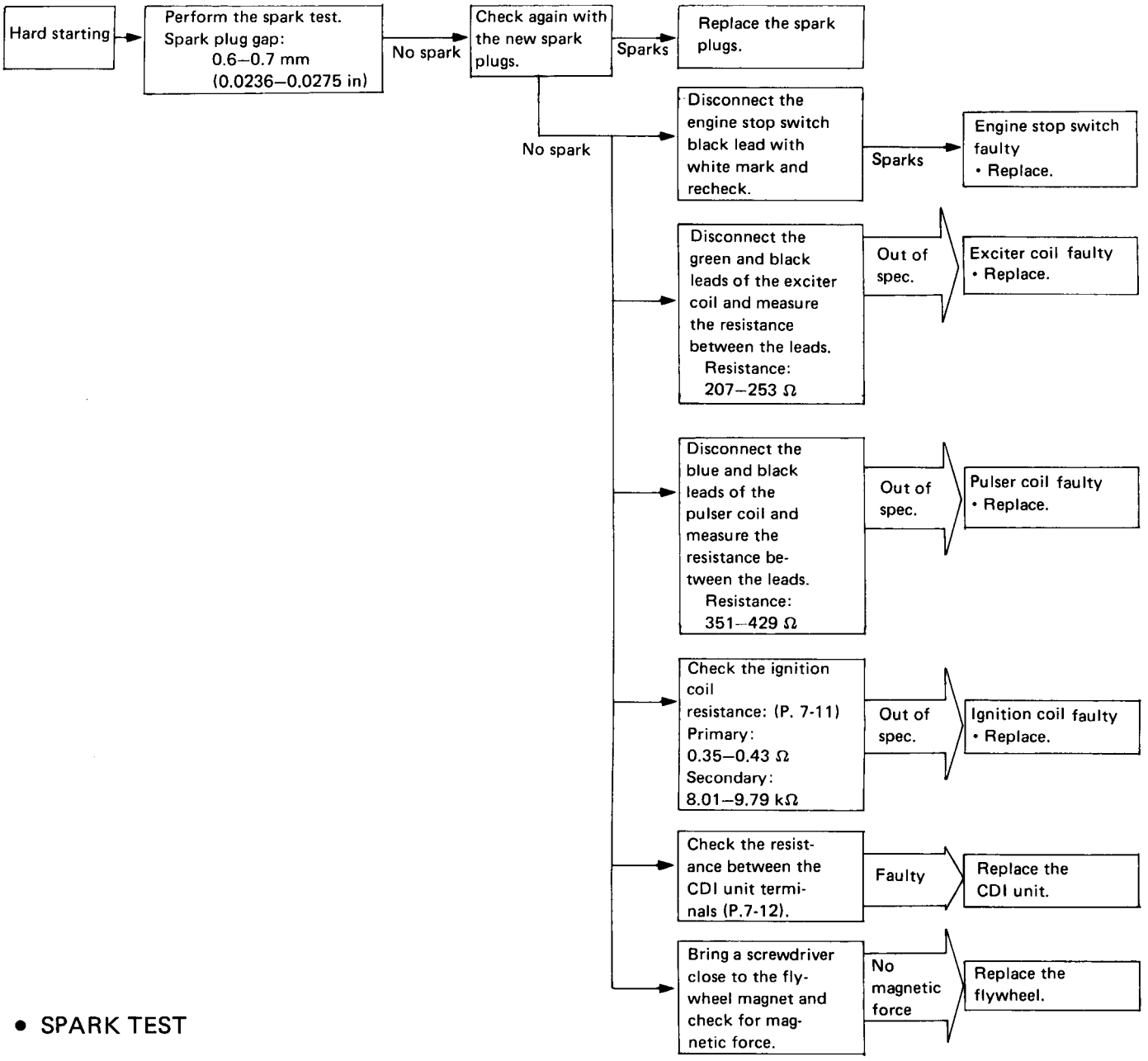
1) Remove the spark plugs.
2) Install a compression gauge in one of the spark plug holes.
3) Operate the starter motor (or pull the recoil starter) until the highest reading is obtained.
4) Install the compression gauge in the other spark plug hole and repeat the step 3).

Cylinder compression	11 ± 1 kg/cm^2 (156 ± 14 psi) at 1,000 min^{-1} (rpm)

5) Check the compression on both cylinders.

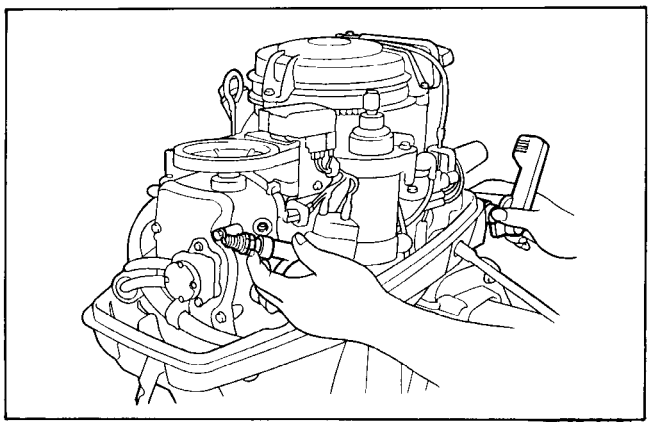


b. IGNITION SYSTEM



• SPARK TEST

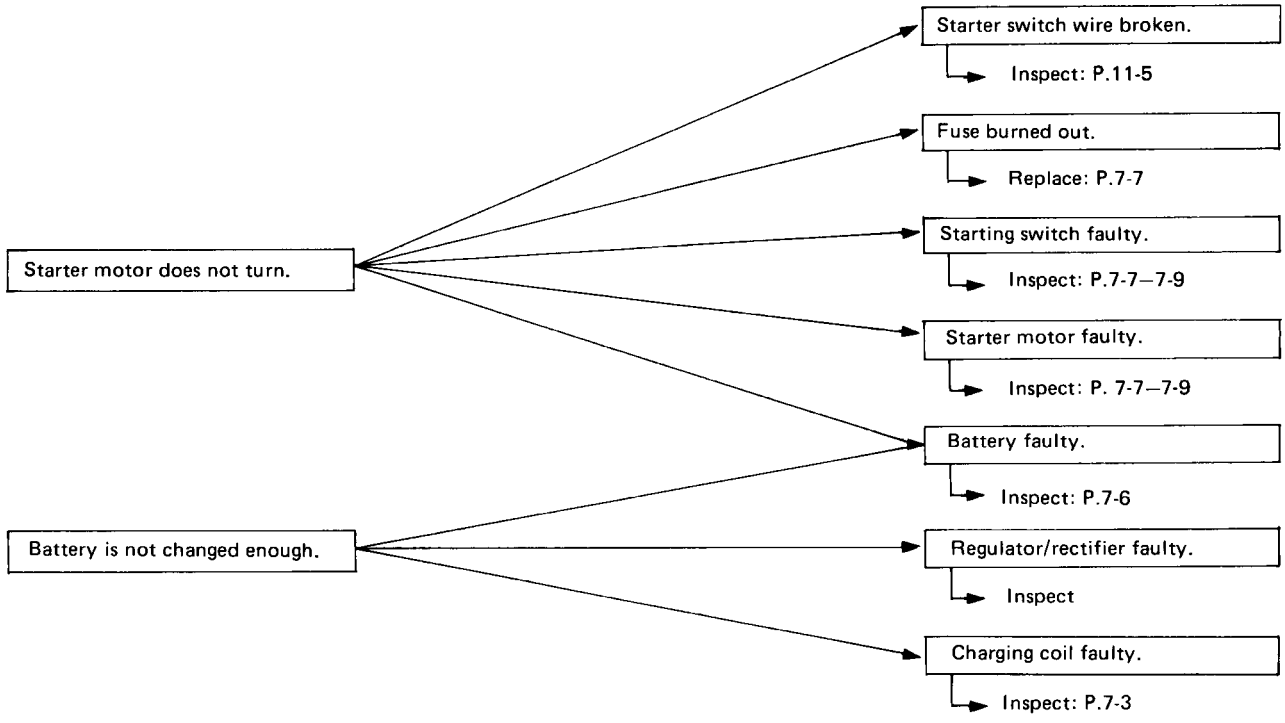
1) Remove one spark plug cap and spark plug.
2) Attach the removed plug to the plug cap and ground the negative (–) terminal of the plug (threads) to the cylinder head cover bolt.
3) Turn the starter switch on (or pull the recoil starter) and check to see if sparks jump across the electrodes.
4) Repeat steps 1) through 3) for another spark plug test.



WARNING

- **Never hold the spark plug wire with wet hands while performing this test.**
- **Make sure that no fuel is spilled on the engine and that the plug is not wet with fuel.**
- **To avoid fire hazards, do not allow sparks near the plug hole.**

STARTER MOTOR (SCS, SDS, LCS, LDS Type only)

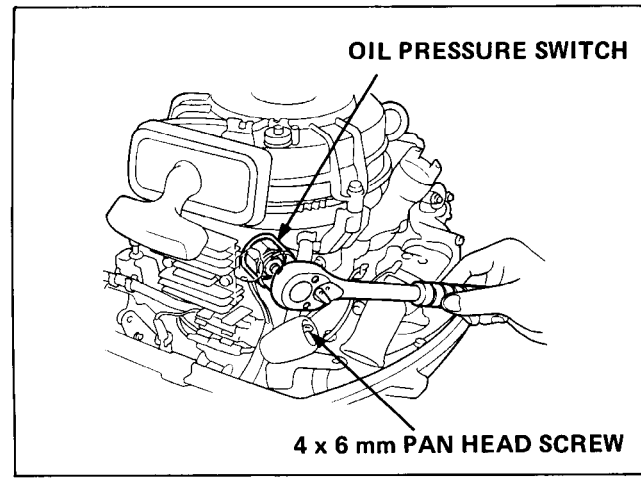


c. POOR REFORMANCE

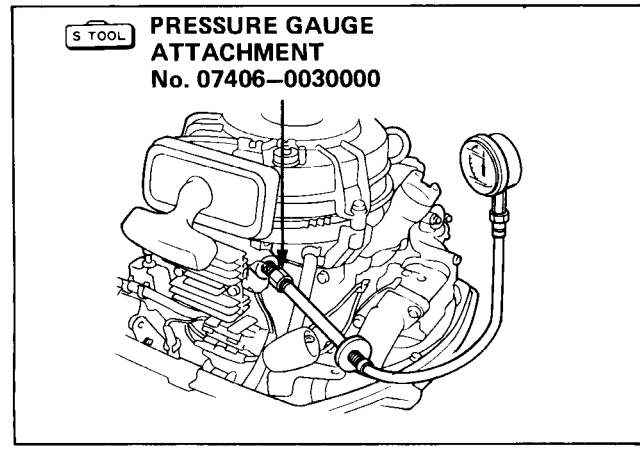
Engine starts but soon stops.	• Wet fouled spark plugs due to improper choke operation. • Spark plug faulty (P.3-3). • Flooded carburetor. • Improperly adjusted carburetor pilot screw and/or throttle stop screw (P.3-4). • Leaking carburetor insulator gasket. • Fuel tank not venting.
Engine speed does not increase.	• Spark plugs fouled or wet (P.3-3). • Choke stuck closed. • Improper valve timing. • Water in carburetor. • Overheating. • Defective valves or valve seats.
Engine speed does not decrease.	• Binding of the throttle cable. • Throttle valve faulty.
Hunting while operating at high speed.	• Engine overheat due to improper propeller installed on the outboard motor. • Outboard motor improperly installed (transom height or tilt angle incorrect). • Propeller excessively worn. • Propeller damper rubber slipping.
Overheating	• Engine oil insufficient (P.3-2). • Oil pump faulty. • Water tube clogged or faulty. • Water pump faulty. • Thermostat faulty. • Water intake port clogged.

• OIL PRESSURE TEST

1) Check the engine oil level (P.3-2).
2) Remove the 4 x 6 mm pan head screw and oil pressure switch.



3) Install the pressure gauge attachment (special tool) on the oil pressure gauge that has a scale calibrated to a maximum of 1–2 kg/cm² (14.2–28.4 psi) scale and on the outboard motor.



CAUTION

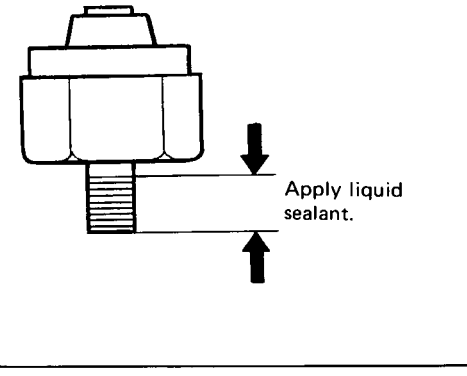
- **Tighten the gauge attachment to 8.5 N·m (85 kg-cm, 6.1 ft-lb).**
- **Overtightening will damage the threads.**

4) Remove the propeller and set the outboard motor in a water tank or apply water to the outboard motor with the rinsing plug, and start the engine.
5) Measure the oil pressure when its temperature reaches 80°C (216.0°F).

Oil pressure [Engine speed 1,100 ± 50 min^{-1} (rpm) in neutral]	0.6 kg/cm² (8.54 psi) min.

6) If the oil pressure is less than the specification, check the oil pump rotors and body for wear.
7) Clean the oil pressure switch threads and apply liquid sealant (THREE BOND 1215 or equivalent) to the threads. Tighten the oil pressure switch to the specified torque.

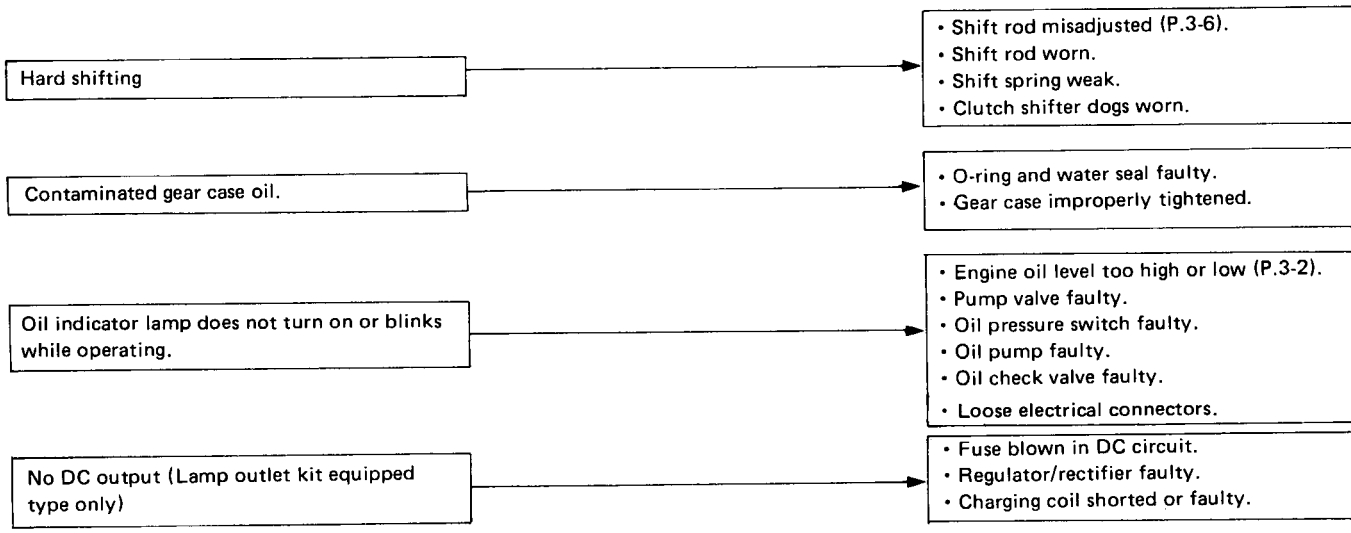
TORQUE: 8.5 N·m (85 kg-cm, 6.1 ft-lb)



CAUTION

- **Be sure to use a torque wrench to tighten the switch.**
- **Overtightening will damage the starter case.**

d. FRAME


Hard shifting
• Shift rod misadjusted (P.3-6).
• Shift rod worn.
• Shift spring weak.
• Clutch shifter dogs worn.
Contaminated gear case oil.
• O-ring and water seal faulty.
• Gear case improperly tightened.
Oil indicator lamp does not turn on or blinks while operating.
• Engine oil level too high or low (P.3-2).
• Pump valve faulty.
• Oil pressure switch faulty.
• Oil pump faulty.
• Oil check valve faulty.
• Loose electrical connectors.
No DC output (Lamp outlet kit equipped type only)
• Fuse blown in DC circuit.
• Regulator/rectifier faulty.
• Charging coil shorted or faulty.

MAINTENANCE SCHEDULE

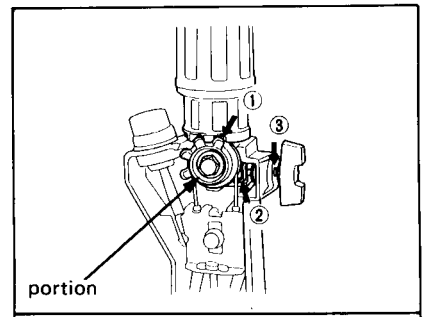
REGULAR SERVICE PERIOD Perform at every indicated month or operating hour intervals, whichever comes first. ITEM		EACH USE	FIRST MONTH OR 20 HRS (2)	EVERY 6 MONTHS OR 100 HRS (2)	EVERY YEAR OR 200 HRS (2)
Engine oil	Check level	○			
	Change		○	○	
Gear case oil	Check level	○			
	Change		○		○
	Check for water contamination			○	
Starter rope				○	
Carburetor linkage	Check		○	○	
Valve clearance	Check-Readjust		○		○
Spark plugs	Clean-Readjust			○	
Propeller (cotter pin)	Check			○	
Lubrication	Grease			○ (1)	
Fuel tank	Clean				○
Fuel filter	Replace				○
Thermostat	Check				○
Fuel line	Check (Replace if necessary)	Every 3 years			

NOTE: (1) Lubricate more frequently when used in salt water.

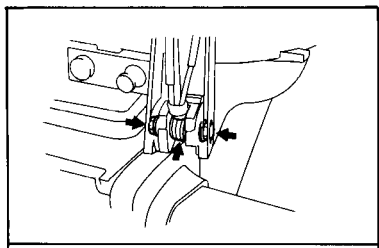
(2) For professional commercial use, log hours of operation to determine proper maintenance intervals.

LUBRICATION

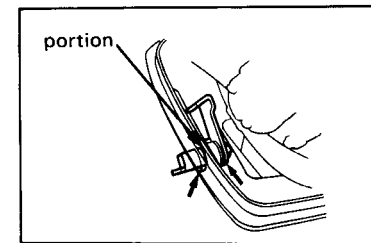
Wipe the outside of the engine with a cloth dipped in oil.
Apply marine anticorrosion grease to the following parts:



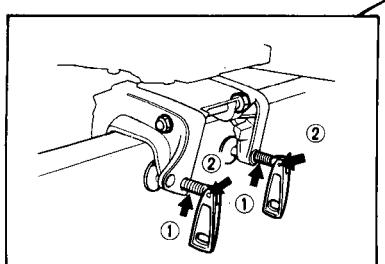
① GRIP PIPE AND CABLE REEL
② THROTTLE FRICTION BLOCK
③ FRICTION BOLT



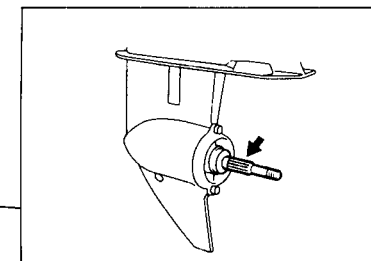
HANDLEBAR PIVOT SCREW



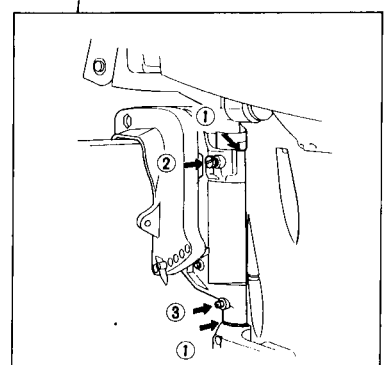
COVER LOCK LEVER



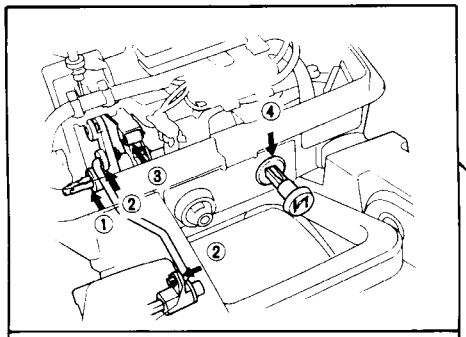
① CLAMP SCREW
② CLAMP GRIP



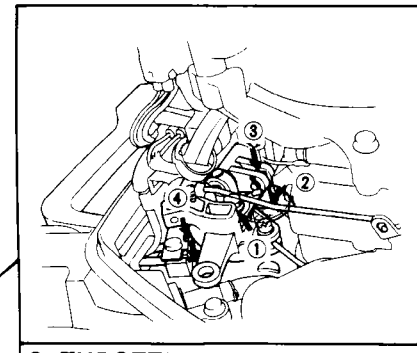
PROPELLER SHAFT



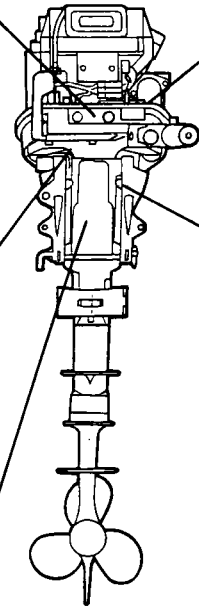
① SWIVEL CASE
② STEERING FRICTION BOLT
③ SWIVEL CASE INSIDE

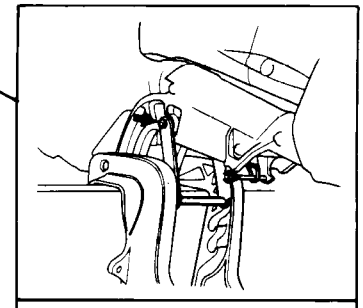


① SHIFT LINK A AND SHIFT SHAFT
② SHIFT LINK A, B AND LINK ROD
③ SHIFT LINK A AND CLIP SPRING
④ CHOKE KNOB

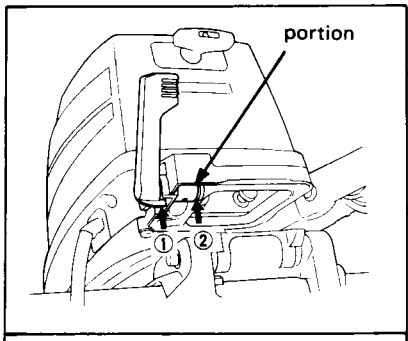


① THROTTLE LEVER
② SHIFT ROD A AND GROMMET
③ SHIFT ARM
④ THROTTLE CABLE

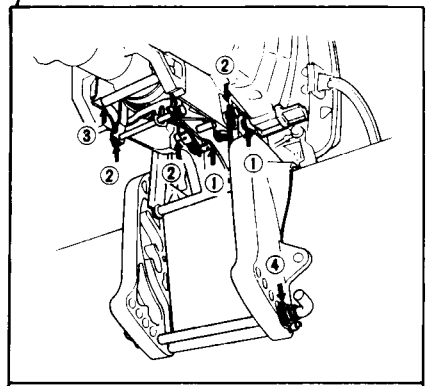




TILT ARM, TILT SHAFT



① SHIFT LEVER SHAFT
② SHAFT BUSHING



① TILT LEVER SHAFT
② TILT ARM SHAFT
③ REVERSE LOCK SHAFT A, B
④ ADJUSTING ROD

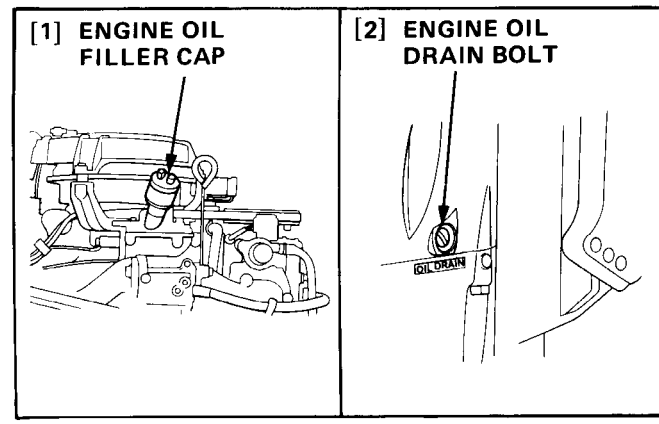
MAINTENANCE

ENGINE OIL

NOTE

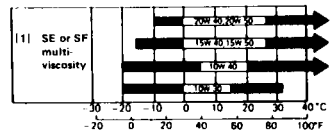
- Draining can be performed rapidly and completely when the engine is still warm.

1) Remove the engine cover.
2) Remove the engine oil filler cap and engine oil drain bolt and drain the engine oil.
3) Reinstall the engine oil drain bolt and tighten it.
4) Fill the engine to the upper level mark with the recommended oil.
   Check the engine oil level with the oil level gauge.

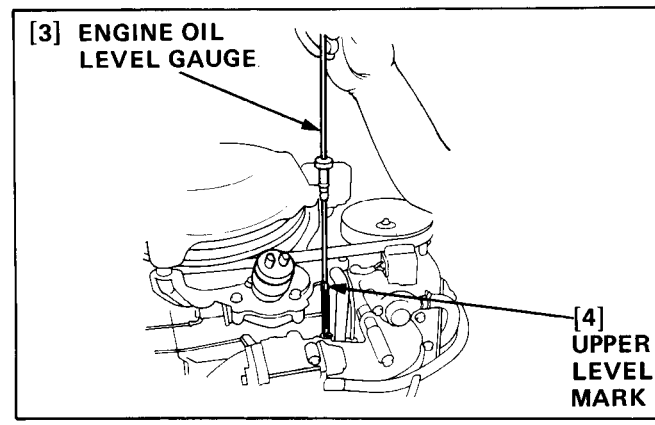


Engine oil capacity	1.1 ℓ (2.33 US pt, 1.94 Imp pt)

RECOMMENDED ENGINE OIL:
SAE 10 W–30 is recommended for general use; service classification SF.



[2] Ambient temperature



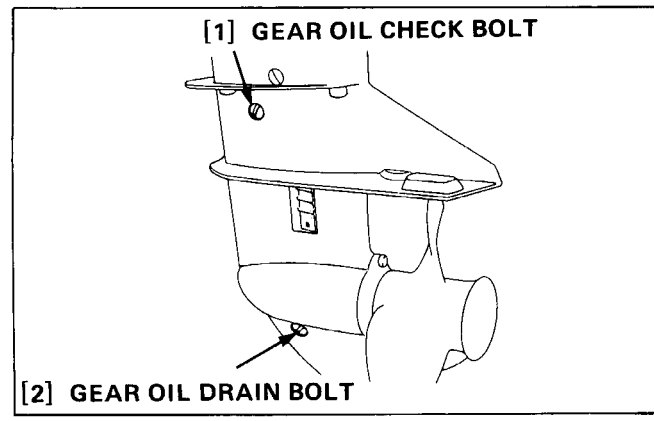
NOTE

- Make sure that the engine is vertical when checking the engine oil level.

5) Reinstall the oil filler cap.

GEAR OIL

1) Remove the gear oil check bolt and gear oil drain bolt to drain oil throughly.



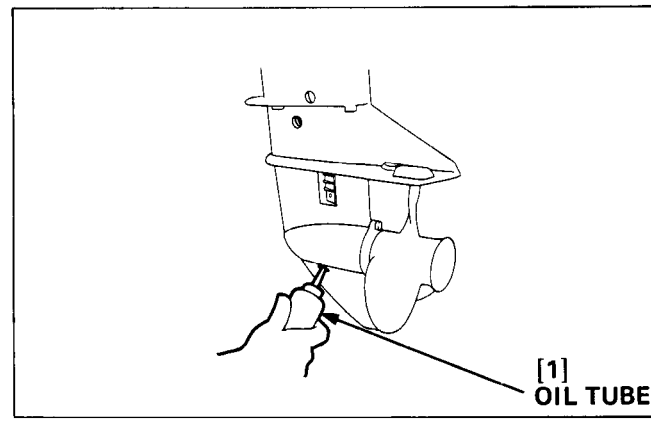
2) Squeeze fresh oil through the drain bolt hole until oil begins flowing out of the check bolt hole. Use the oil tube available as an optional part.

Gear oil capacity	0.24 ℓ (0.254 US qt, 0.211 Imp qt.)

Recommended gear oil	SAE 90 MARINE

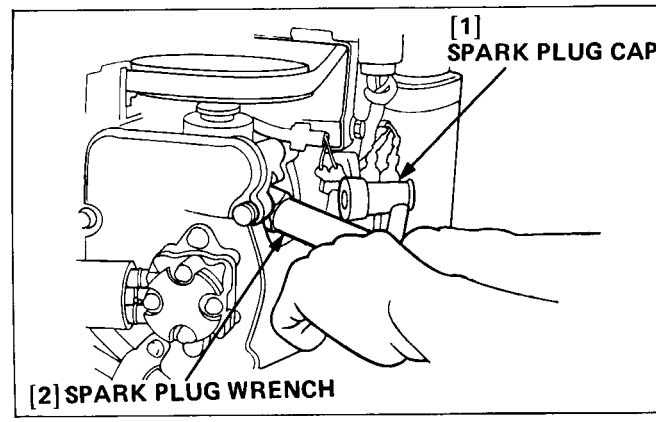
NOTE

- Be sure that the water is not mixed with the gear oil. If the water is mixed in the oil, check the gasket and water seal for damage and check the gear case for tightening.

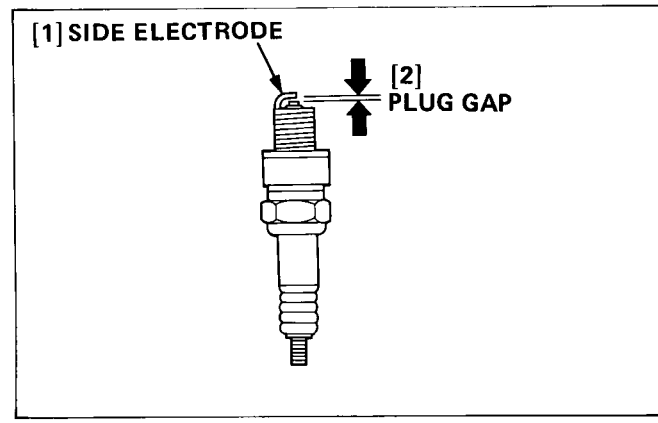


SPARK PLUGS

1) Remove the engine cover and spark plug caps.
2) Use the wrench supplied in the tool kit to remove the spark plugs.
3) Visually inspect the spark plugs. Discard them if the insulator is cracked or chipped.



4) Measure the plug gap with a feeler gauge.
   The gap should be 0.6–0.7 mm (0.024–0.028 in). Correct as necessary by bending the side electrode.
5) Check that the spark plug washer is in good condition, and thread the spark plug in by hand to prevent cross threading.

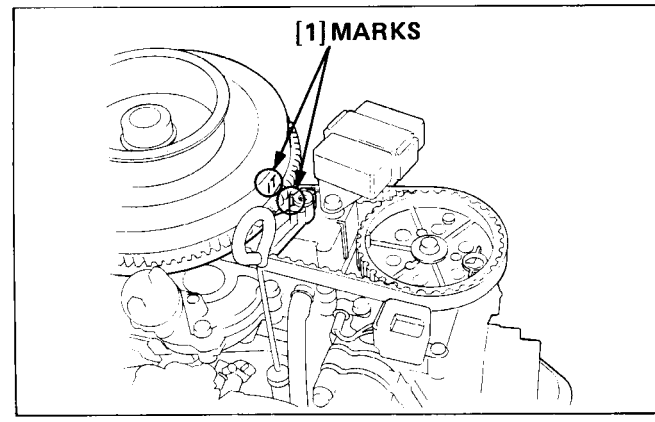


Standard spark plug	BF9.9A: DR-5HS (NGK) X16FSR-U (ND) BF15A: DR-6HS (NGK) X20FSR-U (ND)

Spark plug gap	0.6–0.7 mm (0.024–0.028 in)

VALVE CLEARANCE

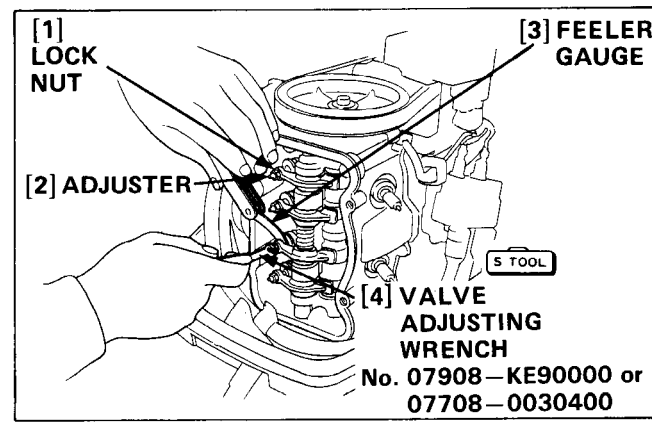
1) When the engine is cool, set the shift lever to "NEUTRAL" and remove the recoil starter assembly.
   Manually turn the flywheel and align mark "T" on the flywheel with the "I" on the starter case.
2) Remove the cylinder head cover.
3) Measure respective valve clearance of IN and EX using a feeler gauge.



Valve clearance	IN.: 0.12 ± 0.02 mm (0.005–0.001 in)
	EX.: 0.20 ± 0.02 mm (0.008–0.001 in)

4) Adjustment can be made by loosening the lock nut and turning the adjuster with adjusting wrench B (special tool). After adjustment, tighten the lock nut securely and recheck.

- The compression stroke between the two cylinder is 360° different. Therefore, upon aligning the marks, adjust the cylinder with the valves closed, then turn the flywheel 360° and adjust the other cylinder.



FUEL FILTER

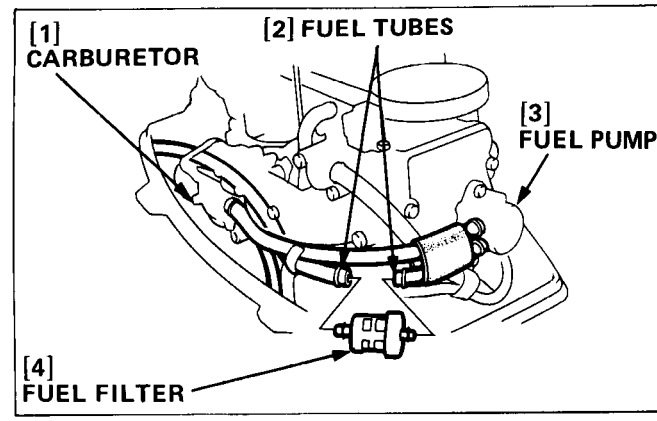
WARNING

- **Be careful not to spill fuel when replacing the filter. Spill fuel or fuel vapor may ignite. If any fuel is spilled, make sure the area is dry before starting the engine.**

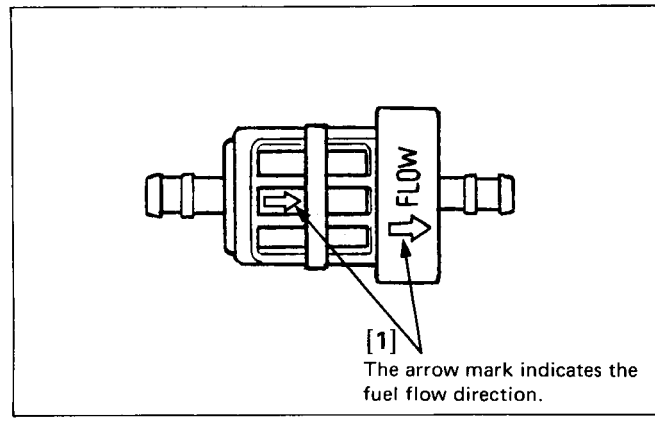
1) Disconnect fuel line at the engine and remove the engine cover.
2) Remove the fuel filter from the fuel tubes.

NOTE

Before removing the fuel filter, place clamps on the fuel tubes on each side of the fuel filter to prevent fuel leakage.



3) Install the new fuel filter, so that arrow mark "⇨" on the fuel filter is on the fuel pump side.
4) Connect the fuel line to the fuel tank, pump the primer bulb, and check for leaks.

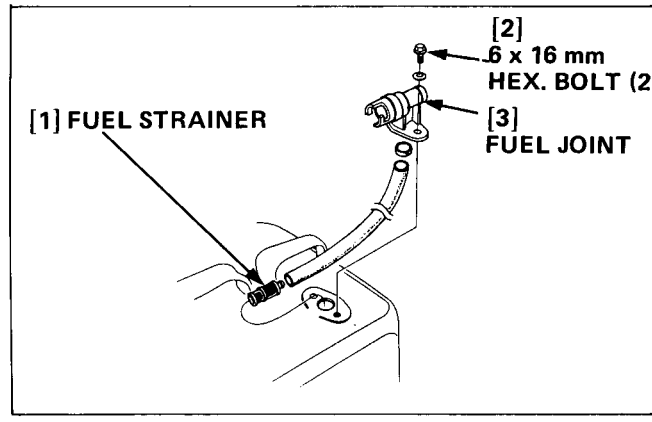


FUEL STRAINER

WARNING

- **Gasoline is flammable and is explosive under certain conditions. Do not smoke or allow flames or sparks near the outboard motor while draining fuel.**
- **Always work in a well-ventilated area.**
- **Be sure that any fuel drained from the outboard motor is stored in a safe container.**

1) Drain the fuel tank.
2) Remove the two 6 x 16 hex. bolts, remove the fuel joint, and remove the fuel strainer.
3) Remove dust and foreign matter from the fuel strainer, and check for tears.
4) After cleaning and checking, reassemble the fuel strainer and the fuel joint.



CARBURETOR

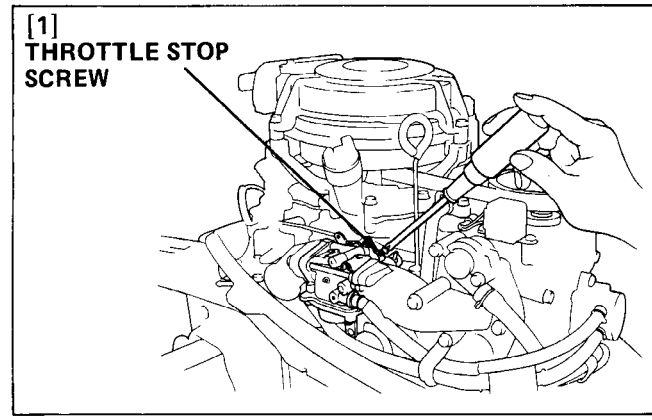
Idle speed

- WITH NO LOAD (SHIFT LEVER IN NEUTRAL)

1) Remove the propeller, and mount the outboard motor in a water tank with the water level at least 4 inches above the anti-cavitation plate.
   A water tank is not required if a hose is connected from a water faucet to the outboard motor, using a hose coupler (optional part).

CAUTION

- **Running the engine without water can cause serious engine damage due to overheating. Be sure that water flows from the water check hole while the engine is running. If not, stop the engine and determine the cause of the problem.**
- **Keep clear of moving parts.**



2) After the engine speed has stabilized turn and adjust the throttle stop screw to achieve the specified idle speed.

Specified idle speed (Shift lever in neutral)	1,100 ± 50 min^{-1} (rpm)

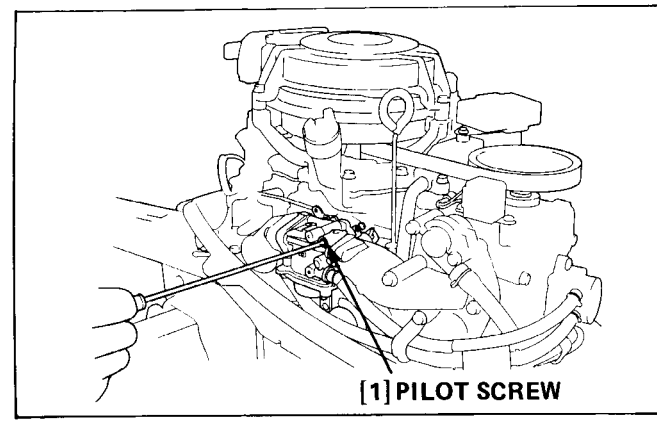
Pilot screw

If the pilot screw setting needs adjustment:

1) Turn the pilot screw in or out until the engine runs at the highest idle rpm. If the pilot screw has been removed and replaced, start with an initial setting from the fully closed position listed in the table below.

Standard pilot screw setting	BF15A: 1-5/8 turns out BF9.9A: 2-3/4 turns out

2) Turn the throttle stop screw to obtain the specified idle speed.

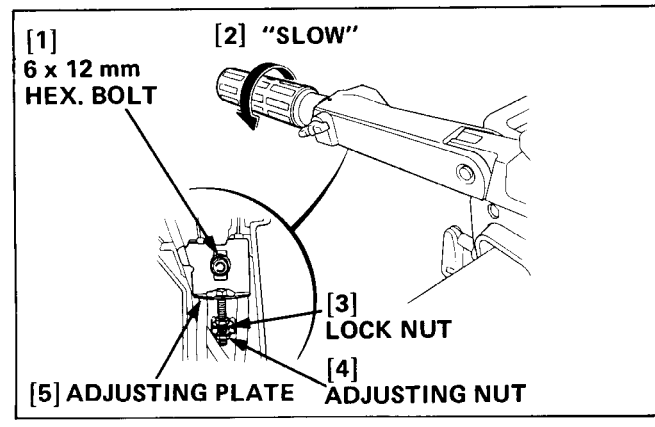


THROTTLE CABLE

1) Loosen the lock nut and 6 x 12 mm hex. bolt at the adjusting plate.
2) Set the throttle grip to the "SLOW" position, and hold the throttle lever in the fully closed position.

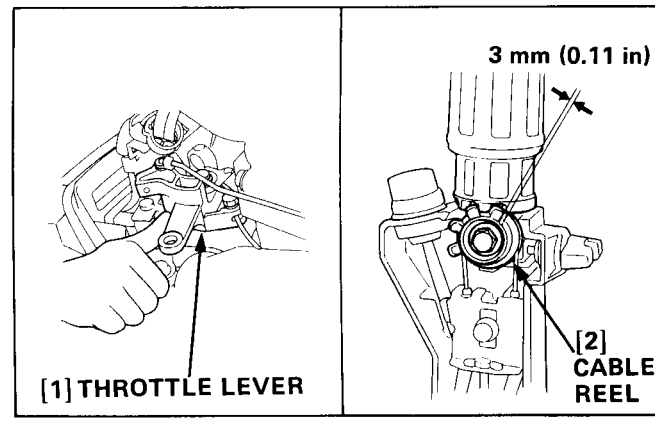
NOTE

- Be sure the throttle damper is released before adjusting cable free play.



3) Move the adjusting plate position by turning the adjusting nut so that the throttle cable free play is less than 3 mm (0.11 in) at the boss of the cable reel. Tighten the lock nut and adjusting nut securely.

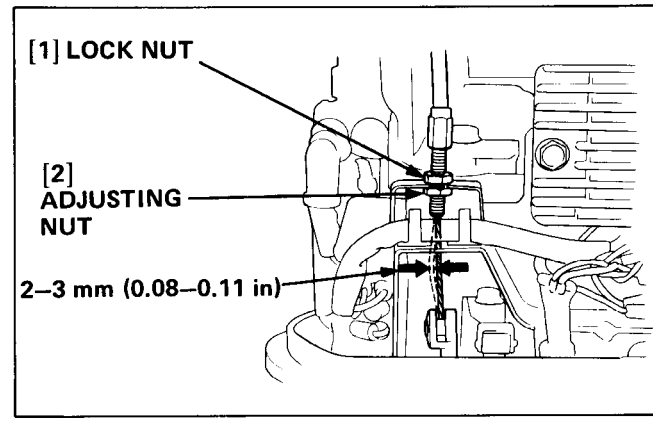
TORQUE:
5 N·m (50 kg-cm, 3.6 ft-lb) LOCK NUT
10 N·m (100 kg-cm, 7.2 ft-lb) ADJUSTING NUT



NEUTRAL STARTING CABLE

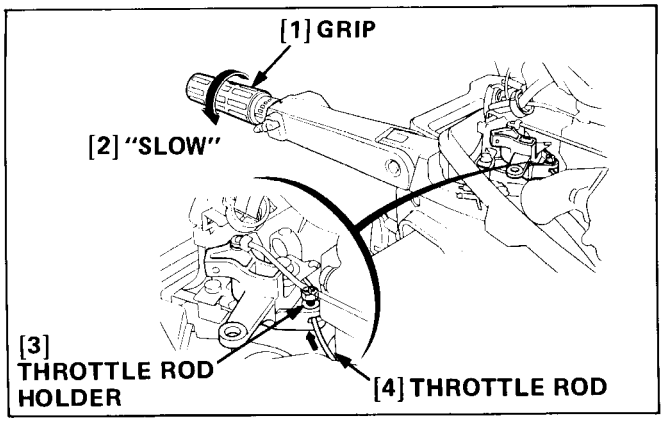
1) Set the shift lever in "NEUTRAL" position.
2) Loosen the lock nut of the neutral starting cable and turn the adjusting nut so that the cable free play is 2–3 mm (0.08–0.11 in).
Retighten the lock nut.

TORQUE: 10 N·m (100 kg-cm, 7.2 ft-lb)

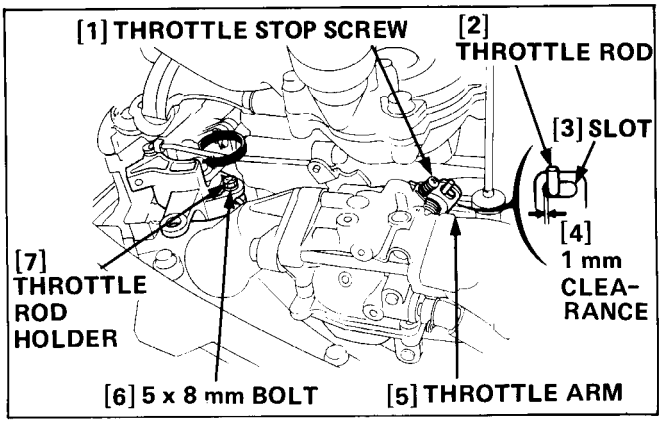


THROTTLE ROD

1) Adjust the throttle cable (P. 3-5).
2) Pass the throttle rod through the throttle rod holder, and set the grip to "SLOW" (until the grip touches the stopper).



3) Touch the throttle arm of carburetor to the throttle stop screw, and then adjust the throttle rod position so that its end is positioned at the left end of throttle arm slot allowing 1 mm clearance (max.) as show.
   Tighten the 5 x 8 mm bolt on the throttle rod holder.
4) Turn the grip and make sure that the carburetor throttle moves the full range from fully closed to fully open.

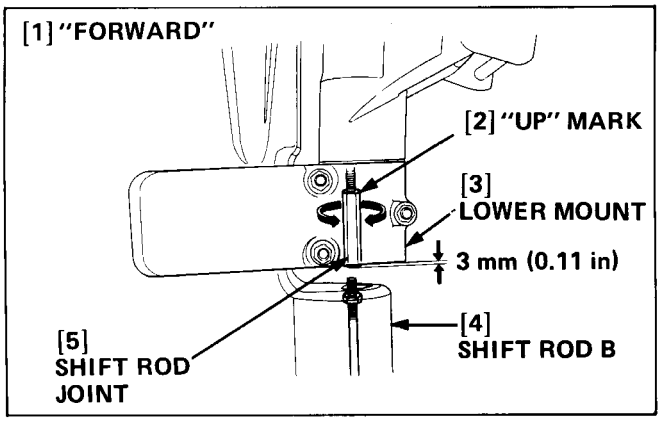


SHIFT ROD

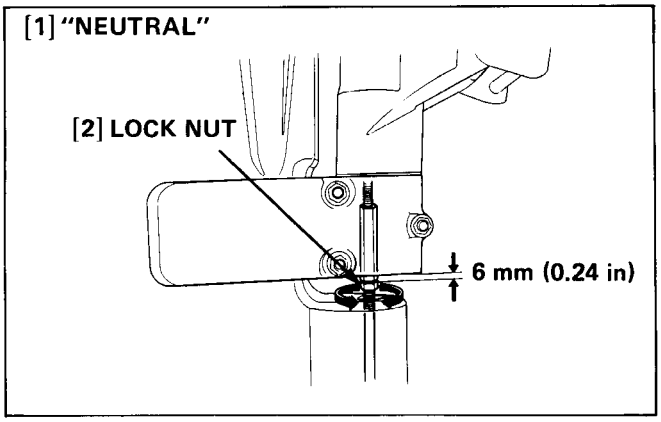
1) Remove the shift rod joint from shift rod B. Set the shift lever to the "FORWARD" position, and screw in the shift rod joint so that its edge is 3 mm (0.11 in) out of the lower mount edge.

NOTE

- Install the shift rod joint with the "UP" mark facing up.



2) Move the shift lever from "FORWARD" to "NEUTRAL", and attach shift rod B to the shift rod joint. Set the shift lever to the "NEUTRAL" position, and turn the shift rod joint so that its edge is 6 mm (0.24 in) out of the lower mount edge. Tighten the lock nut securely.
3) Set the shift lever in "REVERSE" and "FORWARD" and turn the propeller by hand to make sure that the gear change timing is proper.



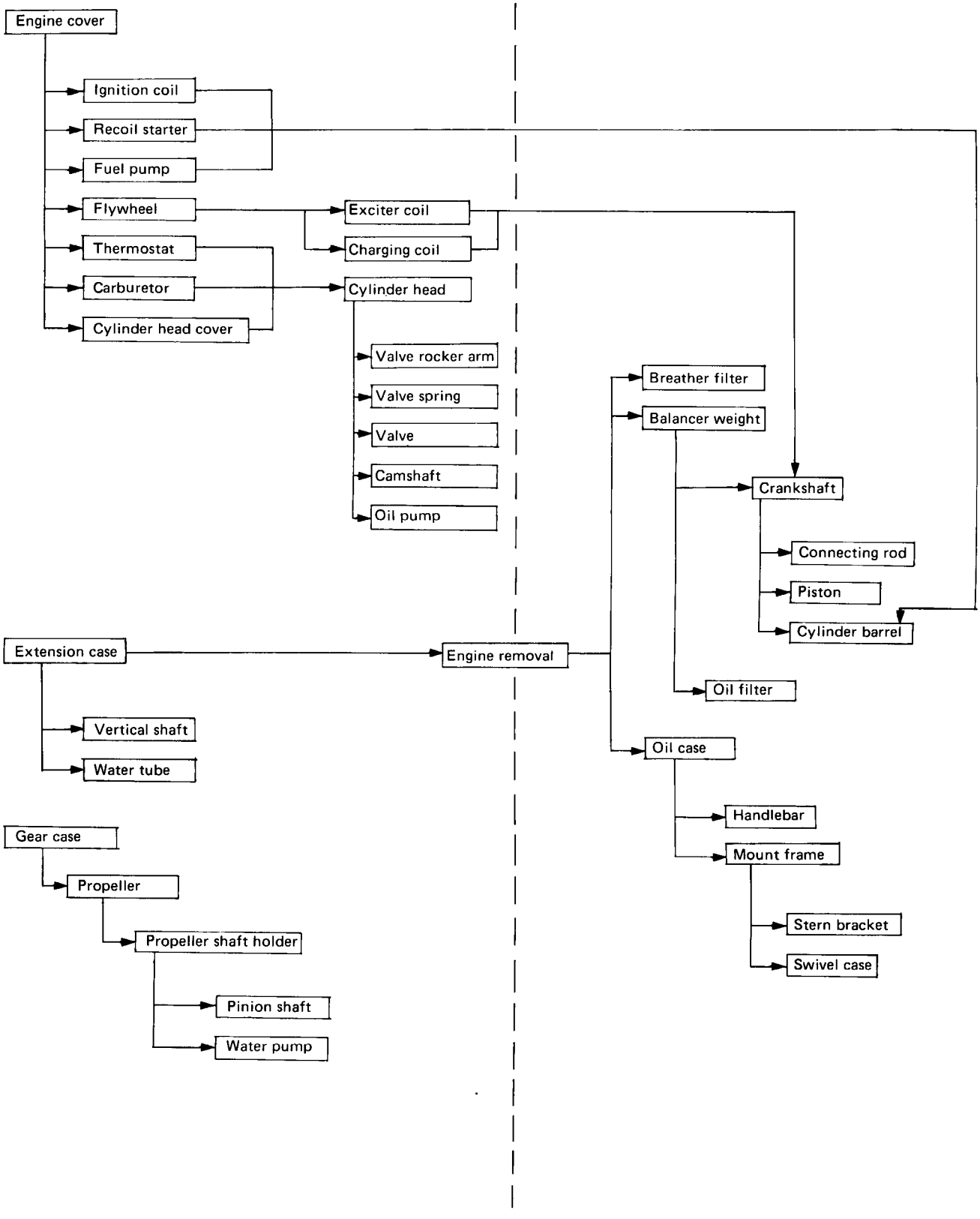
DISASSEMBLY CHART

<Disassembly Chart>

Parts are arranged in the order of disassembly in the chart below.
Refer to the chart and find out what parts you should disassemble to remove and inspect your designated part.

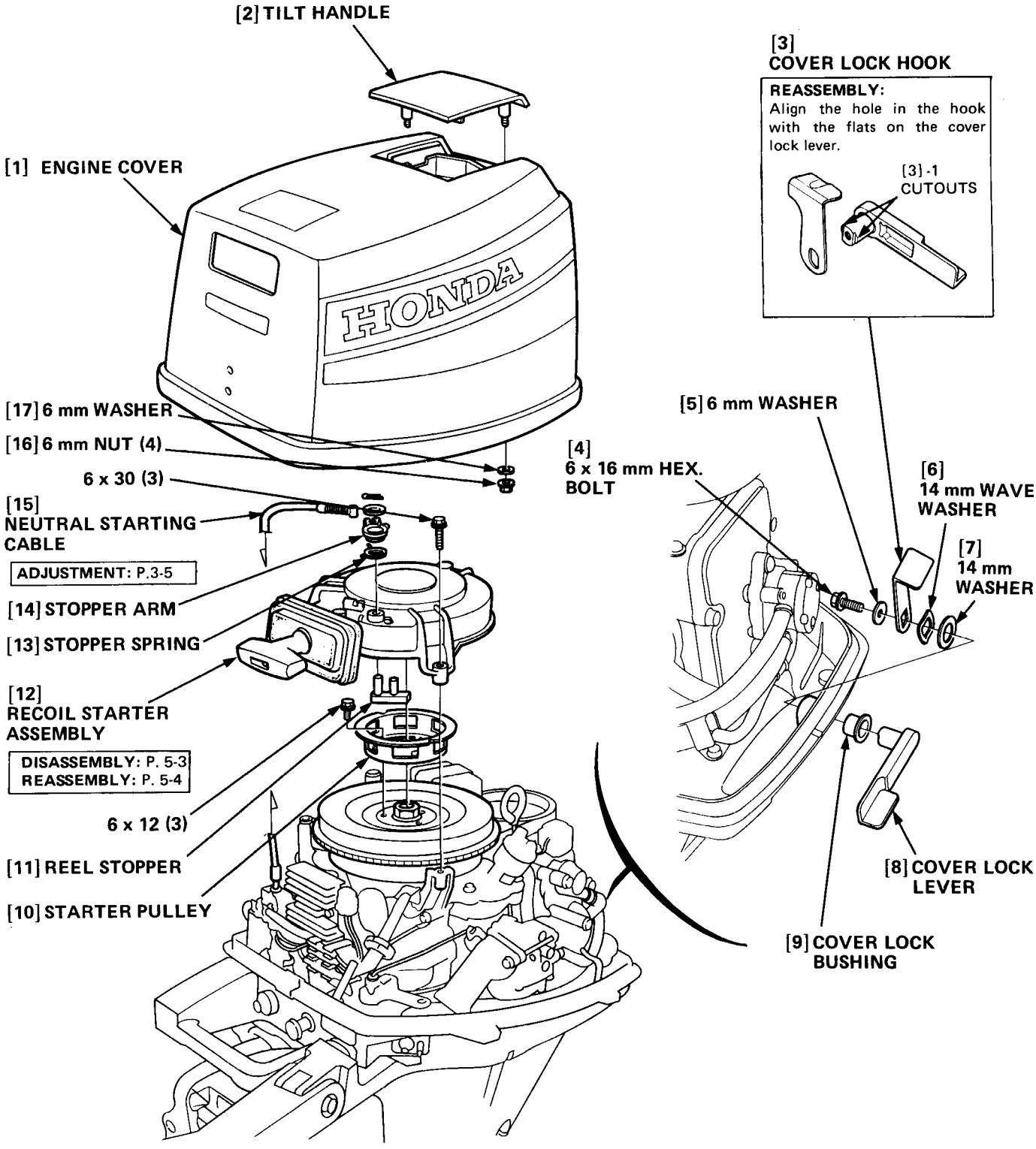
A. Parts that can be disassembled with the engine mounted

B. Parts that must be disassembled with the engine removed

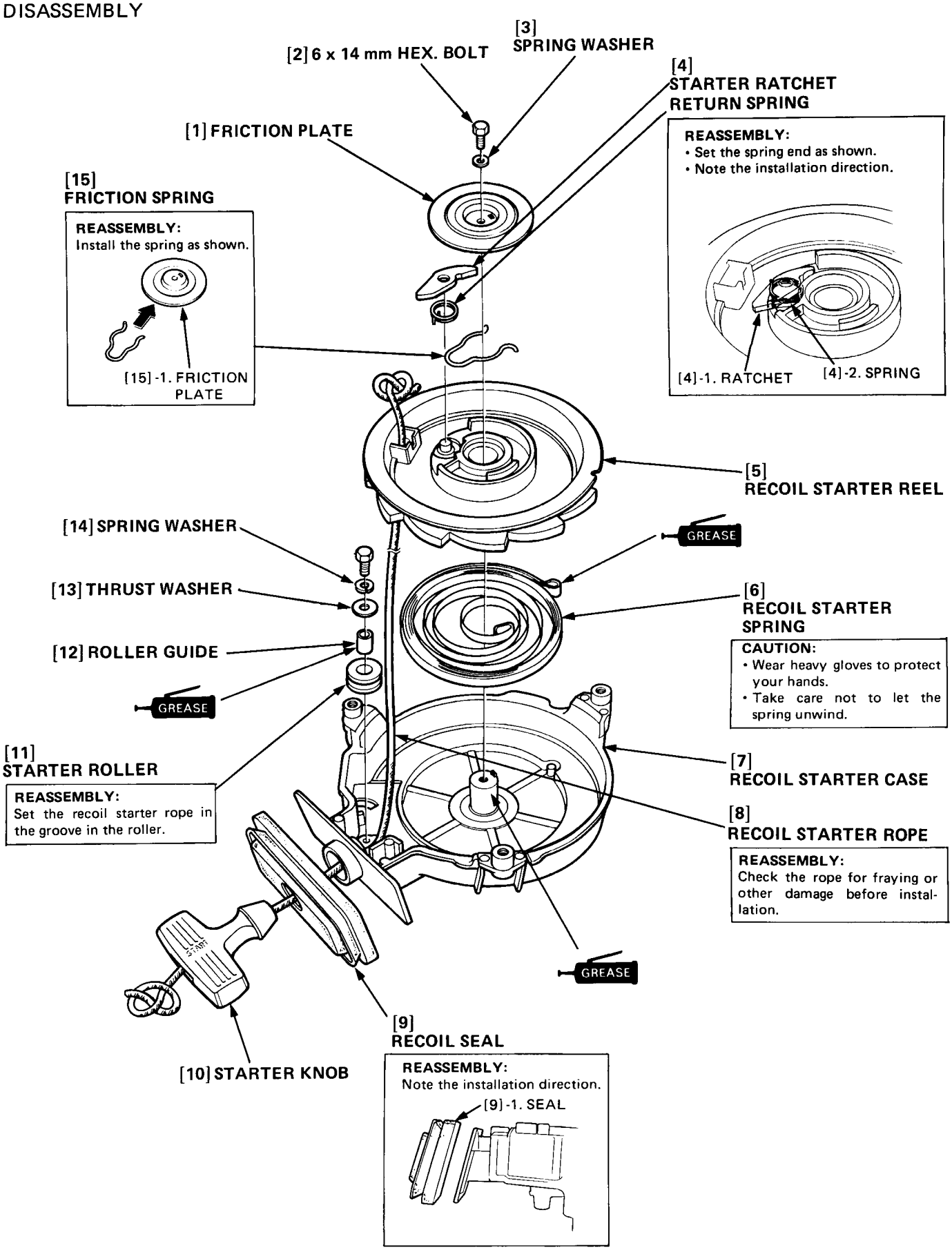


RECOIL STARTER

RECOIL STARTER REMOVAL

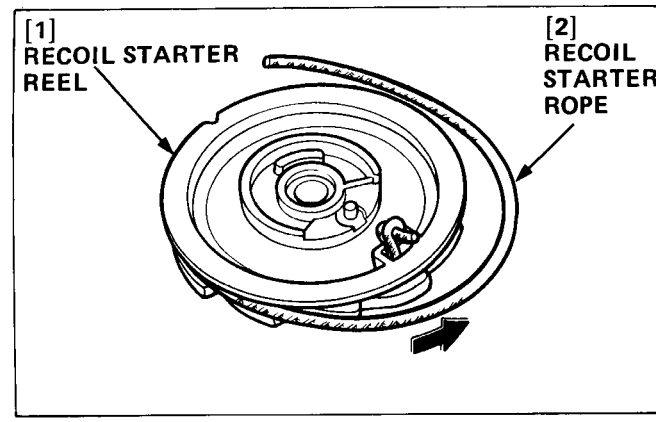


DISASSEMBLY

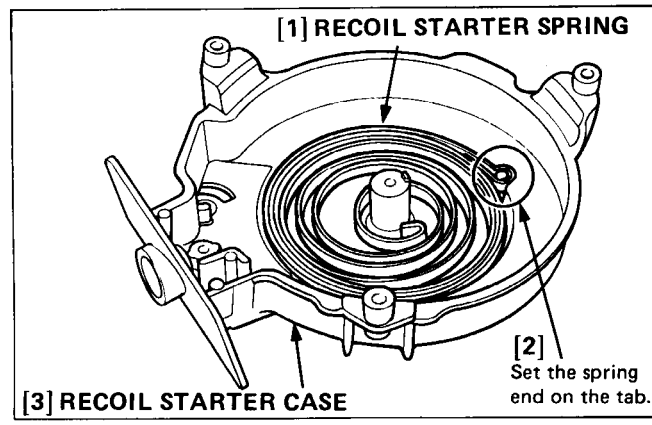


STARTER ROPE ASSEMBLY

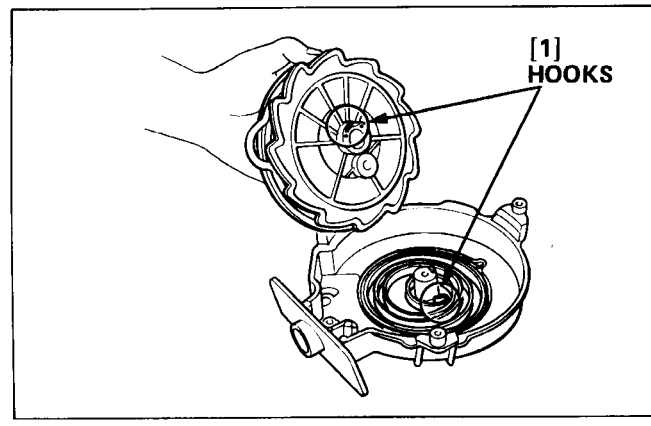
1) Route one end of the recoil starter rope through the hole in the recoil starter reel and tie a knot in the end. Wind the starter rope on the reel in the direction of the arrow.



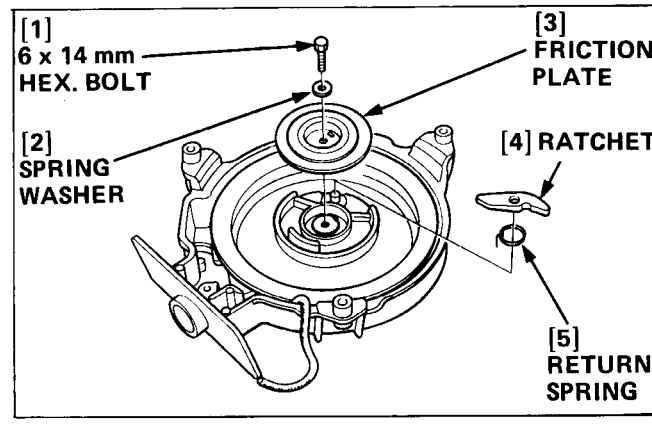
2) Set the recoil starter spring end on the recoil starter case tab and wind the spring so that it is installed in the case securely.



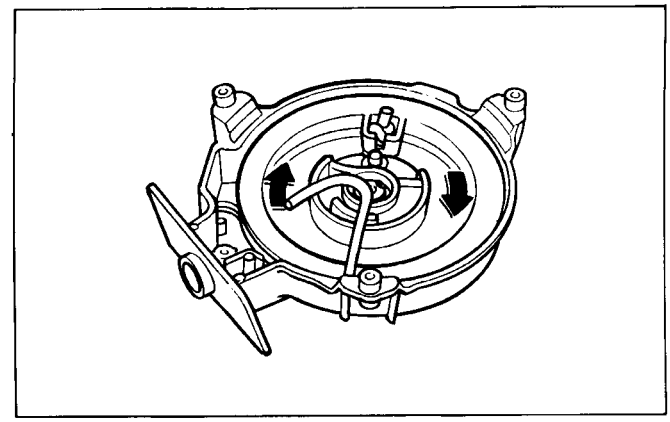
3) Align the hook on the recoil starter spring with the hook on the recoil starter reel and install the reel in the recoil starter case.
Pull the rope end out of the cutout in the reel.



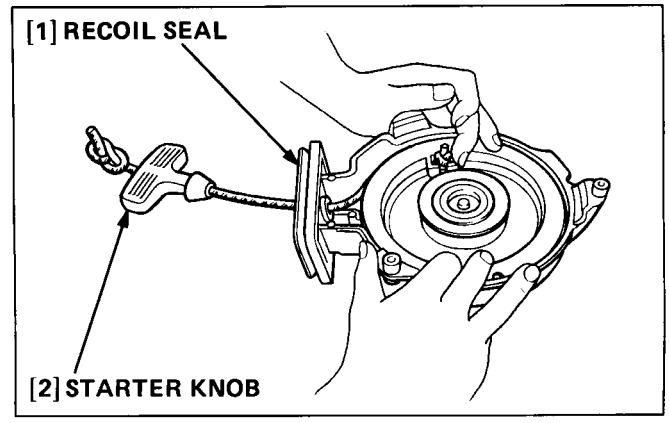
4) Install the return spring and starter ratchet on the reel (P. 5-3).
Install the friction plate on the starter reel and align the hole in the friction plate with the projection on the starter reel.
Install the spring washer and tighten the 6 x 14 mm hex. bolt.



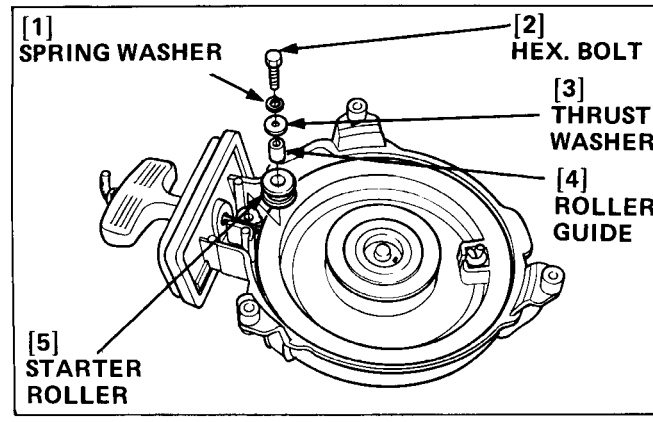
5) While holding the rope end in the cutout in the reel, rotate the reel in the direction of the arrow to preload the spring.



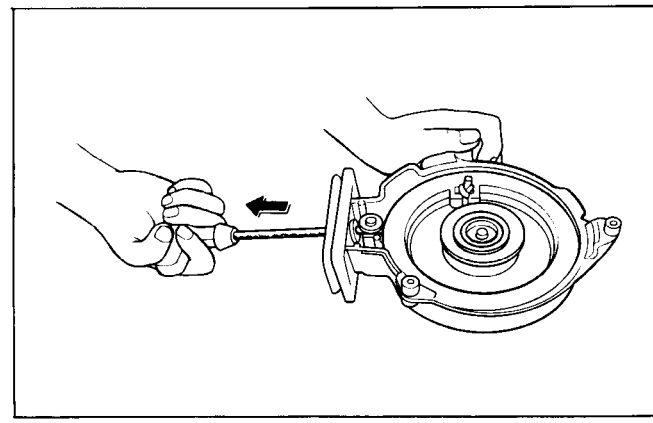
6) Pass the starter rope end through the rope hole in the starter case, recoil seal and recoil starter knob and tie a knot in the end of the rope.



7) Install the starter roller, roller guide, thrust washer and spring washer and tighten the hex. bolt.

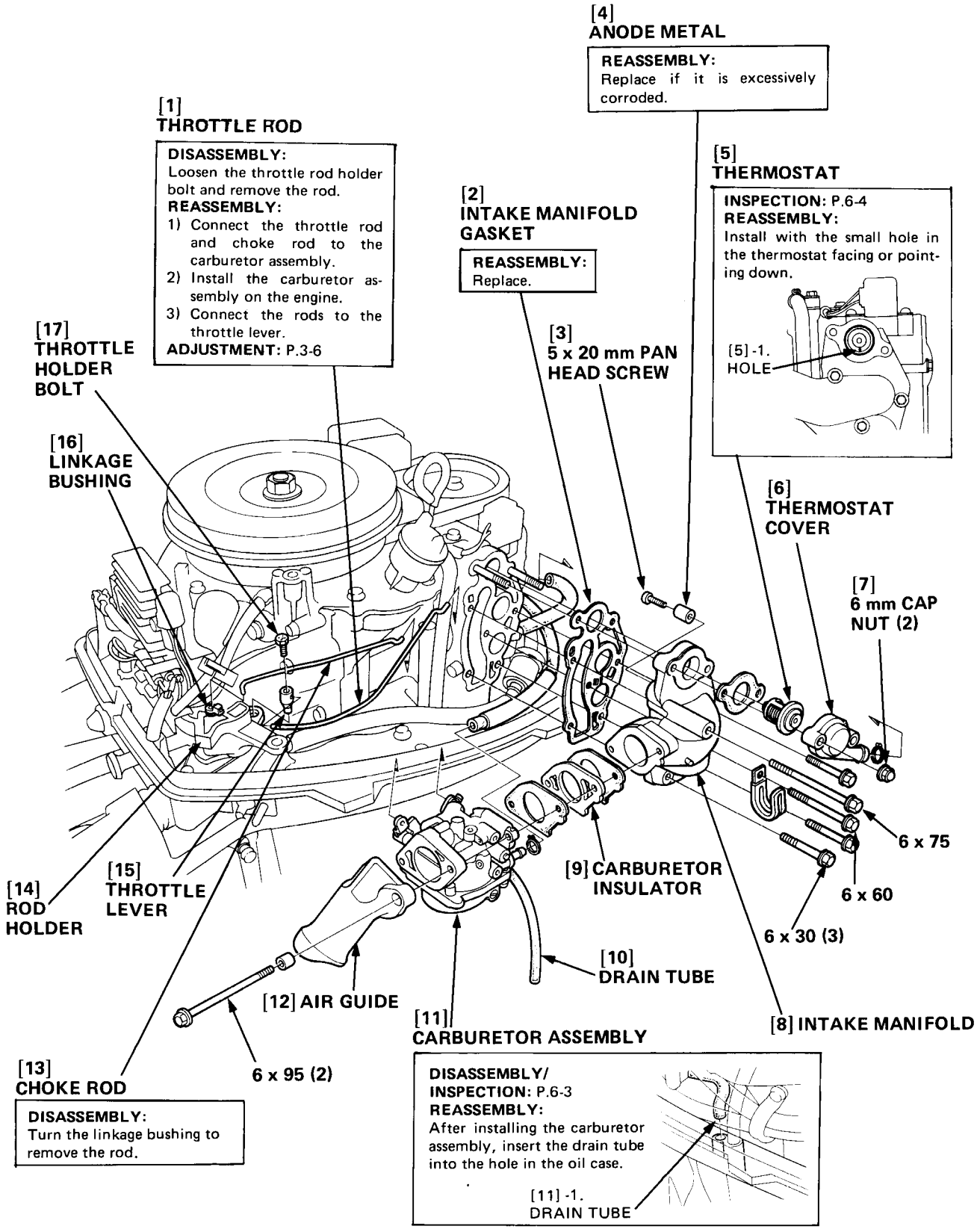


8) Pull the starter knob to be sure that the recoil starter reel rotates smoothly. Release the knob and be sure that it returns smoothly.



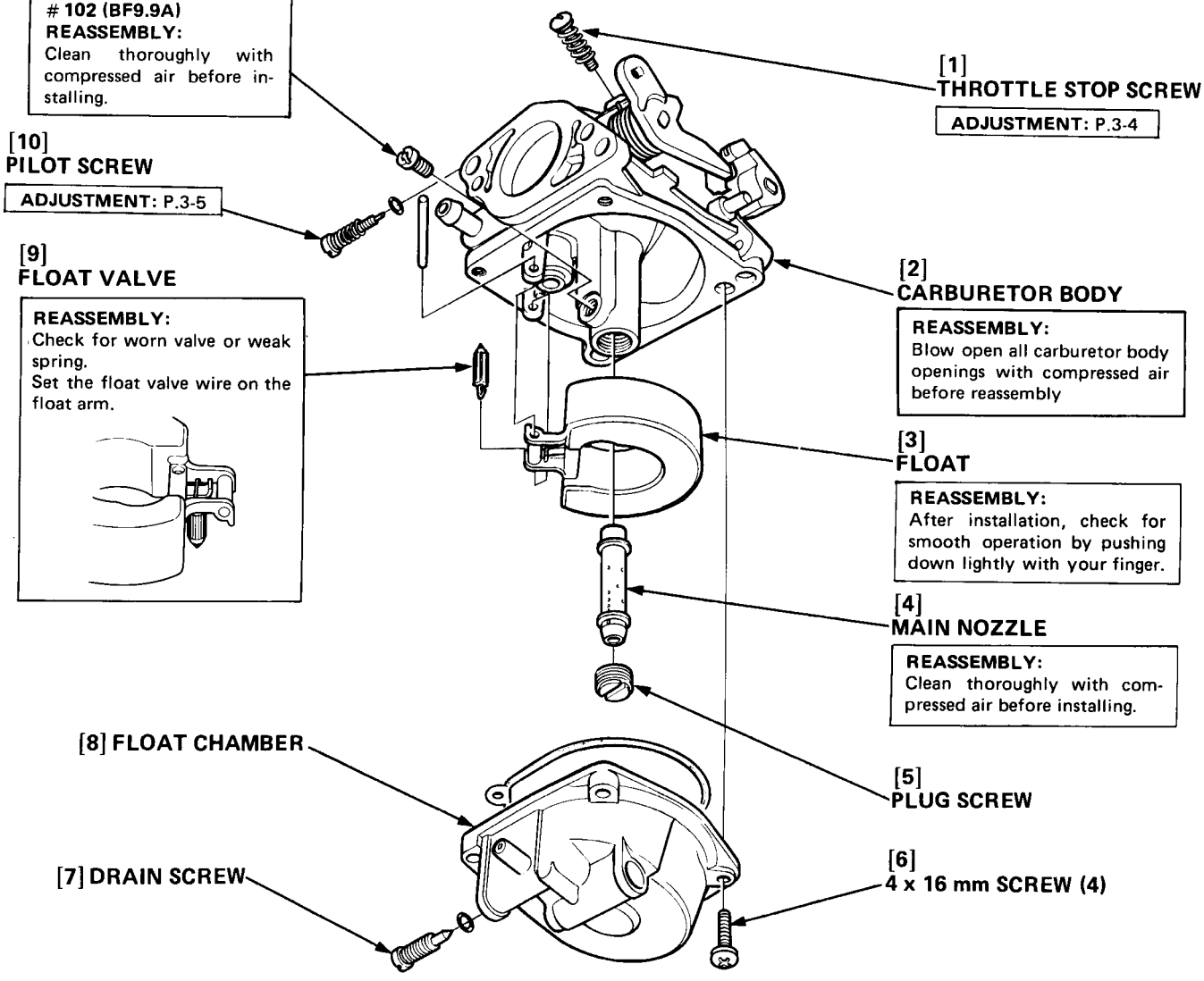
FUEL SYSTEM, THERMOSTAT

CARBURETOR, THERMOSTAT



WARNING

- **Loosen the drain screw and drain the carburetor before disassembly.**
- **Keep gasoline away from flames or sparks. Wipe up spilled gasoline at once.**



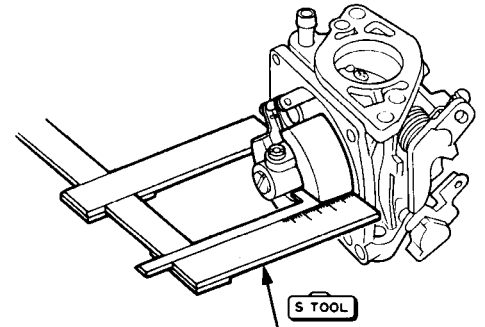
INSPECTION

• CARBURETOR FLOAT LEVEL

Place the carburetor as shown, push the float with your finger, and measure the distance between the float top and carburetor body when the float just contacts the float valve.

Float level	13.0–15.0 mm (0.51–0.59 in)

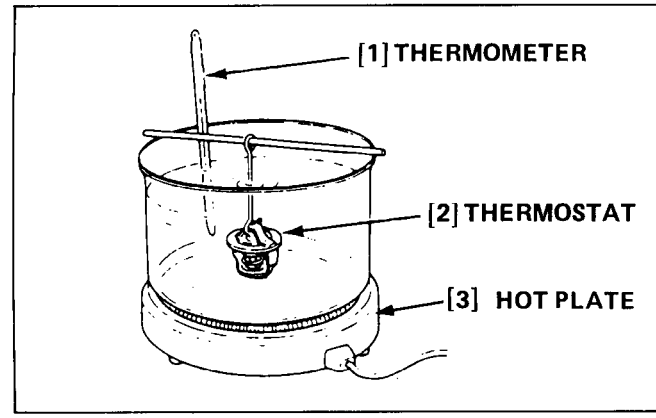
Replace the float, if the float level is out of specification.



[1] FLOAT LEVEL GAUGE
No. 07401–0010000

• THERMOSTAT

Suspend the thermostat in heated water and check for the valve lift.
Measure the water temperature when the thermostat starts opening.

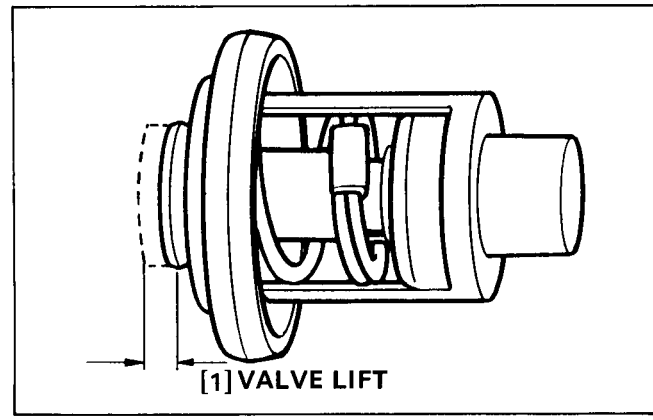


NOTE

- Don't let the thermometer or the thermostat touch the container; this may cause a false reading.

Measure lift height when fully open.

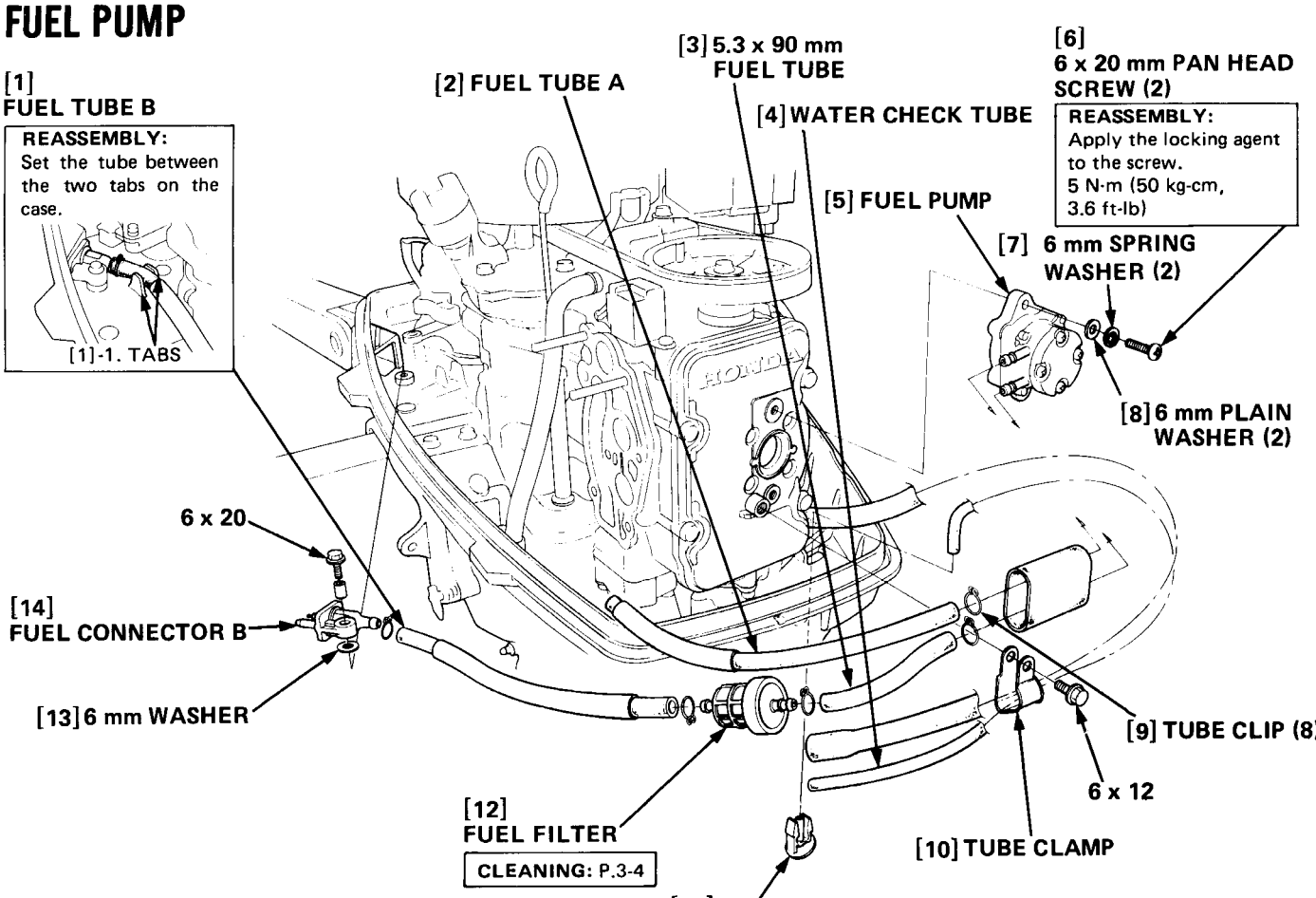
Water temperature	Valve lift
52°C (165.6°F) max. 62°C (183.6°F) min.	0 mm (0 in) 3 mm (0.118 in)



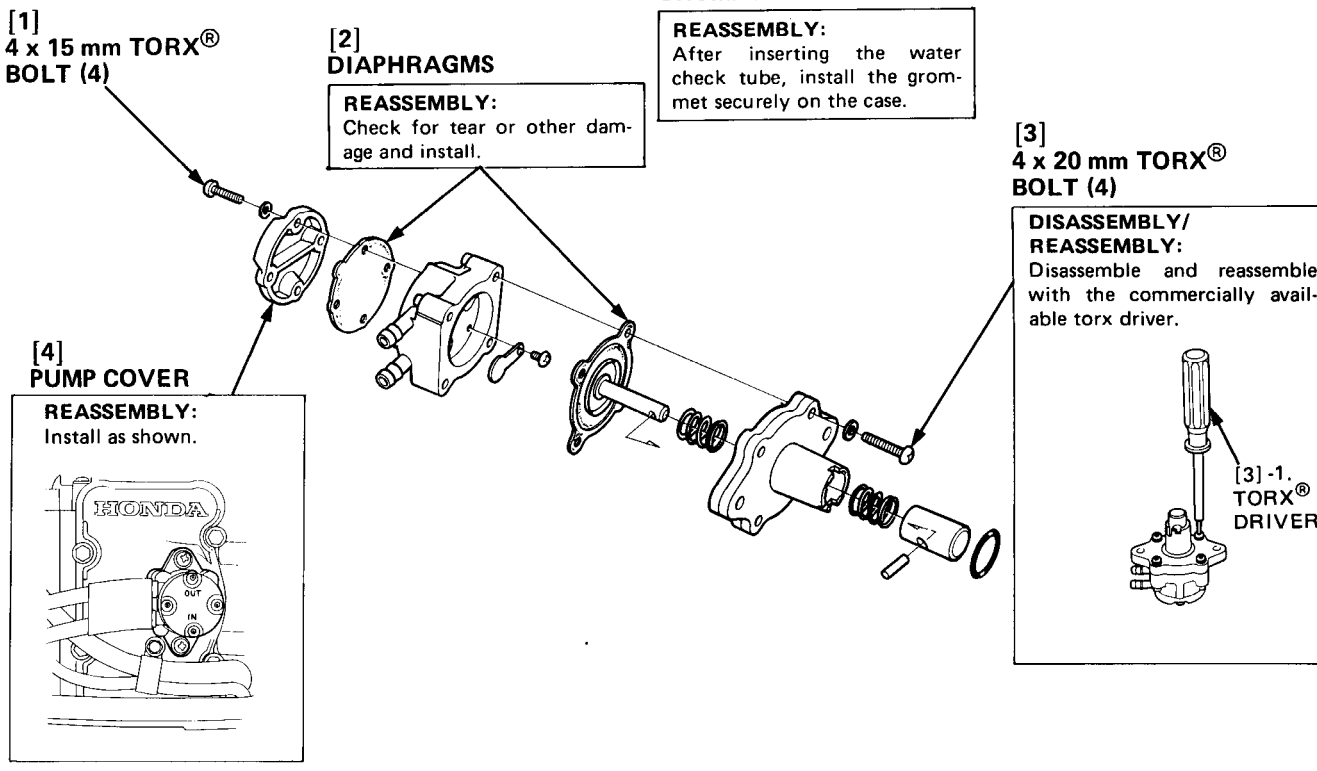
NOTE

- The valve may or may not be partially open when the water temperature is between 52°C (165.6°F) and 62°C (183.6°F); However, this does not indicate faulty valve.
- Replace the thermostat if the valve lift is out of the specification.

FUEL PUMP



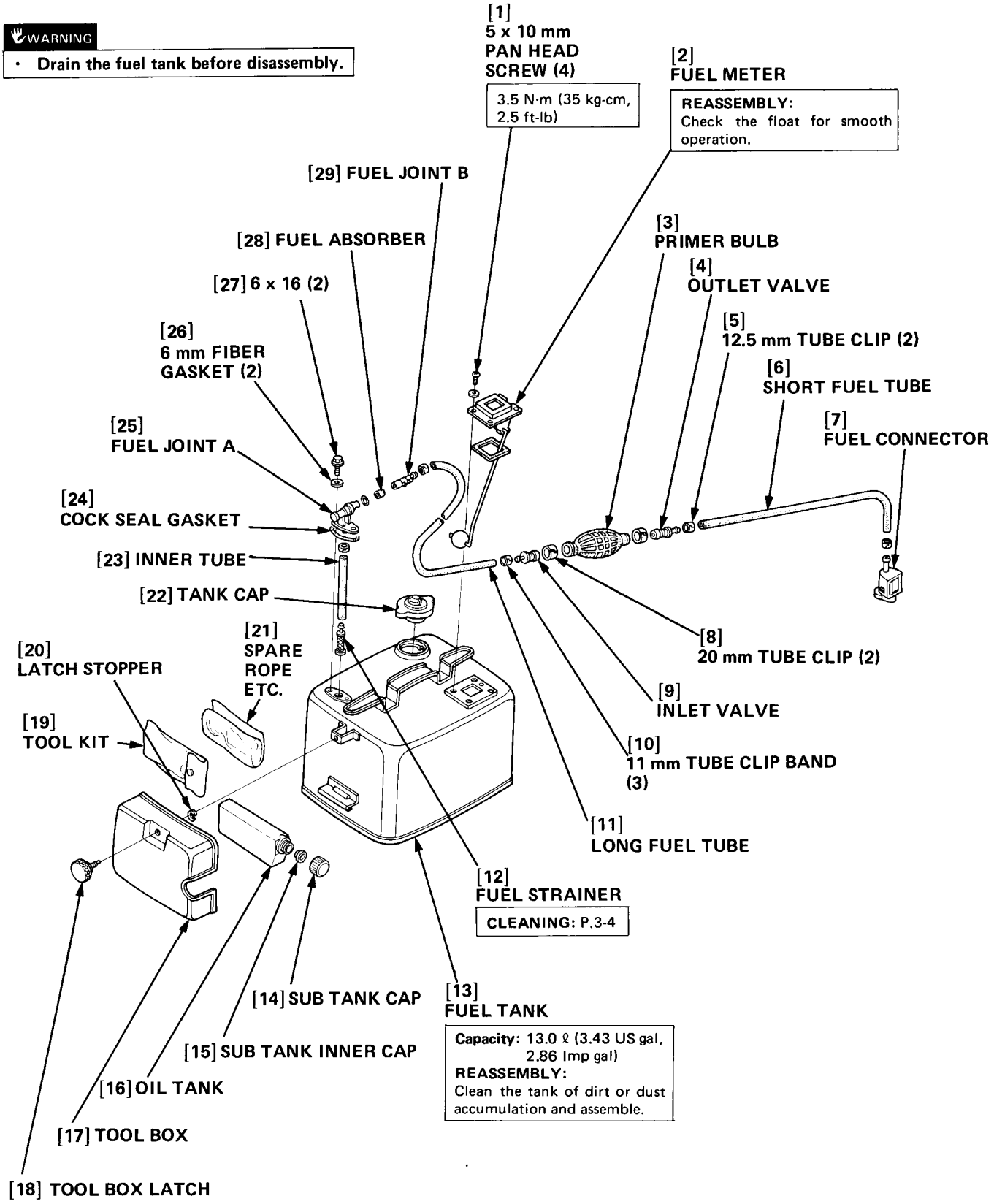
- FUEL PUMP



FUEL TANK

WARNING

- **Drain the fuel tank before disassembly.**



FLYWHEEL, ELECTRICAL

FLYWHEEL

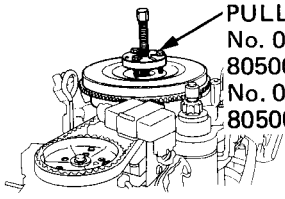
a. DISASSEMBLY/REASSEMBLY

[1] FLYWHEEL

DISASSEMBLY:
Remove the flywheel with the special tool.

S TOOL

[1]-1. FLYWHEEL PULLER No. 07935–8050002 or No. 07935–8050003



REASSEMBLY:
Clean oil or dirt off the mating surface of the center hole before installation.

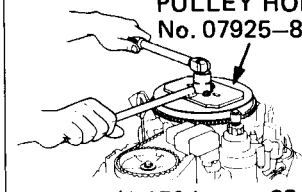
[2] 16 mm SPECIAL NUT

DISASSEMBLY:
Hold the flywheel with the pulley holder (special tool) and remove the nut.

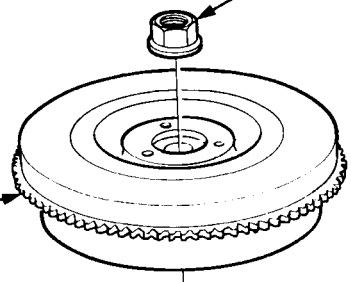
REASSEMBLY:
Apply oil to the thread and seated surface of the nut and install it by hand, then hold the flywheel with the pulley holder and tighten the nut to specified torque.

S TOOL

[2]-1. PULLEY HOLDER No. 07925–8930000



115 N·m (1,150 kg-cm, 83.2 ft-lb)



[3] EXCITER COIL

INSPECTION: P.7-3

[4] 16 x 15 mm SPECIAL KEY

REASSEMBLY:
Do not forget to install. Make sur that the key is properly installed in the key groove.

[5] WIRE CLIP

REASSEMBLY:
Secure the charging and exciter coil leads.

[6] CRANKSHAFT

REASSEMBLY:
Clean oil or dirt off the tapered surface of the crankshaft before installing the flywheel.

6 x 32 (2)

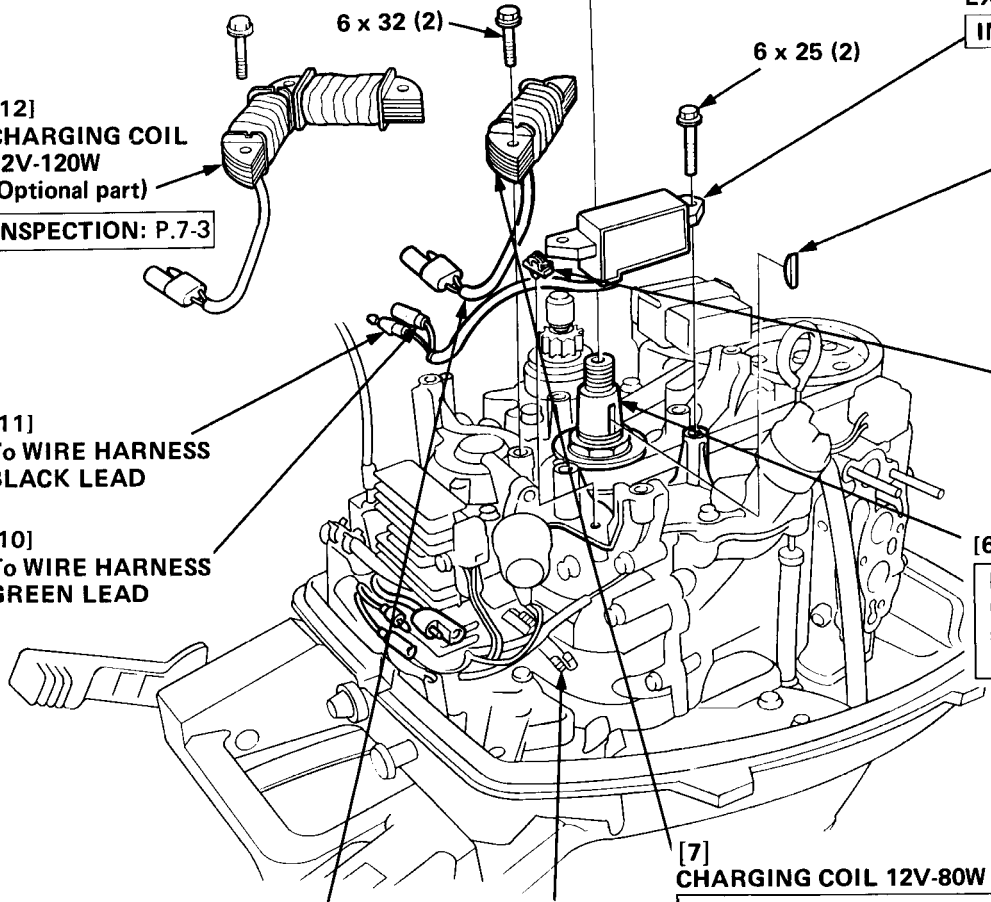
6 x 25 (2)

[12] CHARGING COIL 12V-120W (Optional part)

INSPECTION: P.7-3

[11] To WIRE HARNESS BLACK LEAD

[10] To WIRE HARNESS GREEN LEAD



[7] CHARGING COIL 12V-80W

INSPECTION: P.7-3

REASSEMBLY:
Route the charging coil lead and exciter coil lead as shown, and secure them with the cable clamp.

[7]-1. CHARGING COIL

[7]-2. EXCITER COIL

[7]-3.LEADS

[8] CABLE CLAMP

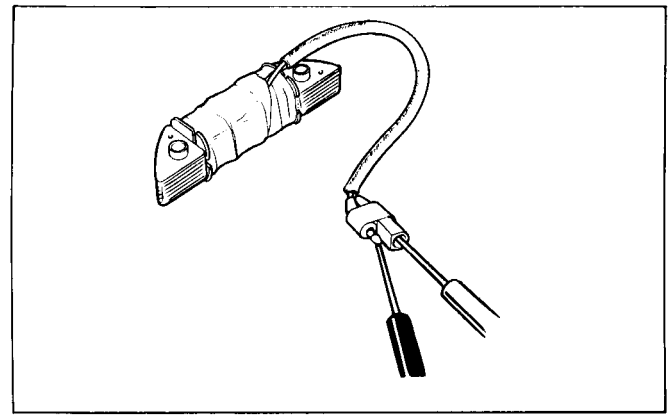
[9] To REGULATOR/RECTIFIER 2P COUPLER

b. INSPECTION

- CHARGING COIL 12V-80W

Measure the resistance between each terminal of the charging coil with the tester.

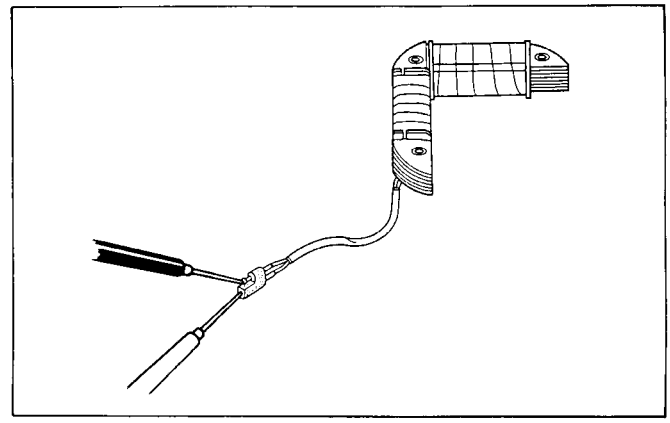
Resistance	0.33–0.41 Ω



- CHARGING COIL 12V-120W (Optional part)

Measure the resistance between each terminal of the charging coil kit with the tester.

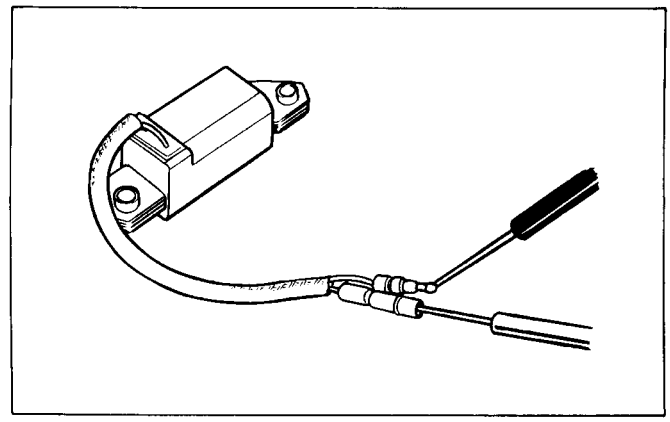
Resistance	0.20–0.24 Ω



- EXCITER COIL

Measure the resistance between each terminal of the exciter coil with the tester.

Resistance	207–253 Ω



STARTER MOTOR, RECTIFIER

a. DISASSEMBLY/REASSEMBLY

[1] STARTER MOTOR ASSEMBLY

Measure starter performance while cranking the engine.
If performance is not within service limits, disassemble and inspect as described on pages 7-5, 7-7, 7-8 and 7-9.

	Under load	No load
Cranking voltage	9 V DC	12 V DC
Cranking current	Below 120 A	Below 22 A
Engine cranking speed	More than 405 rpm	

[2] 6 mm TERMINAL NUT (2)
5 N·m (50 kg-cm, 3.6 ft-lb)

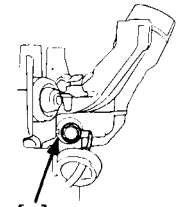
8 x 45 (2)

6 x 12 (4)

[3] CONNECTOR BRACKET B
REASSEMBLY: Refer to pages 1-6 and 1-8 for the order of cable connection.

[4] NEUTRAL STARTING BRACKET

[5] BODY GROUND
REASSEMBLY: Connect the body ground as shown.



[5]-1. BODY GROUND

6 x 12

[6] WIRE HARNESS
REASSEMBLY: Install the grommet securely on the bracket.

[7] GROMMET

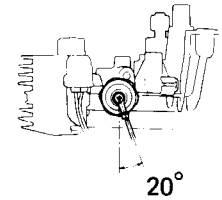
[8] FUSE HOLDER
INSPECTION: P. 7-6
REASSEMBLY: Insert the rubbers on the holder into the connector bracket A.

6 x 20 (2)

[9] REGULATOR/ RECTIFIER
INSPECTION: P.7-6

[10] 4 x 6 mm PAN HEAD SCREW
1.5 N·m (15 kg-cm, 1.1 ft-lb)

[11] OIL PRESSURE SWITCH WIRE
REASSEMBLY: Connect the round terminal to the oil pressure switch so that it is 20° from the vertical line as shown.



6 x 12

[12] STARTING CABLE

[13] OIL PRESSURE SWITCH
INSPECTION: P.7-6

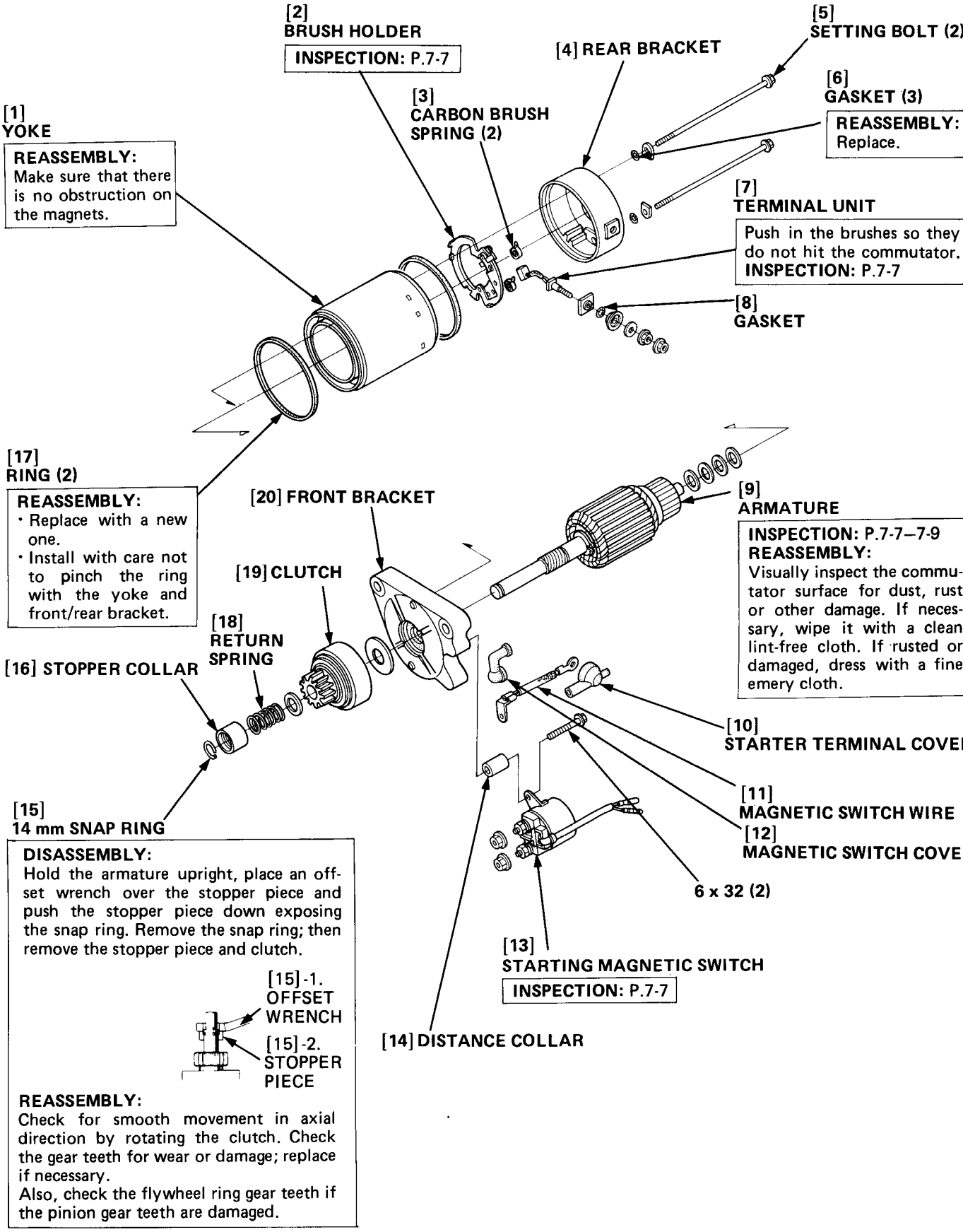
[14] 10 x 16 mm DOWEL PIN (2)

[15] 6 mm NUT WASHER

[16] 15A FUSE

[17] CONNECTOR BRACKET A
REASSEMBLY: Refer to pages 1-6 and 1-8 for the order of cable connection.

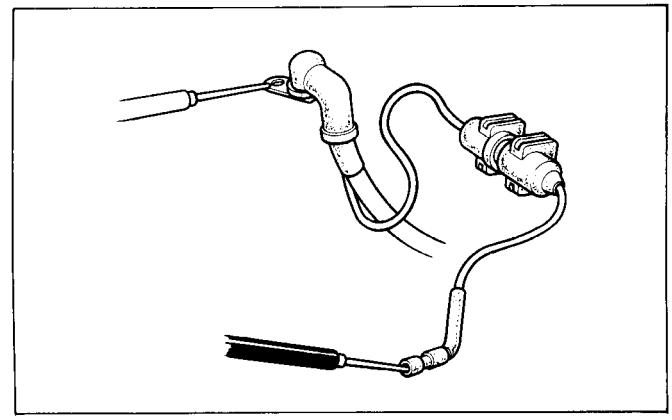
STARTER MOTOR ASSEMBLY



b. INSPECTION

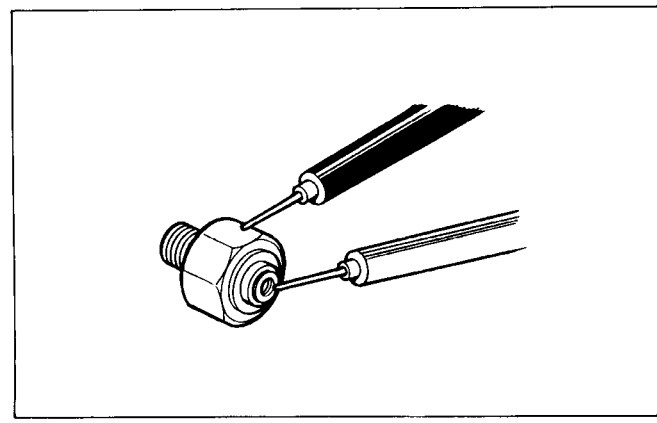
• FUSE/FUSE HOLDER

Check the single unit of the fuse for continuity.
Install the fuse on the fuse holder and check the holder for continuity.



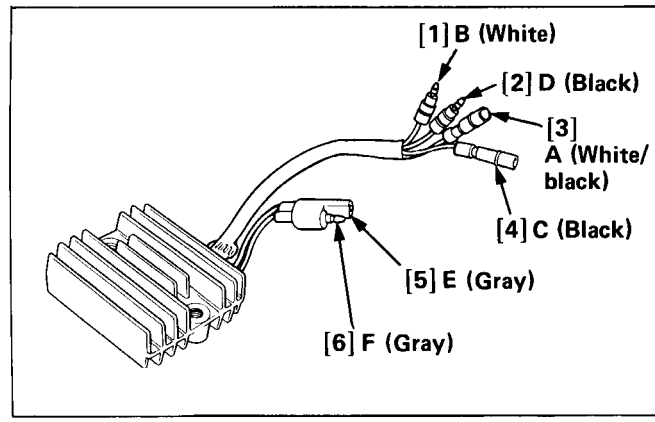
• OIL PRESSURE SWITCH

Attach the tester leads to the terminal joint and switch body and check for continuity. There should be no continuity.



• REGULATOR/RECTIFIER

Measure the resistance between each terminal.
Replace the regulator/rectifier if the measurement is out of the specification listed in the table below.



NOTE

- The regulator/rectifier is fully transistorized. For accurate testing, it is necessary to use a specified tester. Use of an improper tester or measurements in improper range may give false readings.
- Use the tester below.
  SANWA SP–15D No. 07308–0020000 or
  KOWA KE–32–3 No. 07411–0020000

Range: SP–15D x KΩ range
KE–32–3 CDIΩ x 100 range

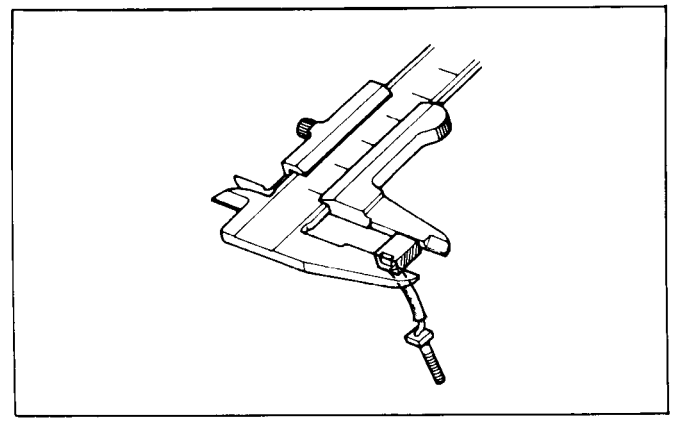
Unit: Ω

Red tester lead \ Black tester lead	A, B	C, D	E	F
A, B		500–100K	1K–200K	
C, D	∞		100–50K	100–50K
E	∞	∞		∞
F	∞	∞	∞	

• BRUSH LENGTH

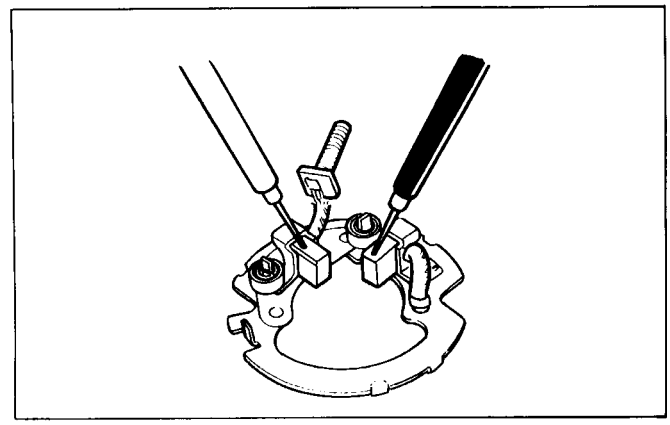
Check the brush for wear and replace if necessary.

Standard	Service limit
12.5 mm (0.49 in)	8.5 mm (0.33 in)



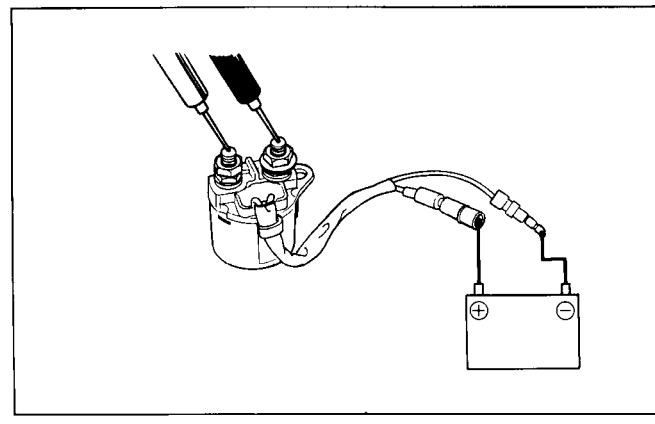
• BRUSH INSULATION

Check for continuity between the brushes.
There should be no continuity.



• STARTING MAGNETIC SWITCH ASSEMBLY

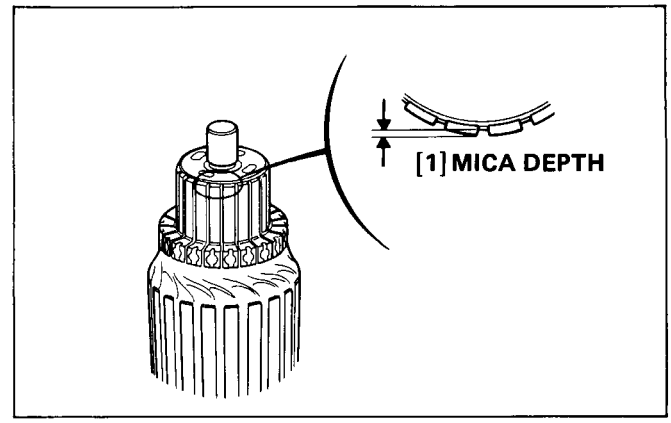
Connect the back/white lead of the staring switch to the positive (+) terminal of the battery and black lead to the negative (–) terminal and check for continuity. There should be continuity between the terminals.
And then there should be no continuity when disconnecting the battery.



• MICA DEPTH

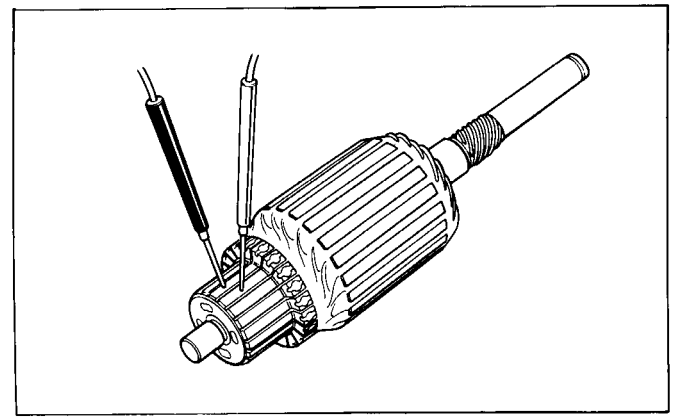
Measure the mica depth.
If the measurement is less than the service limit, correct with a hacksaw blade or a small file.

Service limit	0.15 mm (0.006 in)

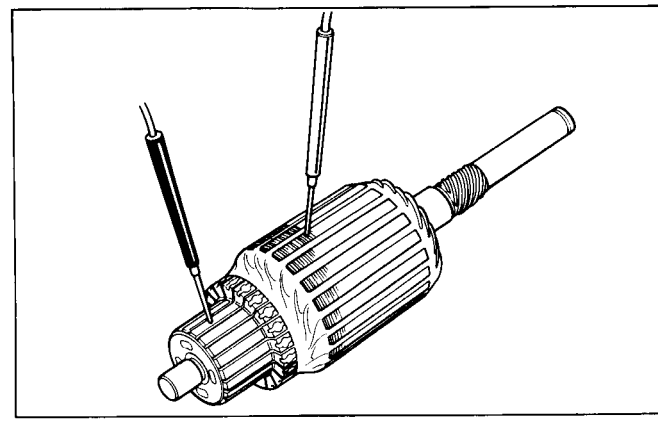


• ARMATURE

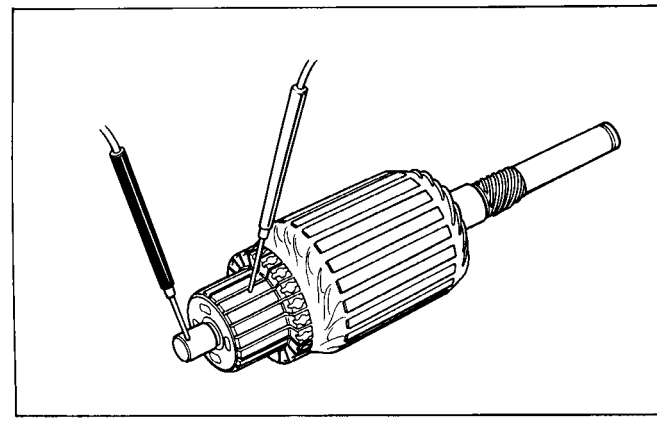
Check the armature with an armature tester, if it is available.



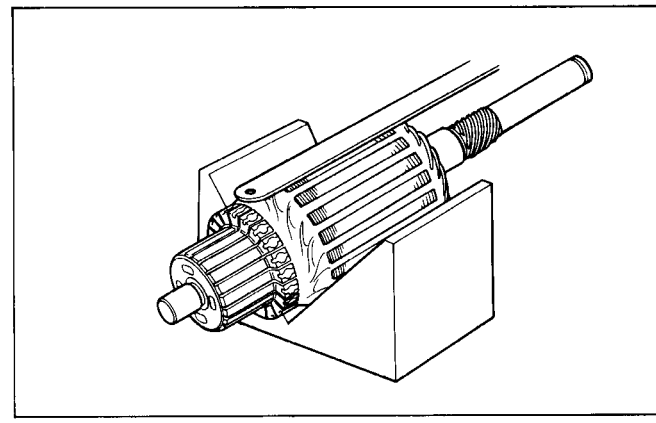
• Continuity Check – Segments
Check for continuity between the segments.
If an open circuit exists between any two segments, replace the armature.



• Short Circuit Test – Core-to-Commutator
Check for continuity between the commutator and armature coil core.
If continuity exists, replace the armature.



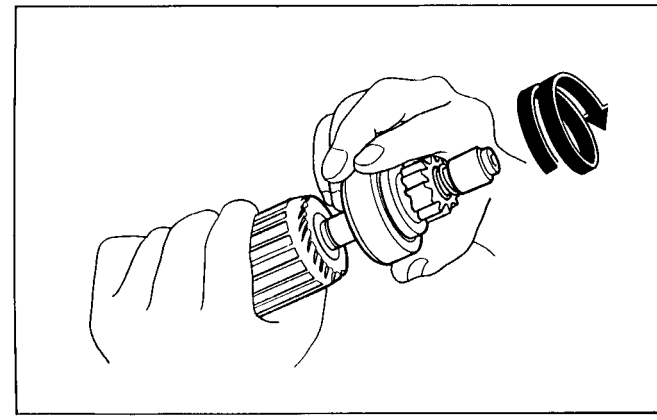
• Short Circuit Test – Shaft-to-Commutator
Check for continuity between the commutator and armature shaft.
If continuity exists, replace the armature.



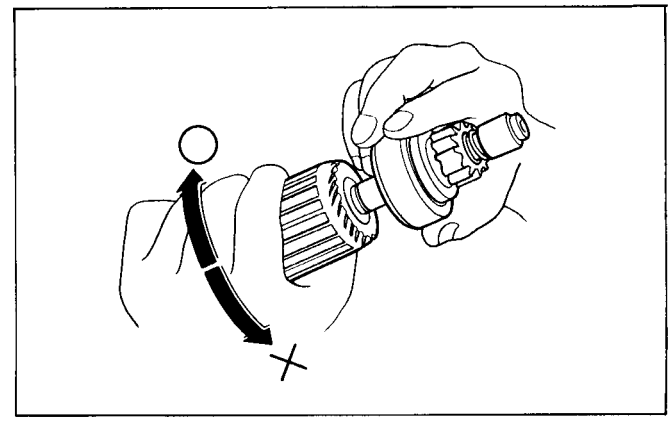
• Short Circuit Test – Armature
Follow the manufacturer's instructions provided with the armature tester.
If using an ordinal growler, place the armature on the growler and hold a hacksaw blade on the armature core.
If the blade is attached to the core, or vibrates while the core is turned, the armature is shorted and must be replaced.

- OVERRUNNING CLUTCH

1) Check the overrunning clutch for smooth axial movement. Apply oil or replace the overrunning clutch if necessary.



2) Check the clutch movement by holding the rotor and turning the clutch. The clutch should turn freely counter-clockwise and should not turn clockwise.
3) Check the pinion gear for wear or damage and replace if necessary.

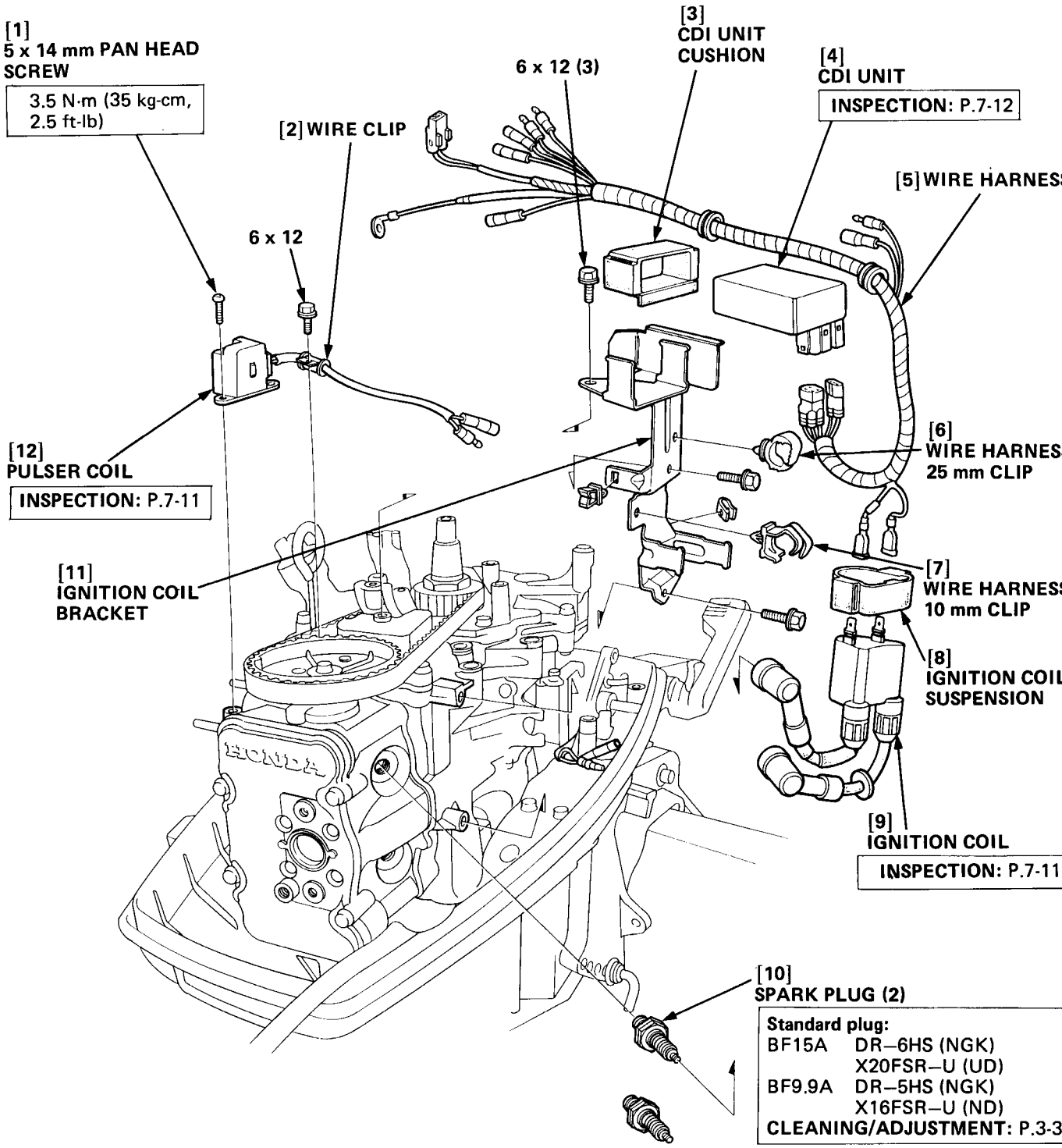


NOTE

- If the pinion gear is worn or damaged, the flywheel ring gear must be inspected.

CDI UNIT, IGNITION COIL, PULSER COIL

a. DISASSEMBLY/REASSEMBLY

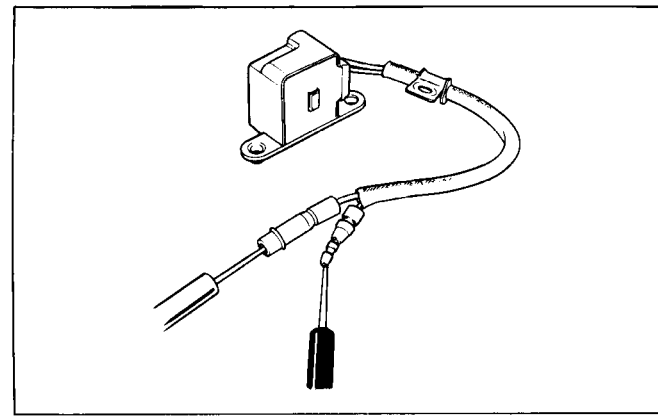


b. INSPECTION

• PULSER COIL

Measure the resistance between the leads with a tester.

Resistance	351–429 Ω

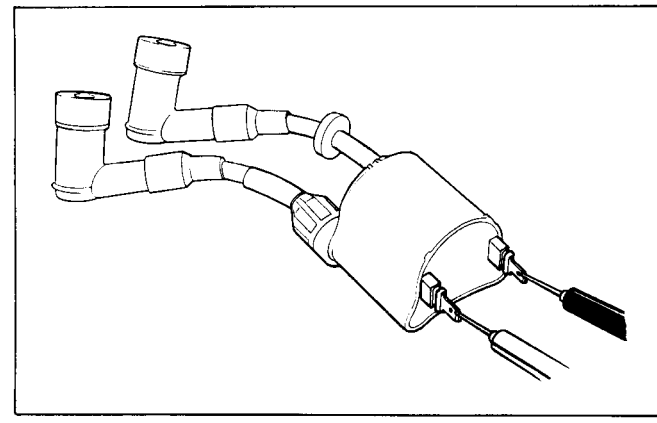


• IGNITION COIL

Primary coil

Attach the tester leads to the flat terminals and measure the primary coil resistance.

Resistance	0.35–0.43 Ω

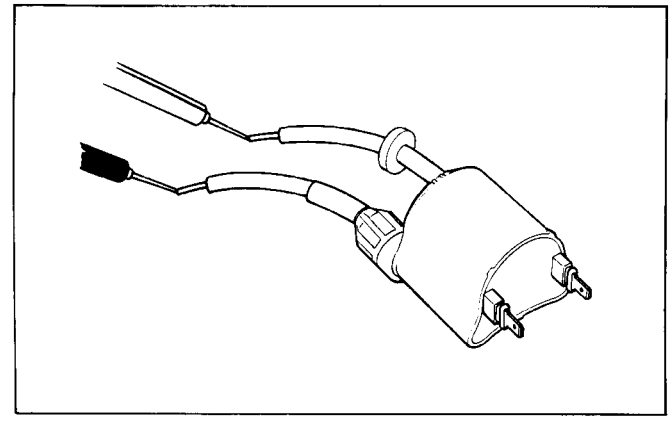


Secondary coil

Remove the spark plug cap.

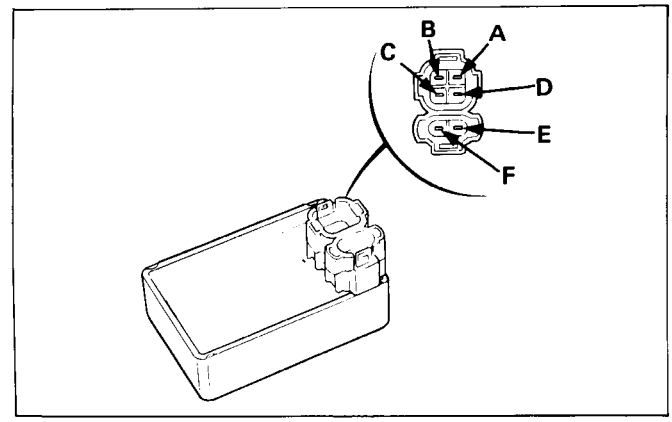
Attach the tester terminals to the high tension wires and measure the secondary coil resistance.

Resistance	8.01–9.79 Ω



• CDI UNIT

Measure the resistance between each terminal of the CDI unit coupler.
Replace the CDI unit if the measurement is out of the specification listed in the table below.



NOTE

- The CDI unit is fully transistorized. For accurate testing, it is necessary to use a specified tester. Use of an improper test or measurements in improper range may give false readings.
- Use the tester below.
  SANWA SP−15D No. 07308−0020000

Range: SP−15D x KΩ range

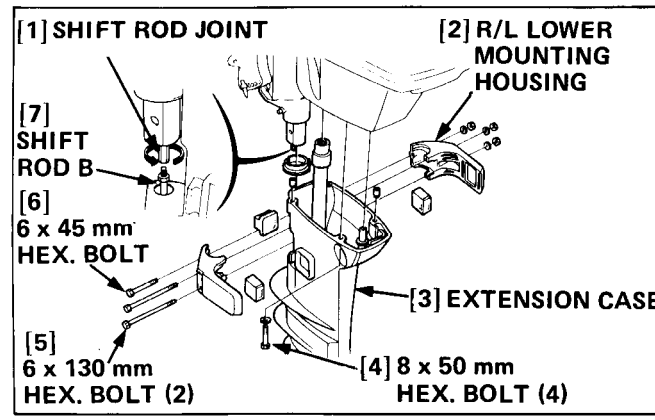
Unit: kΩ

Black tester read / Red tester lead	A	B	C	D	E	F
A		50–500	50–500	∞	100–∞	100–∞
B	20–200		0–5	∞	50–500	50–500
C	20–200	0–5		∞	50–500	50–500
D	∞	∞	∞		∞	∞
E	50–500	5–50	5–50	∞		∞
F	50–500	0.5–20	0.5–20	∞	5–50	

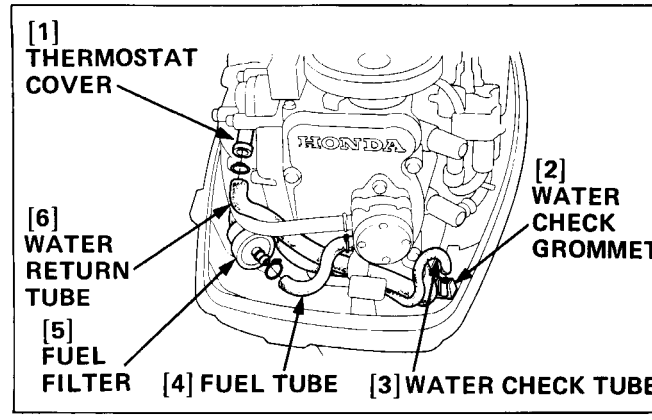
ENGINE REMOVAL/INSTALLATION

REMOVAL

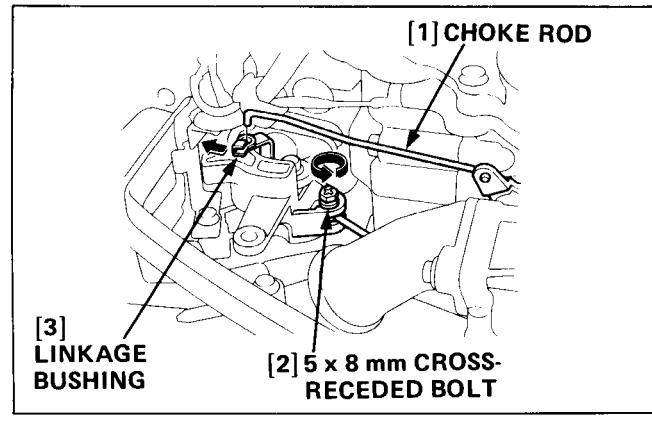
1) Remove a 6 x 45 mm hex. bolt and two 6 x 130 mm hex. bolts and remove the right and left lower mounting housings.
   Disconnect the shift rod joint from the shift rod B.
   Remove four 8 x 50 mm hex. bolts and remove the extension case.



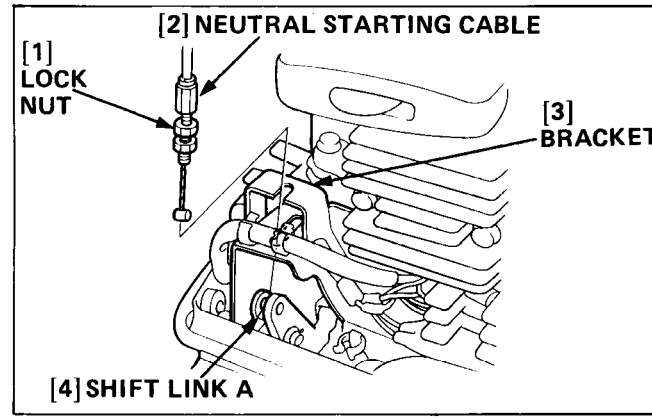
2) Disconnect the water check tube from the water check grommet.
   Disconnect the water return tube from the thermostat cover.
   Disconnect the fuel tube from the fuel filter.



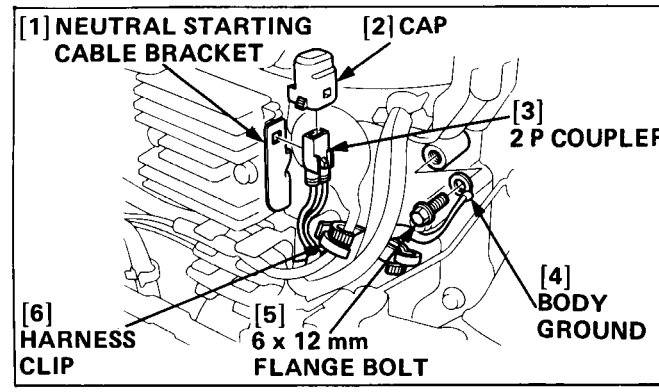
3) Turn the linkage bushing, then pull the choke rod out of the throttle lever.
   Loosen a 5 x 8 mm cross-receded bolt



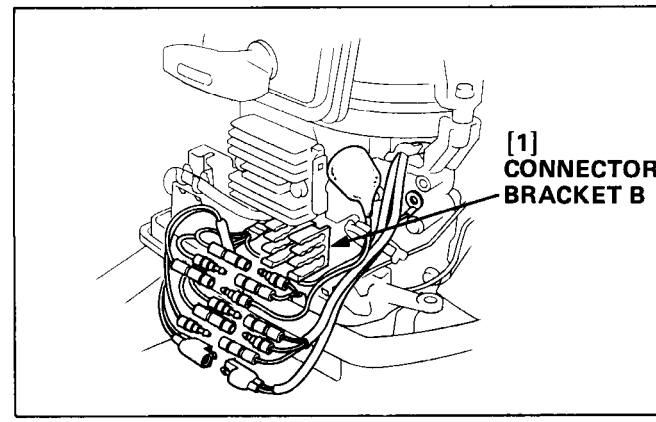
4) Loosen the neutral starting cable lock nut, remove the cable from the bracket and disconnect the cable end from the shift link A.



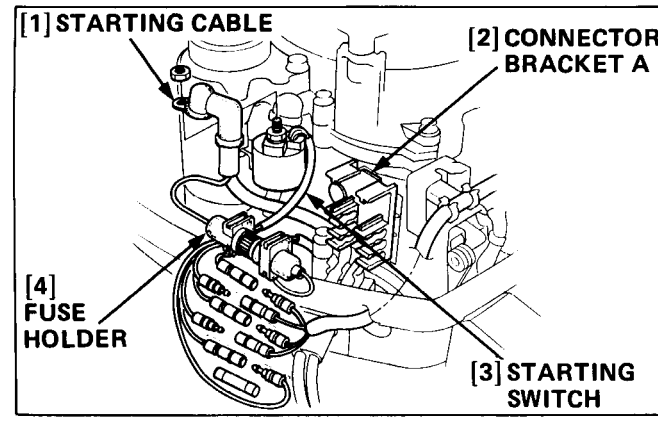
5) Remove the cap and disconnect the 2P coupler from the neutral starting cable bracket.
Remove the harness clip and 6 x 12 mm flange bolt and disconnect the body ground.



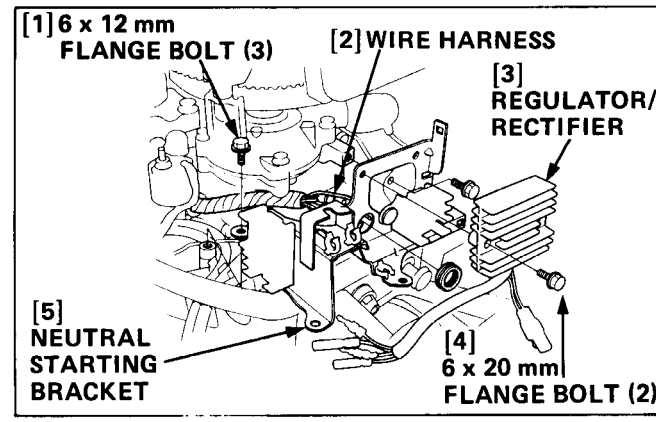
6) Remove all connectors from the connector bracket B.



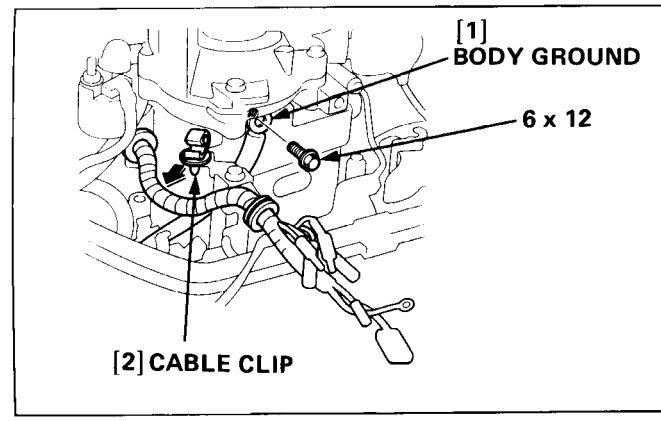
7) Disconnect the starting cable from the starting switch of the starter motor.
Remove the fuse holder and all connectors from the connector bracket A.



8) Remove two 6 x 20 mm flange bolts and remove the regulator/rectifier.
Remove four 6 x 12 mm flange bolts, pull the wire harness out of the neutral starting bracket, and remove the bracket.

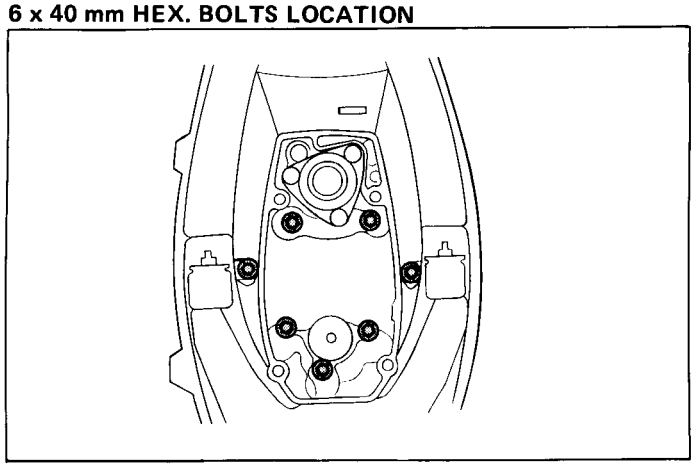


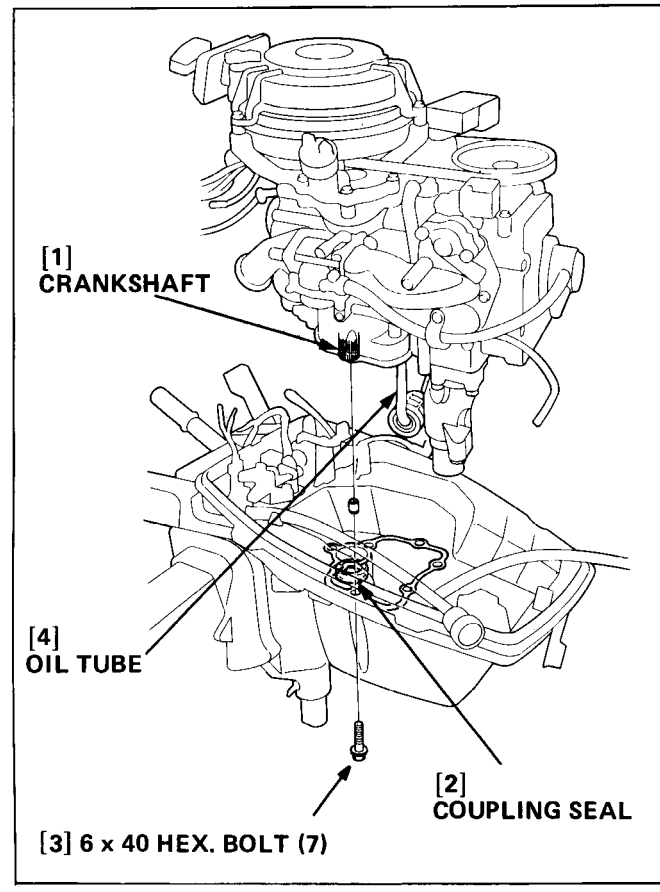
9) Remove a 6 x 12 mm flange bolt and disconnect the starting cable body ground.
Remove the wire harness from the cable clip.



10) Remove seven 6 x 40 mm hex. bolts, raise the engine and remove it.

6 x 40 mm HEX. BOLTS LOCATION





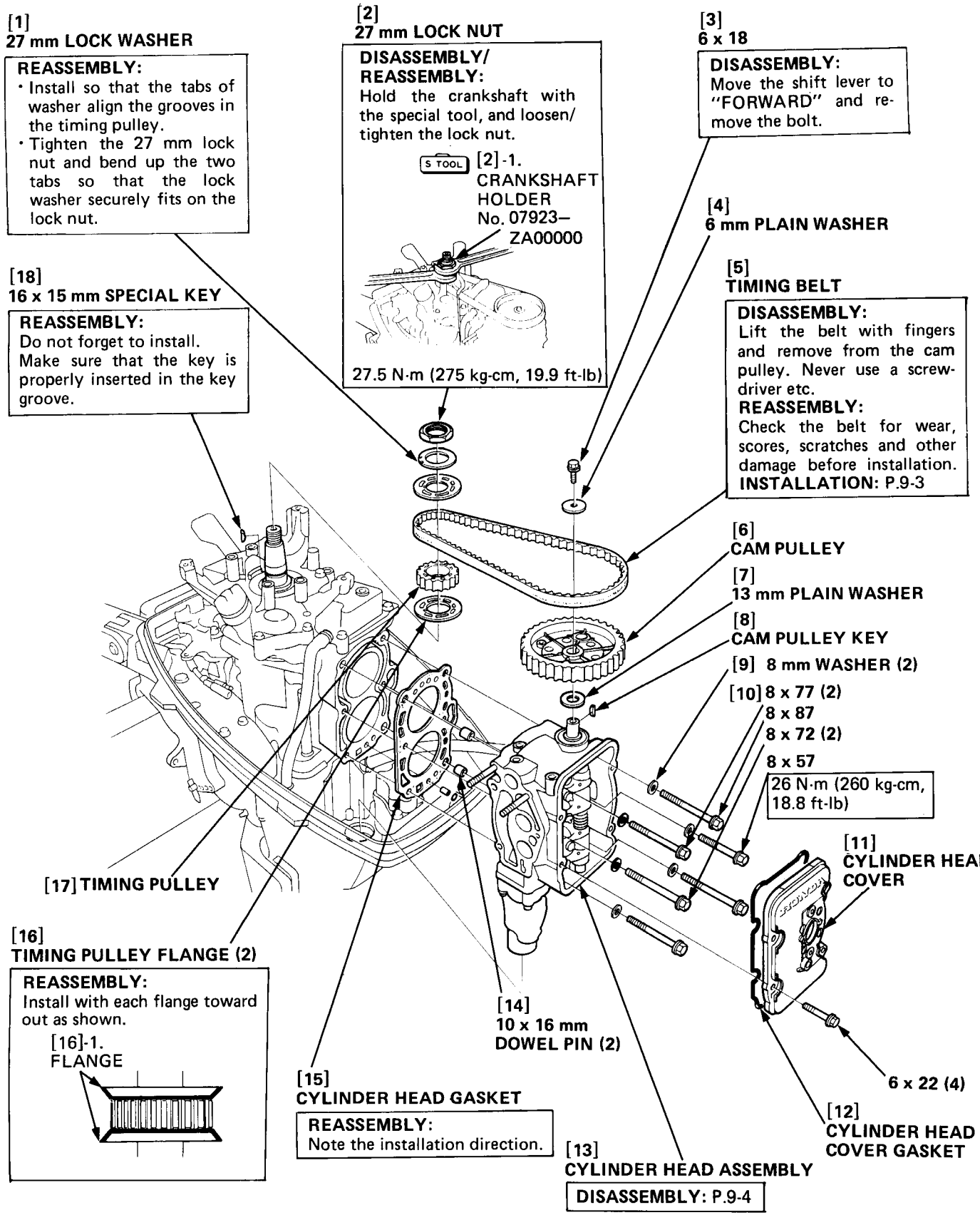
INSTALLATION

Installation is the reverse order of removal.
Note the following.

- On engine installation, take care not to dislocate the coupling seal spring with the crankshaft end.
- Be sure not to pinch the oil tube of the oil filter with the oil case flanges.
- Be sure to install the grommet on the neutral starting bracket when you insert the wire harness through the bracket.
- Refer to pages 1-6 and 1-8 for the connector locations in the connector brackets A and B.
- Refer to page 7-4 for the wire harness body ground angle.
- After installing the engine, adjust;
  - Neutral starting cable (P. 3-5)
  - Throttle rod (P. 3-6)
  - Shift rod (P 3-6)

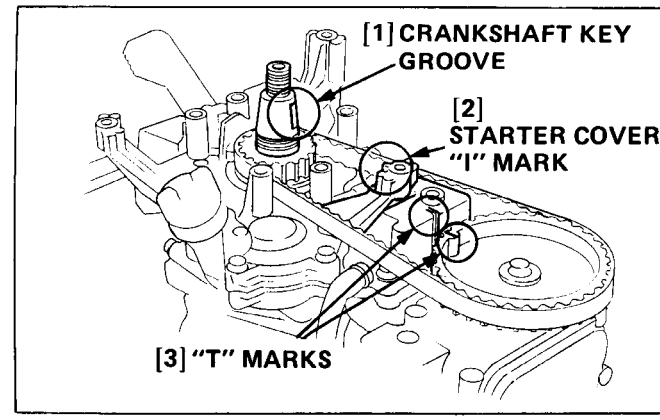
CYLINDER HEAD, TIMING BELT

TIMING BELT, PULLEY



• TIMING BELT INSTALLATION

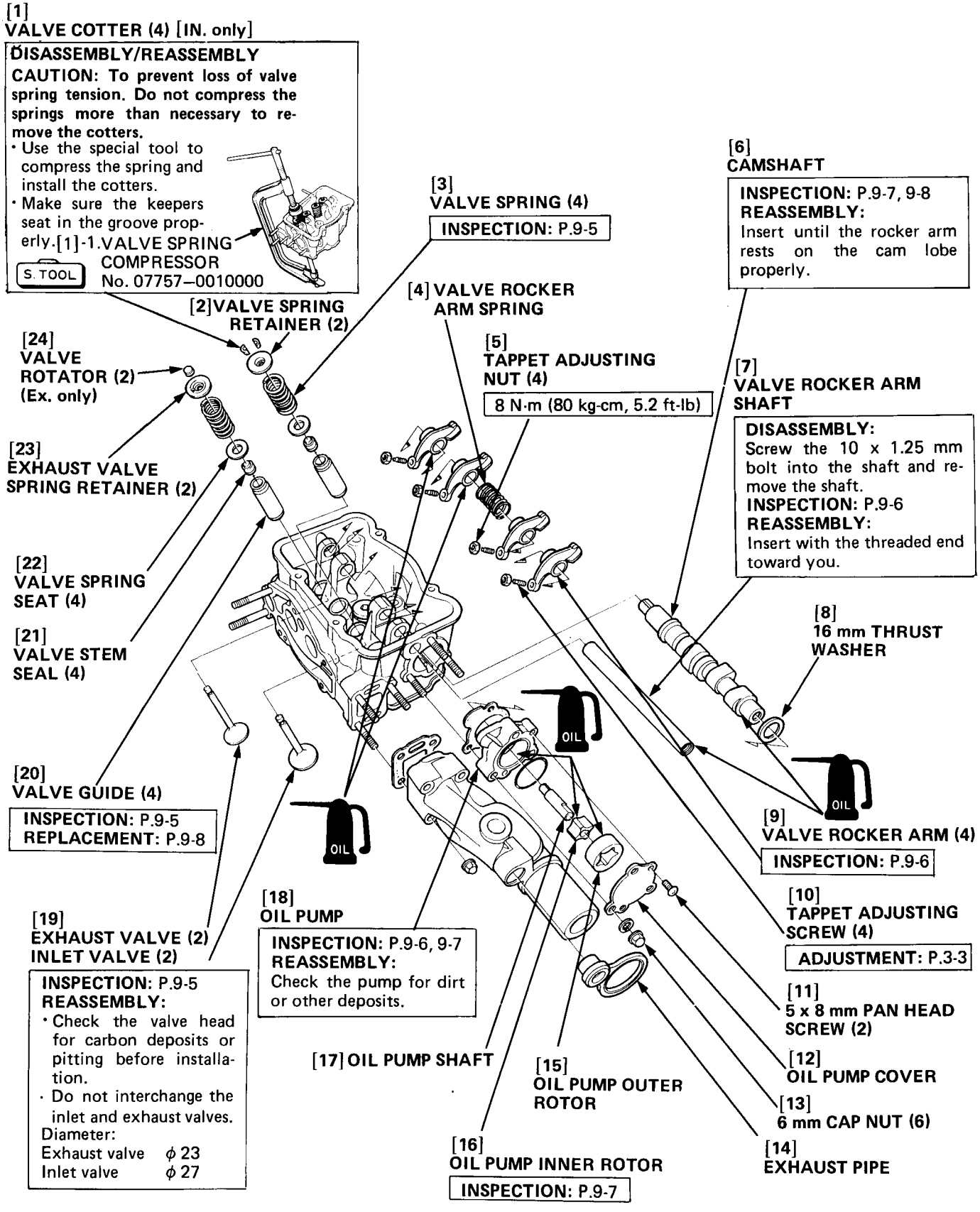
Install the cylinder head assembly on the engine and install the cam pulley. Rotate the cam pulley by hand and align its "T" mark with the "T" mark on the breather cover.
Set the shift lever in "FORWARD" or "REVERSE", rotate the propeller until the crankshaft key groove aligns with the "I" mark on the starter cover, and install the timing belt.



CYLINDER HEAD, VALVE

a. DISASSEMBLY/REASSEMBLY

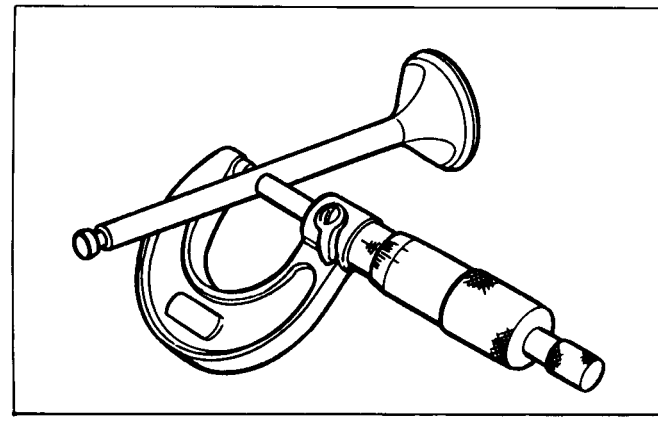
Loosen the tappet adjusting screw and nut on the valve rocker arms to disassemble the camshaft and valve rocker arm shaft.



b. INSPECTION

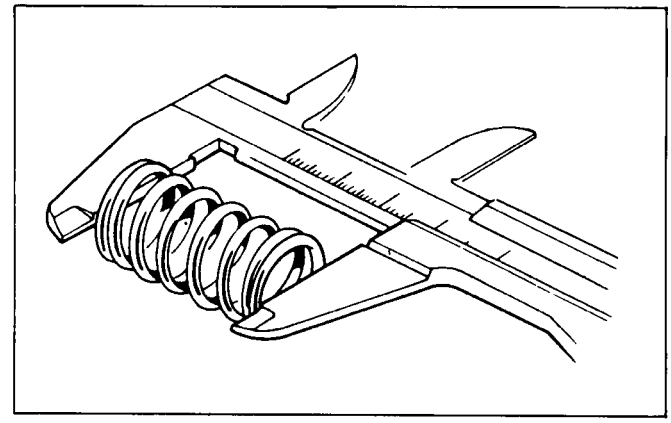
- VALVE STEM O.D.

	Standard	Service limit
IN	5.49 mm (0.2161 in)	5.47 mm (0.2153 in)
EX	5.47 mm (0.2153 in)	5.45 mm (0.2145 in)



- VALVE SPRING FREE LENGTH

Standard	Service limit
36.8 mm (1.45 in)	35.3 mm (1.39 in)

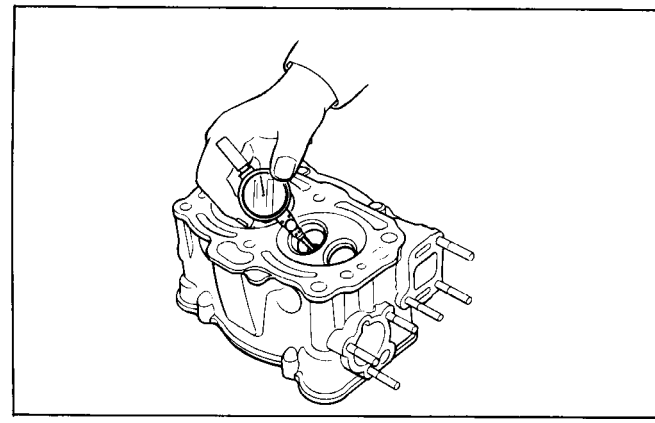


- VALVE GUIDE I.D.

	Standard	Service limit
IN	5.5 mm (0.2165 in)	5.54 mm (0.2181 in)
EX	5.5 mm (0.2165 in)	5.57 mm (0.2192 in)

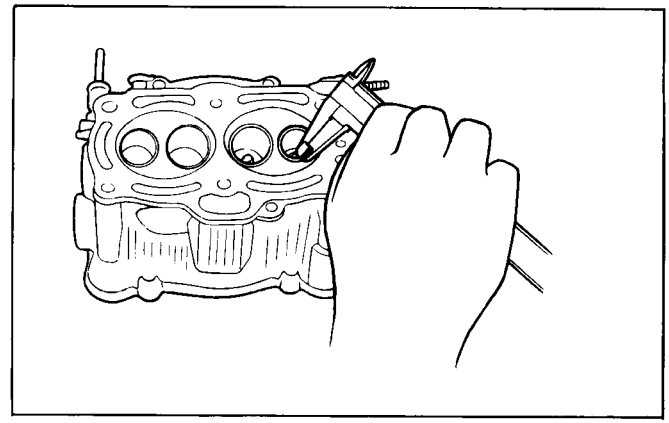
- VALVE GUIDE-TO-STEM CLEARANCE

	Standard	Service limit
IN	0.010–0.037 mm (0.00039–0.00145 in)	0.07 mm (0.00275 in)
EX	0.030–0.057 mm (0.00118–0.00224 in)	0.12 mm (0.00472 in)



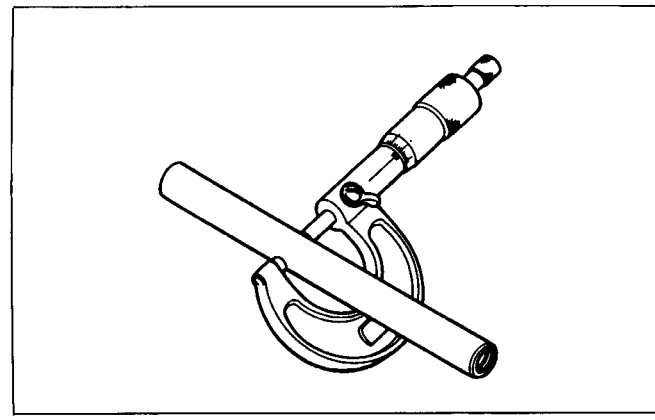
- VALVE SEAT WIDTH

Standard	Service limit
1.0 mm (0.04 in)	2.0 mm (0.078 in)



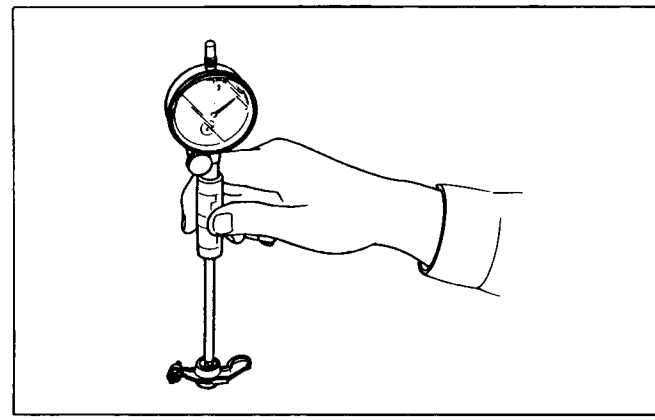
- VALVE ROCKER ARM SHAFT O.D.

Standard	Service limit
12.968 mm (0.5106 in)	12.92 mm (0.5087 in)



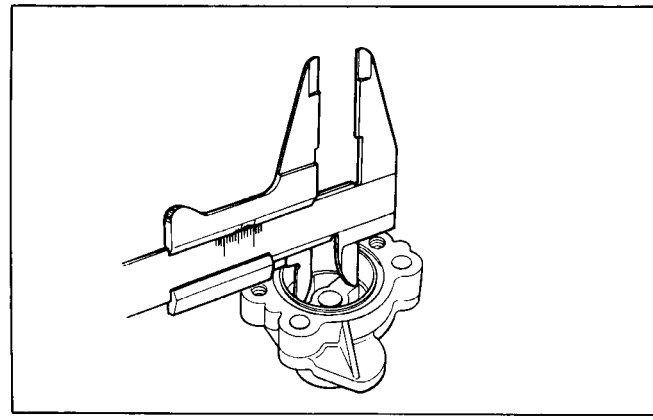
- VALVE ROCKER ARM I.D.

Standard	Service limit
13.0 mm (0.5118 in)	13.04 mm (0.5133 in)



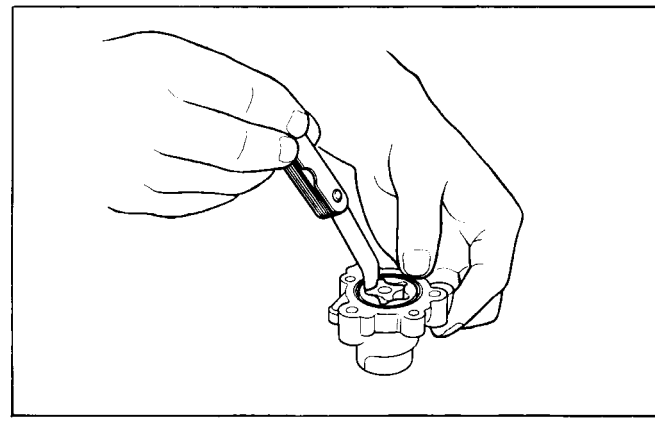
- OIL PUMP BODY I.D.

Standard	Service limit
29.10 mm (1.146 in)	29.30 mm (1.154 in)



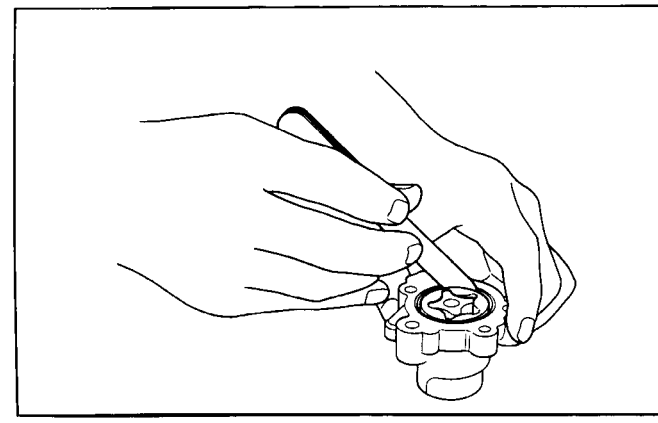
- OIL PUMP INNER ROTOR-TO-OUTER ROTOR CLEARANCE

Standard	Service limit
0.15 mm (0.0059 in)	0.20 mm (0.0079 in)



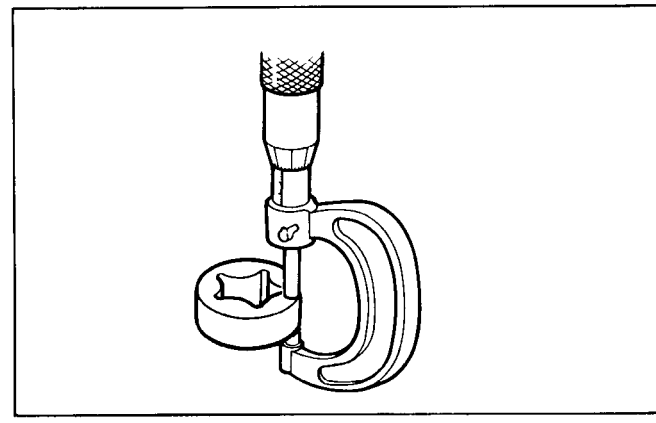
- OIL PUMP BODY-TO-OUTER ROTOR CLEARANCE

Standard	Service limit
0.10–0.21 mm (0.0039–0.0083 in)	0.26 mm (0.0102 in)



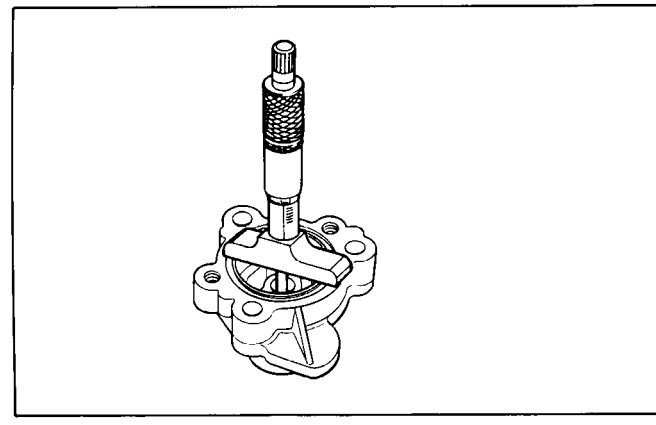
- OUTER ROTOR HEIGHT

Standard	Service limit
13.0 mm (0.51 in)	12.95 mm (0.509 in)



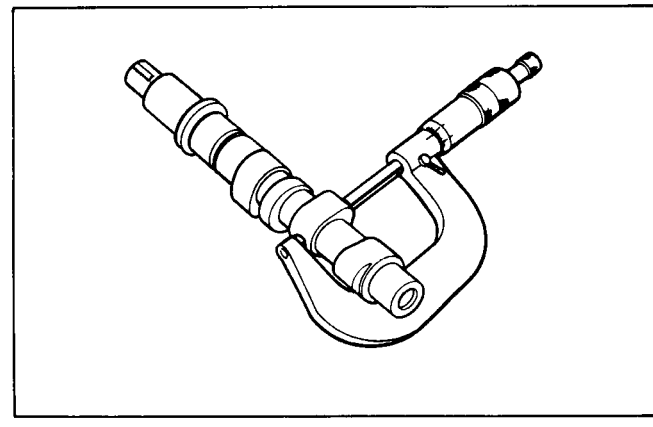
- OIL PUMP BODY DEPTH

Standard	Service limit
13.02 mm (0.513 in)	13.08 mm (0.515 in)



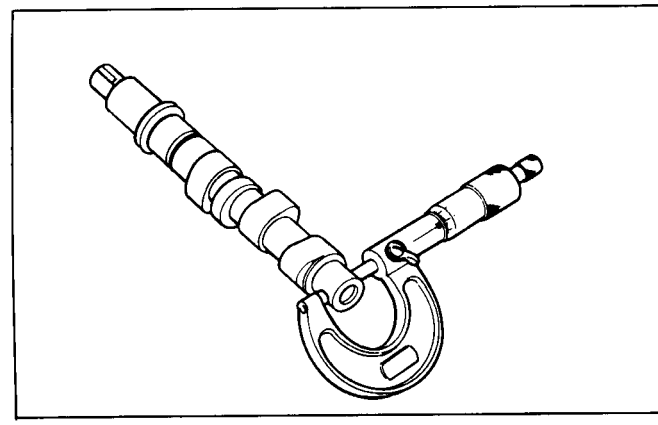
- CAMSHAFT CAM HEIGHT

		Standard	Service limit
BF15A	IN	24.47 mm (0.9634 in)	24.22 mm (0.9535 in)
	EX	24.52 mm (0.9654 in)	24.27 mm (0.9555 in)
BF9.9A	IN	23.89 mm (0.9405 in)	23.64 mm (0.9307 in)
	EX	23.94 mm (0.9425 in)	23.69 mm (0.9326 in)



• CAMSHAFT JOURNAL O.D.

	Standard	Service limit
Oil pump side	15.984 mm (0.6292 in)	15.95 mm (0.6279 in)
Pulley side	17.984 mm (0.7080 in)	17.95 mm (0.7066 in)



c. VALVE GUIDE REPLACEMENT

1) Chill the replacement valve guides in the freezer section of refrigerator for about an hour.
2) Use a hot plate or oven to heat the cylinder head evenly to 150°C (300°F). Check the temperature with a temperature indicating stick (available at welding supply stores) or equivalent.

WARNING

- **To avoid burns, use heavy gloves when handling the heated cylinder head.**

CAUTION

- **Do not use a torch to heat the cylinder head; warpage of the cylinder head may result.**
- **Do not get the head hotter than 150°C (300°F); excessive heat may loosen the valve seats.**

3) Remove the heated cylinder head from hot plate and support it with wooden blocks.
   Drive the valve guides out of the head from the combustion chamber side.

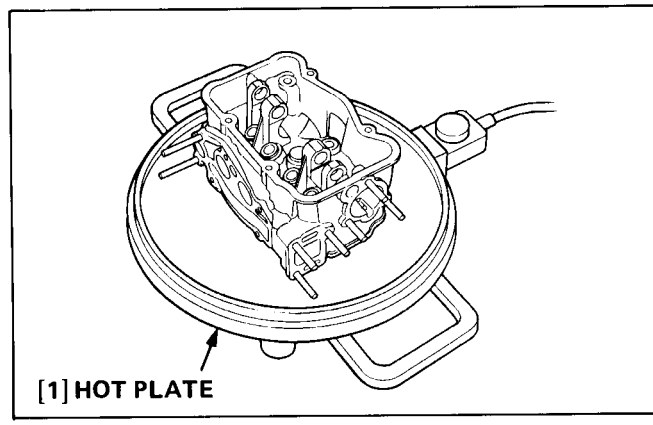
CAUTION

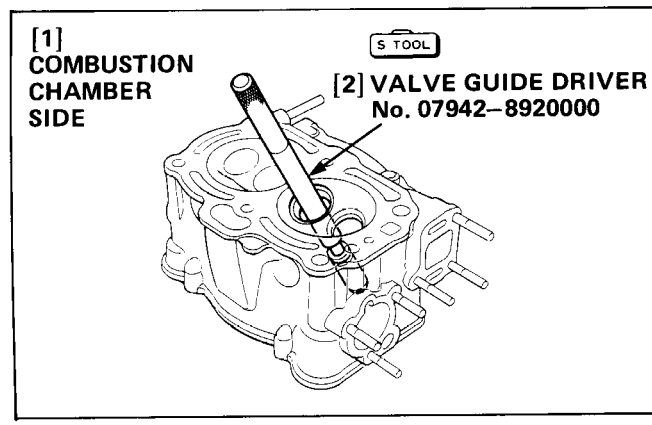
- **When driving the valve guides out, be careful not to damage the head.**

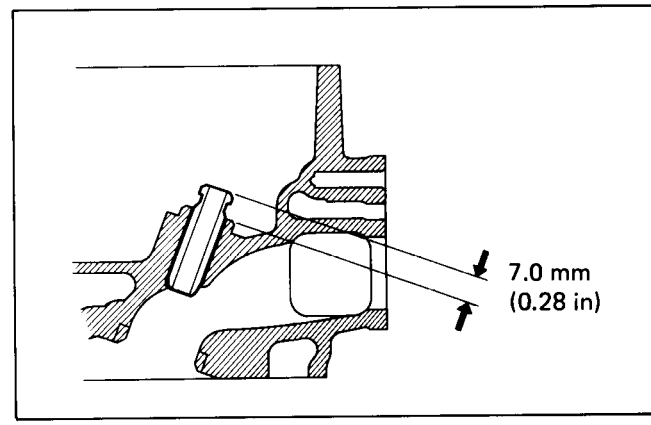
4) Remove the new valve guides from the refrigerator one at a time as needed.

5) Install the new valve guides from the valve spring side of the cylinder head. Drive each valve guide to the specified height (measured from the top of the valve guide to the cylinder casting as shown).

6) After installation, inspect the valve guide for damage. Replace the guide if damaged.







VALVE GUIDE REAMING

NOTE

- For best results, be sure the cylinder head is at room temperature before reaming valve guides.

1) Coat the reamer and valve guide with cutting oil.

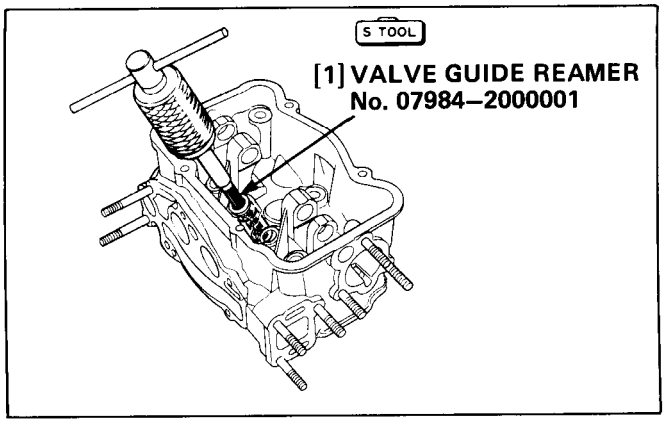
2) Rotate the reamer clockwise through the valve guide the full length of the reamer.

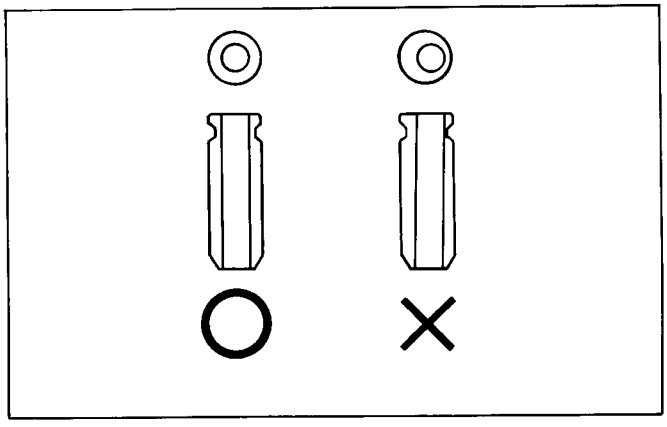
3) Continue to rotate the reamer clockwise while removing it from the valve guide.

4) Thoroughly clean the cylinder head to remove any cutting residue.

5) Check the valve guide bore; it should be straight, round and centered in the valve guide. Insert the valve and check operation. If the valve does not operate smoothly, the guide may have been bent during installation. Replace the valve guide if it is bent or damaged.

6) Check the Valve Guide-to-Stem Clearance (P. 9-5).

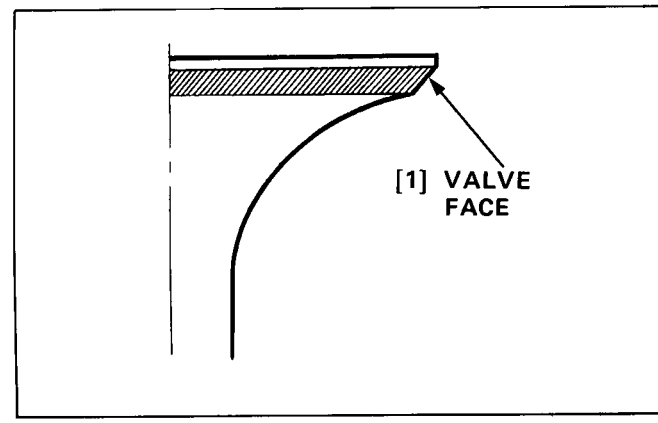


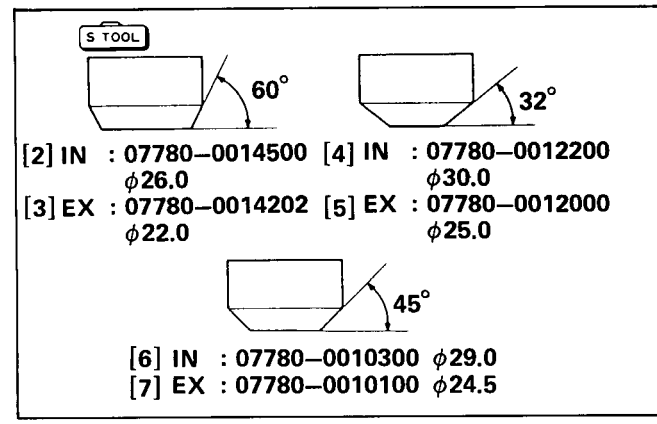


d. VALVE SEAT INSPECTION AND RECONDITIONING

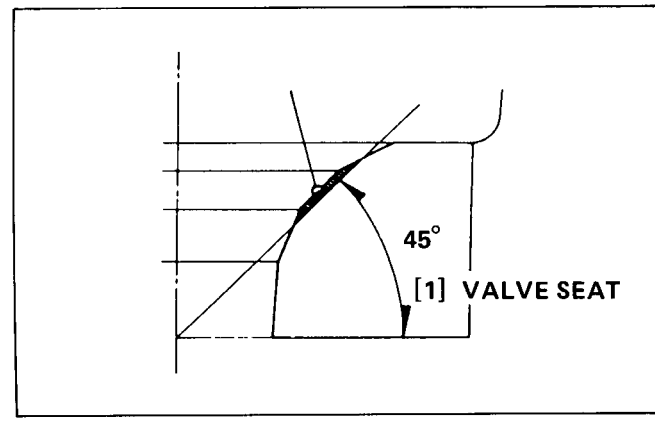
1) Thoroughly clean the combustion chambers and valve seats to remove carbon deposits.
Apply a light coat of Prussian Blue or erasable felt-tipped marker ink to the valve faces.

2) Insert the valves, and then lift them and snap them closed against their seats several times. Be sure the valve does not rotate on the seat. The transferred marking compound will show any area of the seat that is not concentric.



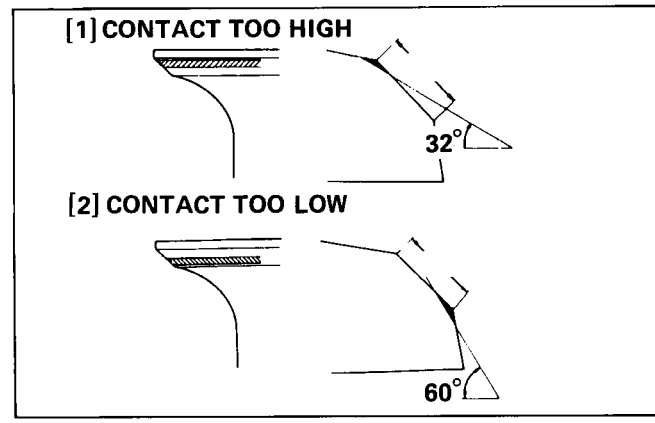


3) Using a 45° cutter, remove enough material to produce a smooth and concentric seat.
Turn the cutter clockwise, never counterclockwise. Continue to turn the cutter as you lift it from the valve seat.



4) Use the 30°–32° and 60° cutters to narrow and adjust the valve seat so that it contacts the middle of the valve face. The 30°–32° cutter removes material from the top edge. The 60° cutter removes material from the bottom edge. Be sure that the width of the finished valve seat is within specification.

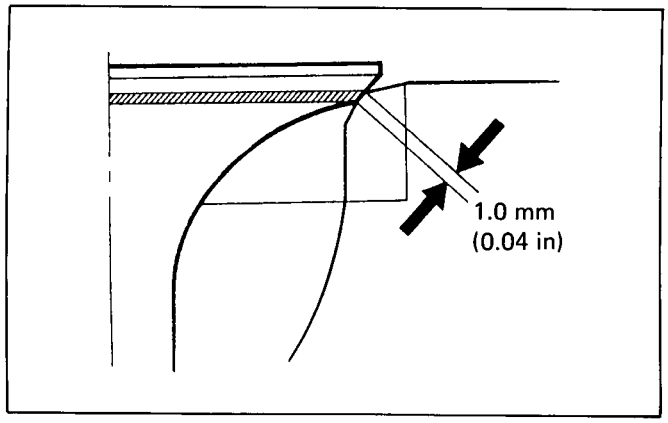
STANDARD VALVE SEAT WIDTH: 1.0 mm (0.04 in)



5) Make a light pass with 45° cutter to remove any possible burrs at the edges of the seat.

6) After resurfacing the seats, inspect for even valve setting. Apply Prussian Blue compound or erasable felt-tipped marker ink to the valve faces. Insert the valves, and then lift them and snap them closed against their seats several times. Be sure the valve does not rotate on the seat.
The seating surface, as shown by the transferred marking compound, should have good contact all the way around.

7) Lap the valves into their seats, using a hand valve lapper and lapping compound (commercially available).

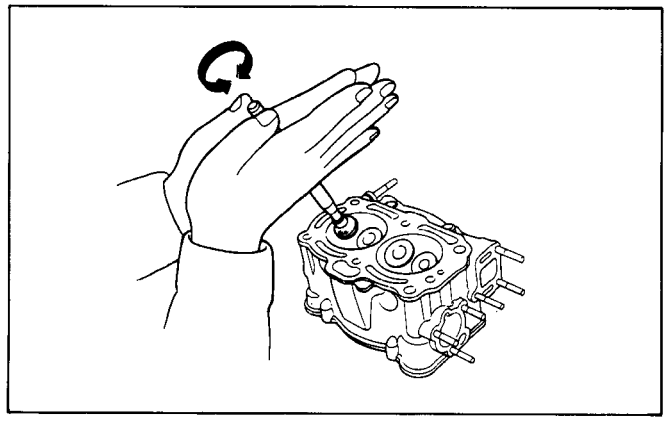


CAUTION

- **To avoid severe engine damage, be sure to remove all lapping compound from the engine before reassembly.**

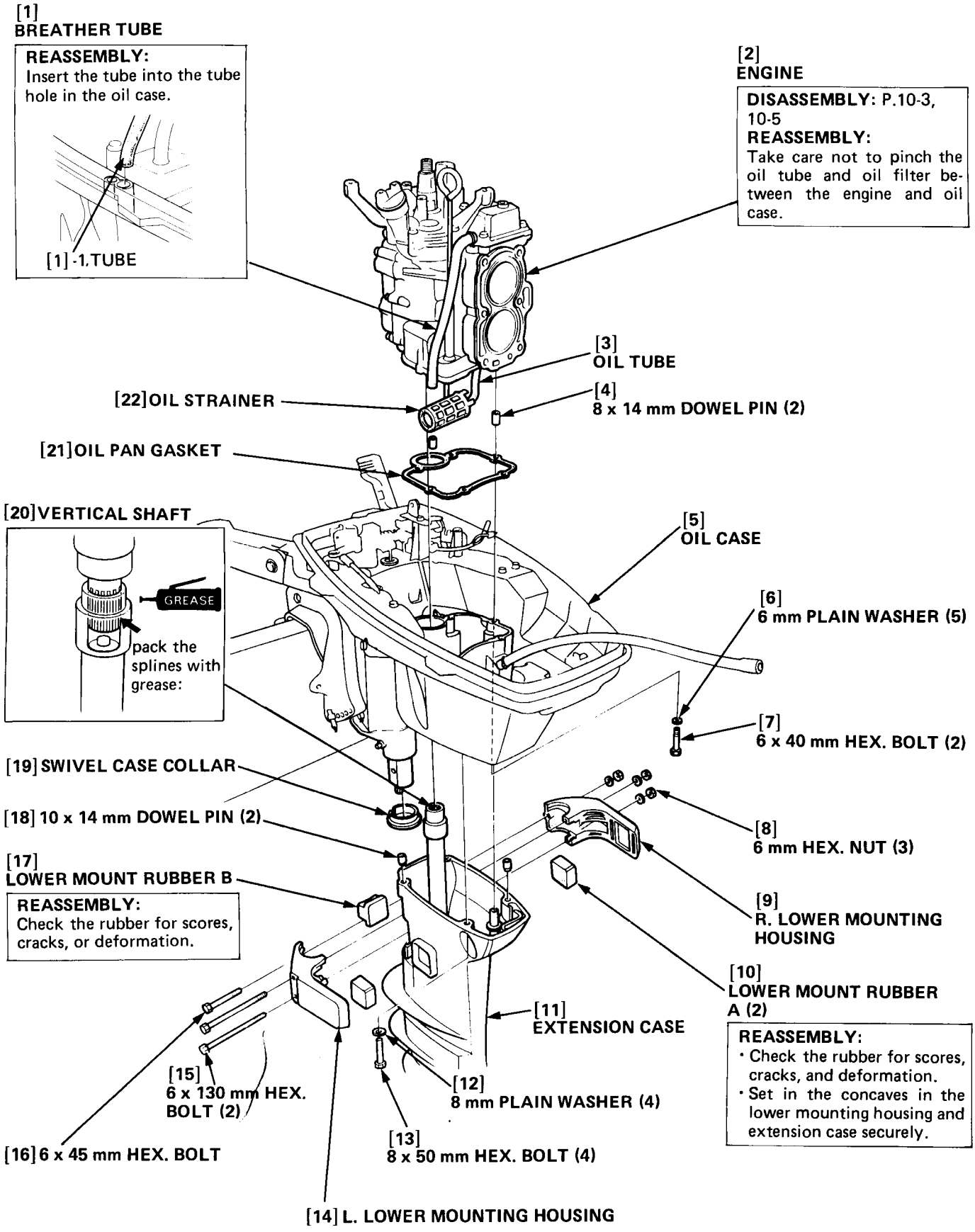
NOTE

- Check valve clearance after reassembly (P. 3-3).

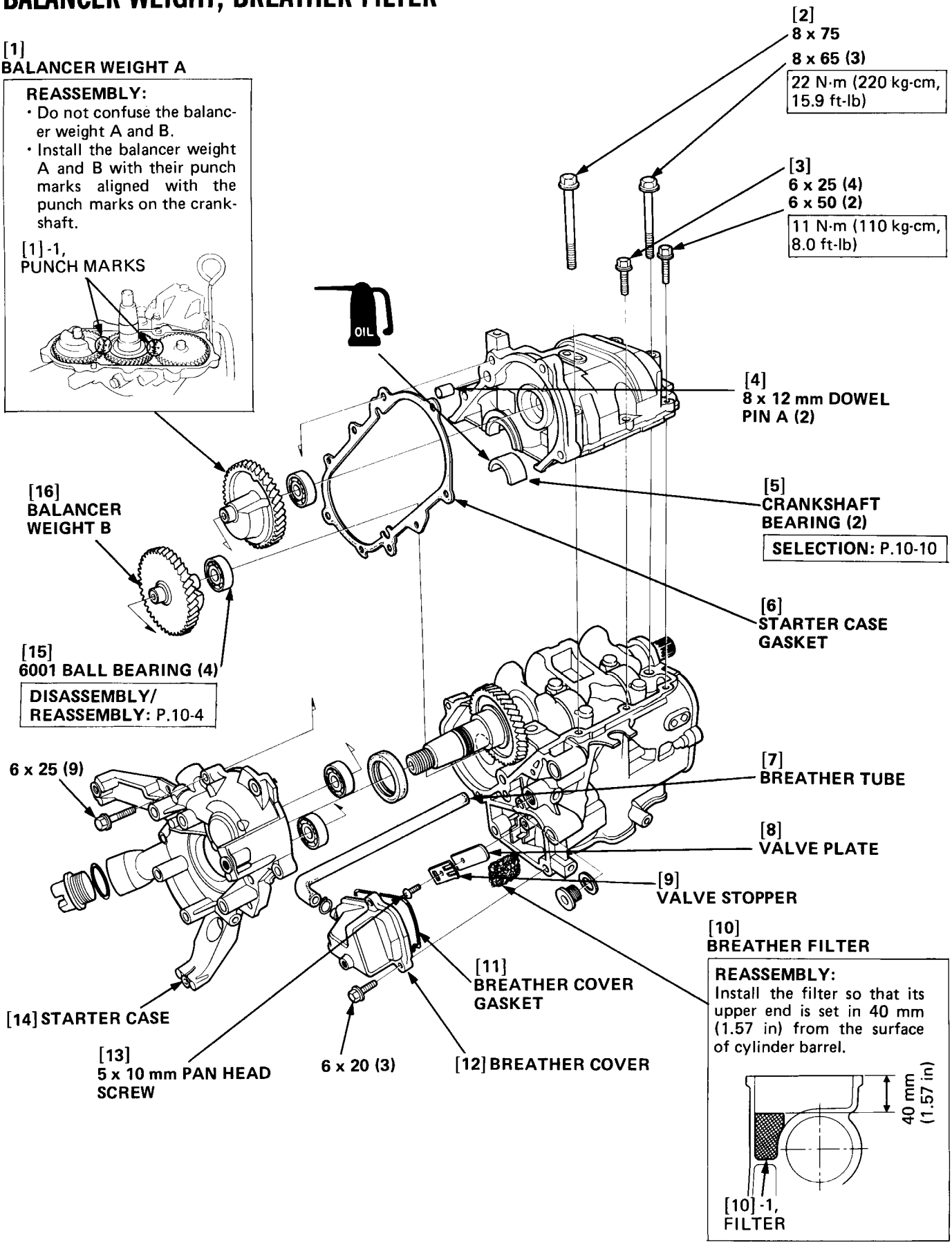


CYLINDER BARREL, CRANKSHAFT, PISTON

INSTALLATION/REMOVAL

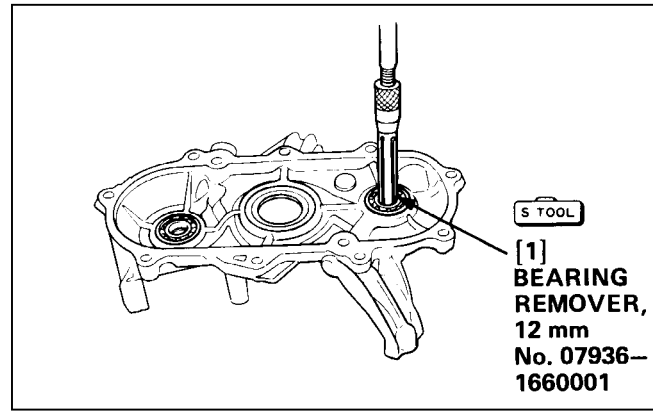


BALANCER WEIGHT, BREATHER FILTER



• 6001 BALL BEARING

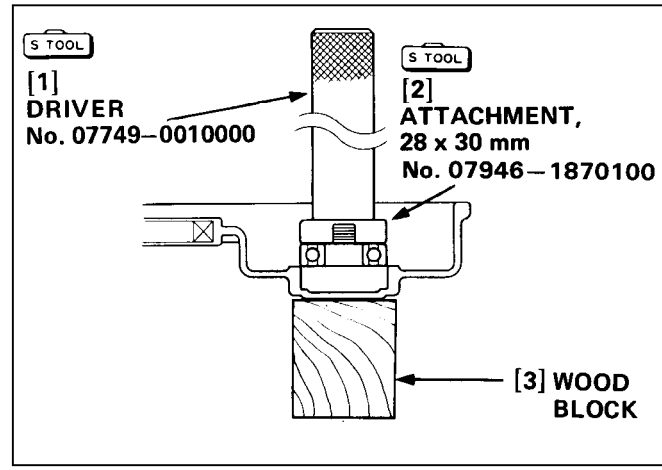
REMOVAL:
Pull the bearings off the starter case or cylinder barrel using 12 mm bearing remover (special tool).



INSTALLATION:
Apply oil to the new bearings, then drive them into the starter case or cylinder barrel using the driver, 28 x 30 mm attachment (special tools).
Before driving, be sure to place a wood block under the starter case.

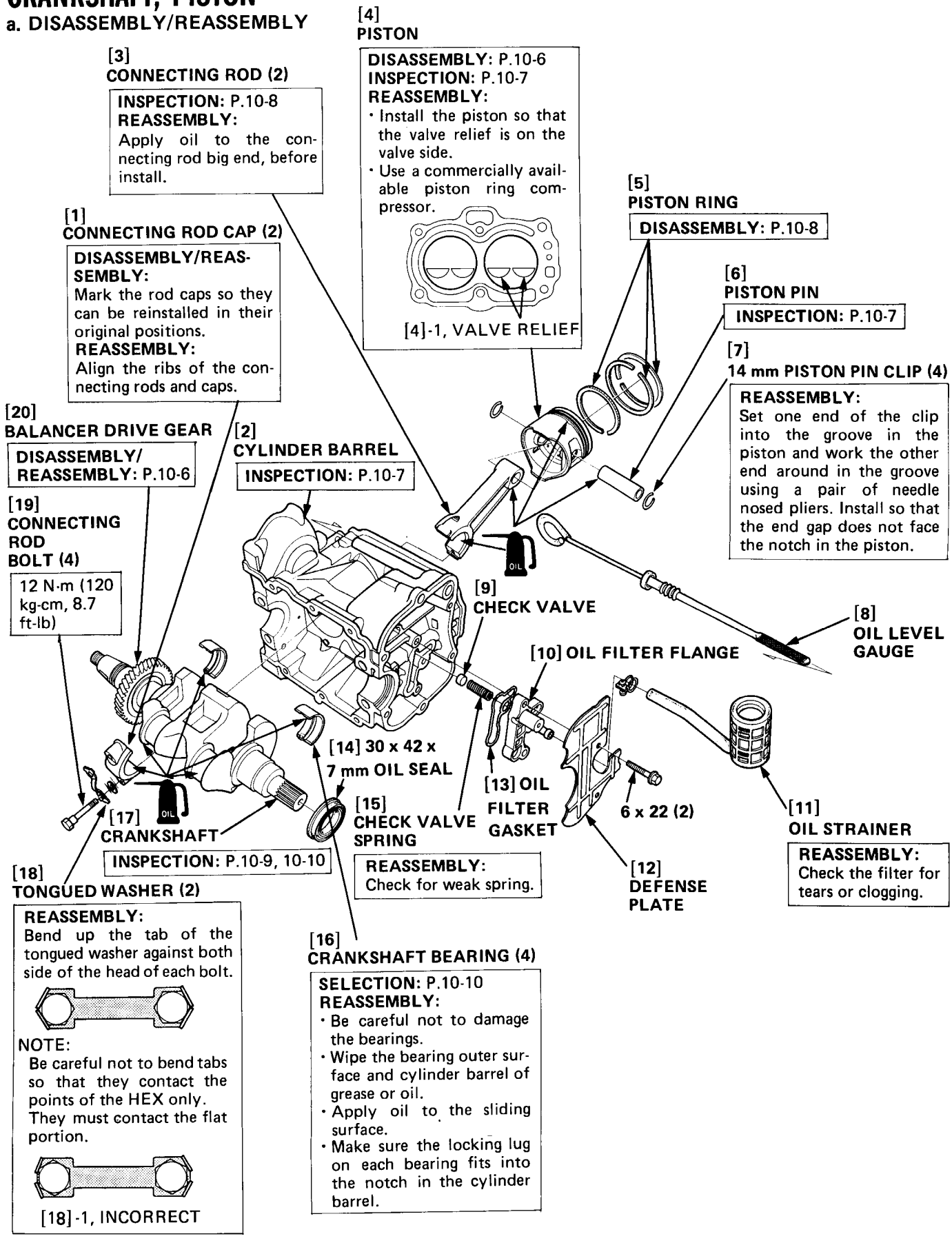
NOTE

- To avoid damage to the case, do not use the pilot with the special tool.



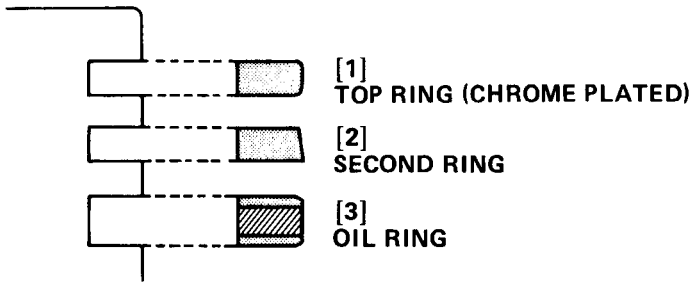
CRANKSHAFT, PISTON

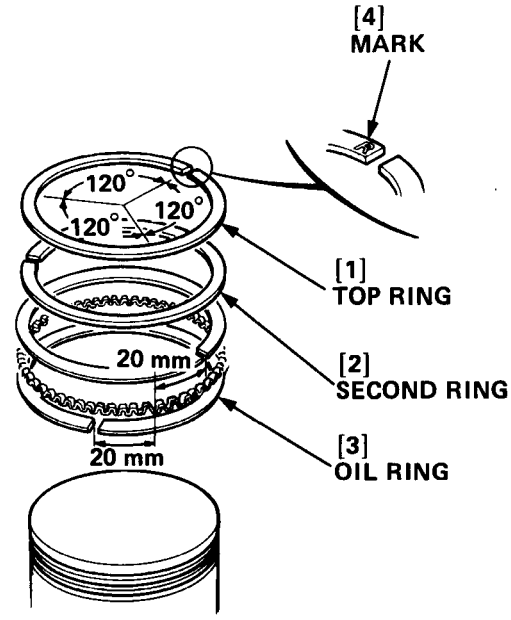
a. DISASSEMBLY/REASSEMBLY



PISTON RING

- Install the rings with the marking facing up.
- Be careful not to interchange the top and second rings.
- After installation, be sure that the rings rotate freely in the piston groove.
- Stagger the ring end gaps 120° apart. Do not align with the piston pin or thrust sides.

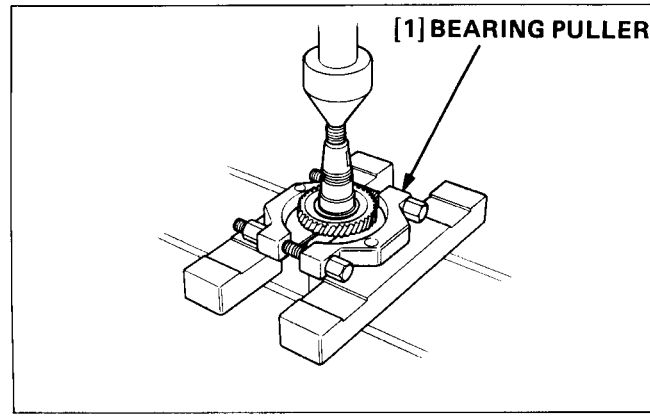




• BALANCER DRIVE GEAR

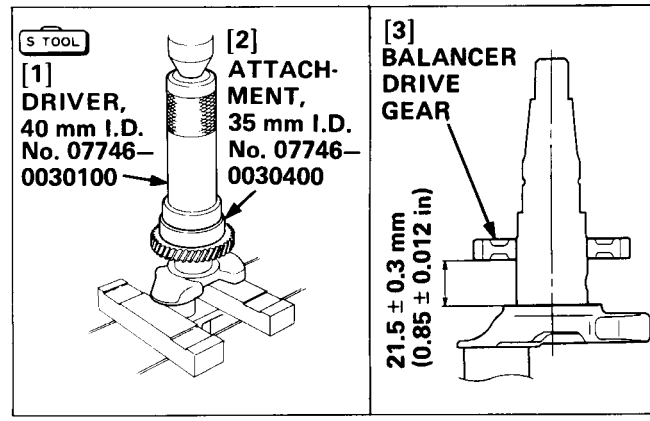
REMOVAL:

Make a mark on the crankshaft and balancer drive gear.
Set the commercially available bearing puller under the balancer drive gear and drive out the gear using a hydraulic press.



INSTALLATION:

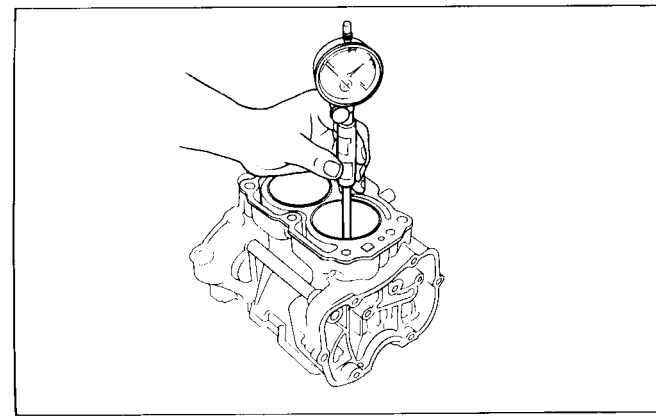
Using the old gear for reference, mark a line at the same position on the new balancer drive gear.
Use a hydraulic press and the special tools to press on the balancer drive gear 21.5 ± 0.3 mm (0.85 ± 0.012 in) from top of the crankshaft weight.
Be sure to align the marks.



b. INSPECTION

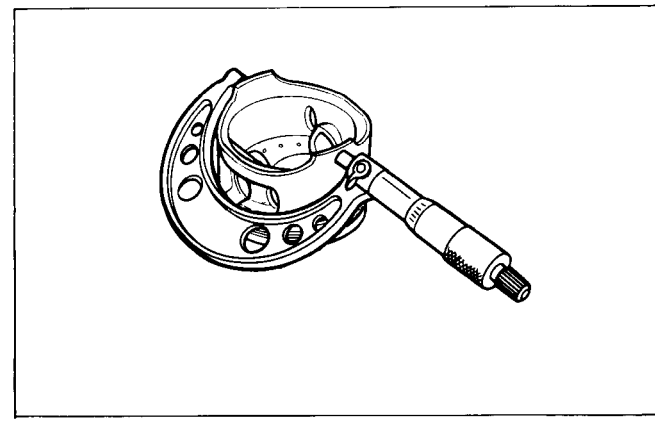
- CYLINDER I.D.

Standard	Service limit
58.0 mm (2.28 in)	58.055 mm (2.2856 in)



- PISTON SKIRT O.D.

Standard	Service limit
57.985 mm (2.2829 in)	57.92 mm (2.280 in)

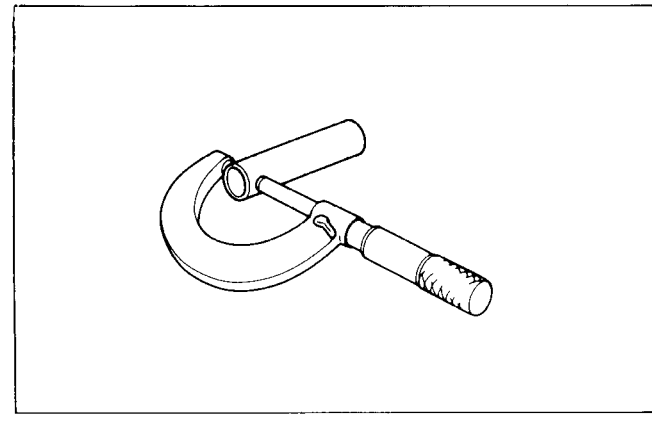


- CYLINDER-TO-PISTON CLEARANCE

Standard	Service limit
0.015–0.050 mm (0.0006–0.0020 in)	0.1 mm (0.0039 in)

- PISTON PIN BORE I.D.

Standard	Service limit
14.002 mm (0.05513 in)	14.02 mm (0.552 in)

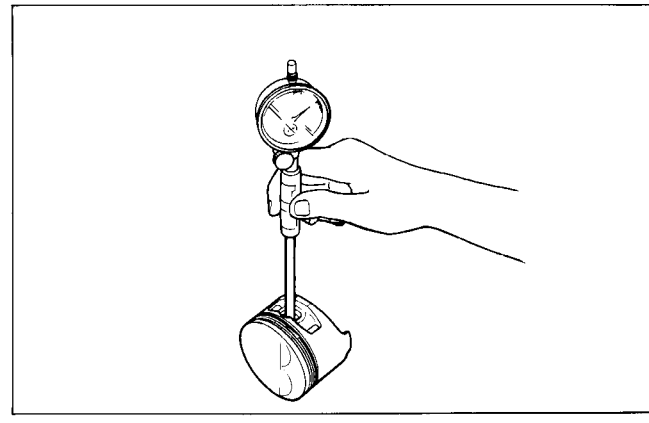


- PISTON PIN O.D.

Standard	Service limit
14.0 mm (0.55 in)	13.97 mm (0.550 in)

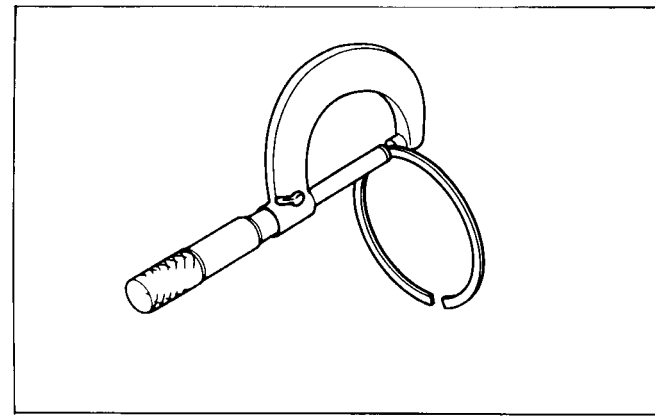
- PISTON PIN BORE-TO-PISTON PIN CLEARANCE

Standard	Service limit
0.002–0.014 mm (0.00007–0.00055 in)	0.04 mm (0.002 in)



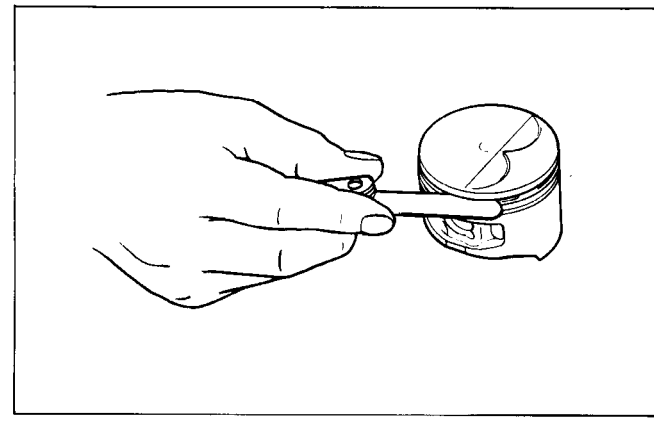
- PISTON RING WIDTH

	Standard	Service limit
Top/second	1.2 mm (0.047 in)	1.08 mm (0.043 in)



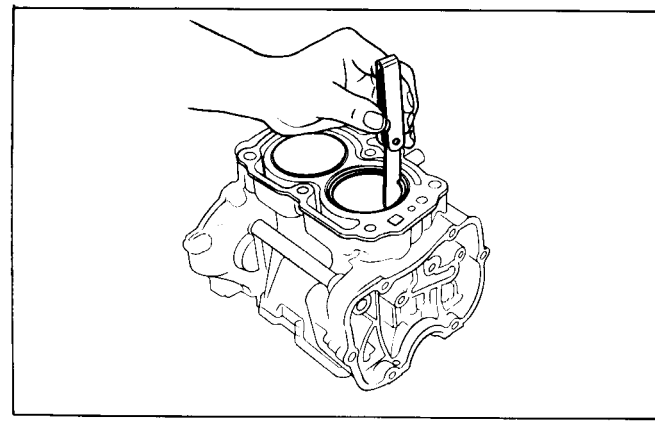
- PISTON RING SIDE CLEARANCE

	Standard	Service limit
Top/second	0.025–0.055 mm (0.00098–0.00217 in)	0.1 mm (0.0039 in)
Oil	0.055–0.140 mm (0.00217–0.0055 in)	0.2 mm (0.0079 in)



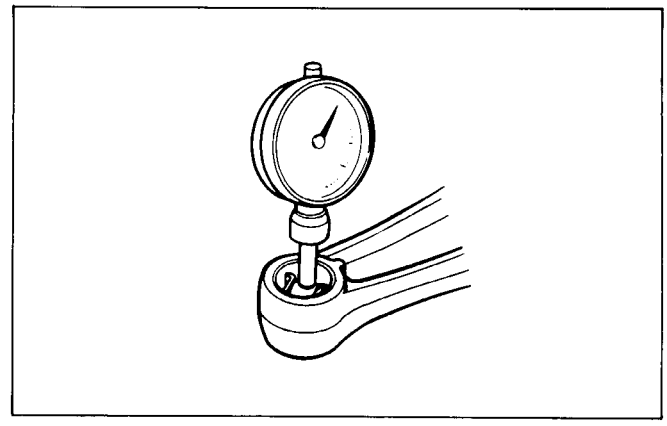
- PISTON RING END GAP

	Standard	Service limit
Top	0.15–0.30 mm (0.0059–0.0118 in)	0.5 mm (0.0197 in)
Second	0.35–0.50 mm (0.0138–0.0197 in)	0.7 mm (0.0276 in)
Oil	0.2–0.8 mm (0.0079–0.0315 in)	1.0 mm (0.039 in)



- CONNECTING ROD SMALL END I.D.

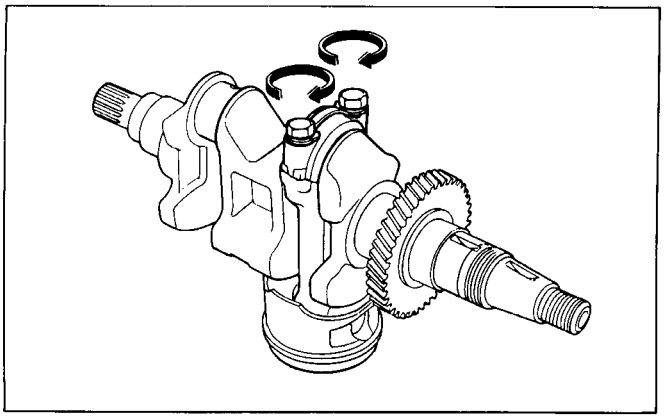
Standard	Service limit
14.005 mm (0.5514 in)	14.04 mm (0.5528 in)



• CONNECTING ROD BIG END OIL CLEARANCE

1) Wipe the crank pin and connecting rod bearing surface clean of oil.
2) Set the plastigauge on the crank pin, install the connecting rods, and tighten the connecting rod bolts to the specified torque.

TORQUE: 12 N·m (120 kg-cm, 8.7 ft-lb)

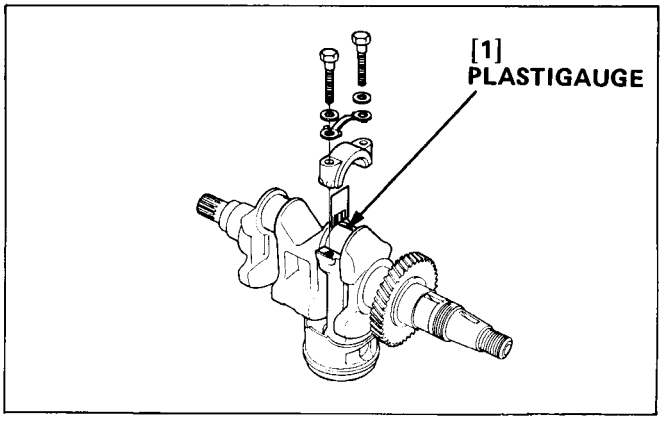


CAUTION

- **Do not rotate the crankshaft while the plastigauge is in place.**

3) Remove the connecting rod and measure the plastigauge.

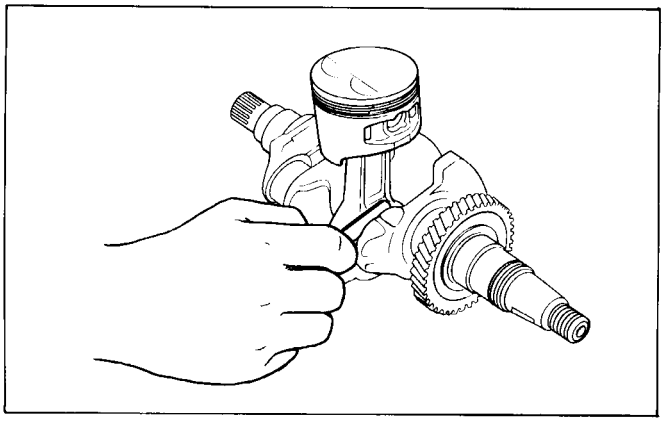
Standard	Service limit
0.040–0.066 mm (0.0016–0.0026 in)	0.08 mm (0.0031 in)



4) If the clearance exceeds the service limit, replace the connecting rod and recheck the clearance.

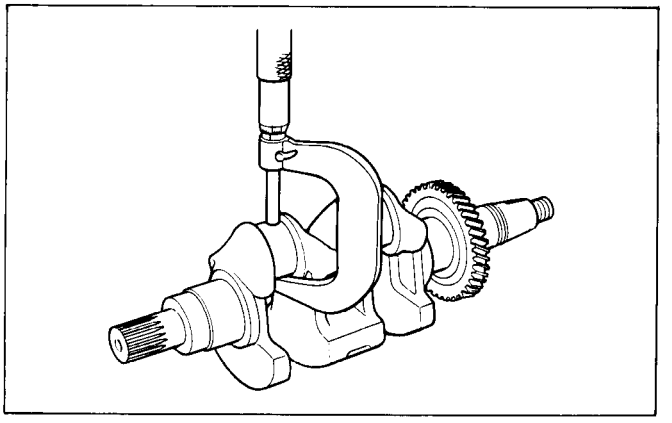
• CONNECTING ROD BIG END SIDE CLEARANCE

Standard	Service limit
0.15–0.35 mm (0.0059–0.0138 in)	0.7 mm (0.0276 in)



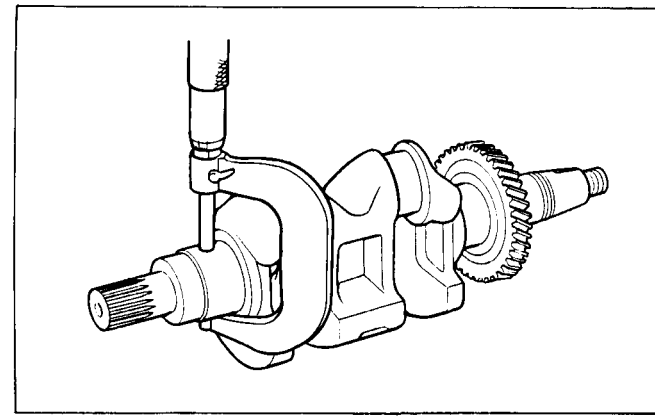
• CRANK PIN O.D.

Standard	Service limit
29.98 mm (1.180 in)	29.95 mm (1.179 in)



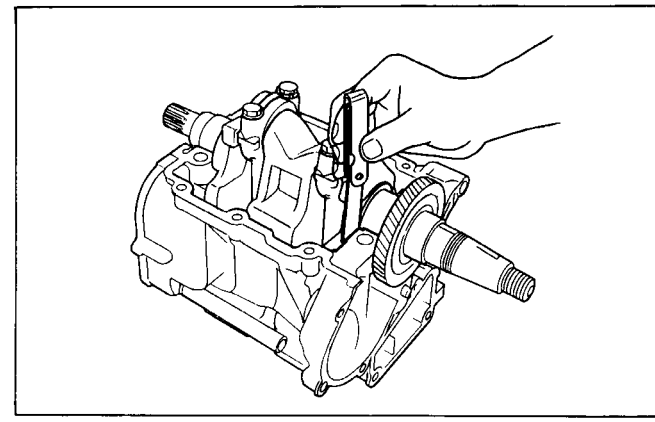
• CRANKSHAFT MAIN JOURNAL O.D.

Standard	Service limit
33.0 mm (1.299 in)	32.98 mm (1.298 in)



• CRANKSHAFT SIDE CLEARANCE

Standard	Service limit
0.10–0.30 mm (0.0039–0.0118 in)	0.6 mm (0.0236 in)



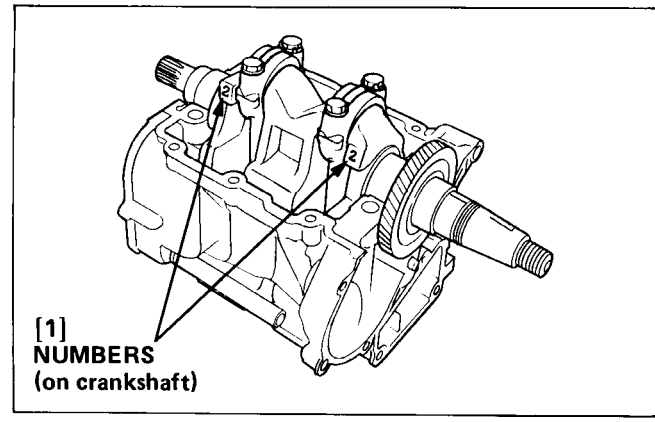
• CRANKSHAFT BEARING SELECTION

Measure the bearing oil clearance.

Standard	Service limit
0.021–0.040 mm (0.0008–0.0016 in)	0.05 mm (0.0020 in)

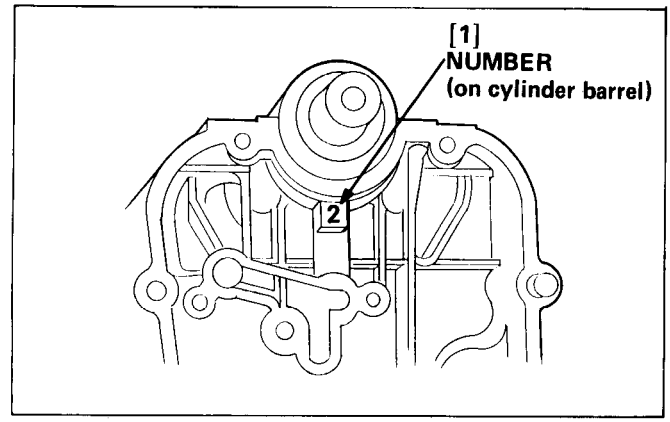
If the clearance is less than the service limit, refer to the numbers stamped on the crankshaft and cylinder barrel and select the bearing from the table below.

CYLINDER BARREL I.D.36φ \ CRANKSHAFT O.D.33φ		1 +0.018 +0.012	2 +0.012 +0.006	3 +0.006 0
1	+0.006 0	5 RED	4 YELLOW	3 GREEN
2	+0.011 +0.006	4 YELLOW	3 GREEN	2 BROWN
3	+0.016 +0.011	3 GREEN	2 BROWN	1 BLACK



Types of bearing

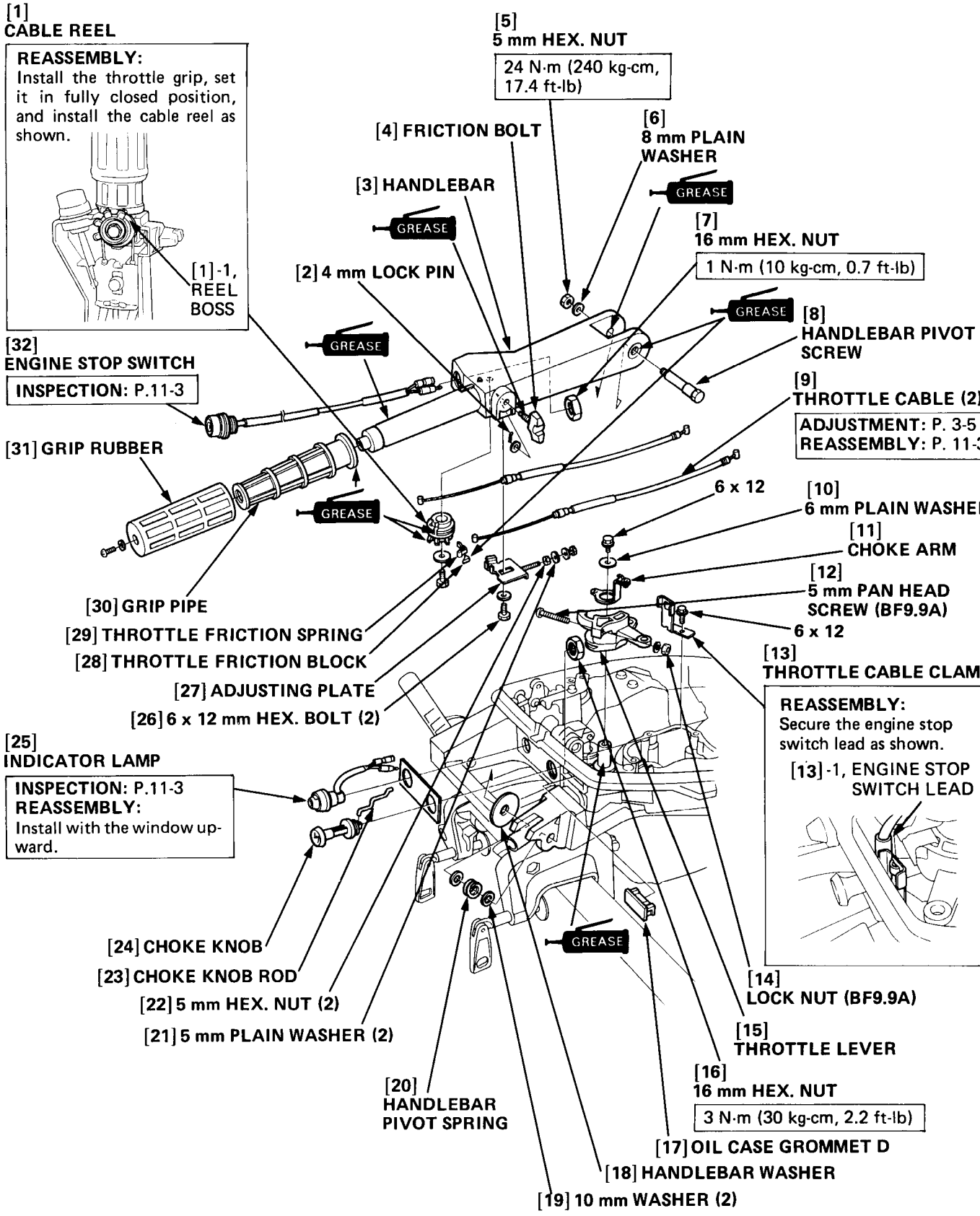
1. Black	13321–ZA0–003
2. Brown	13322–ZA0–003
3. Green	13323–ZA0–003
4. Yellow	13324–ZA0–003
5. Red	13325–ZA0–003



HANDLEBAR, SHIFT LEVER

HANDLEBAR

a. DISASSEMBLY/REASSEMBLY

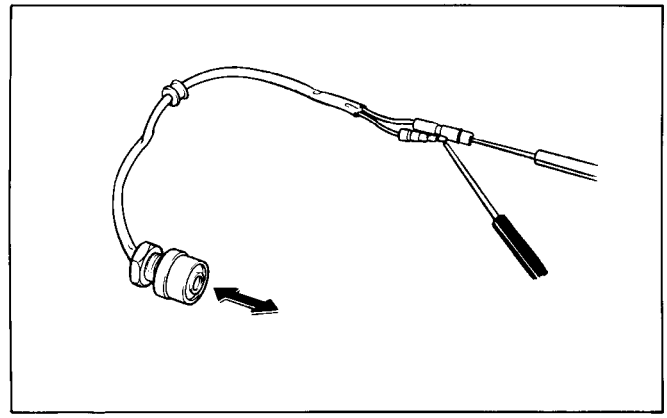


b. INSPECTION

- ENGINE STOP SWITCH

Attach the tester leads to the engine stop switch leads and check for continuity when the switch is pressed or released.

SWITCH	CONTINUITY
PRESSED	YES
RELEASED	NO

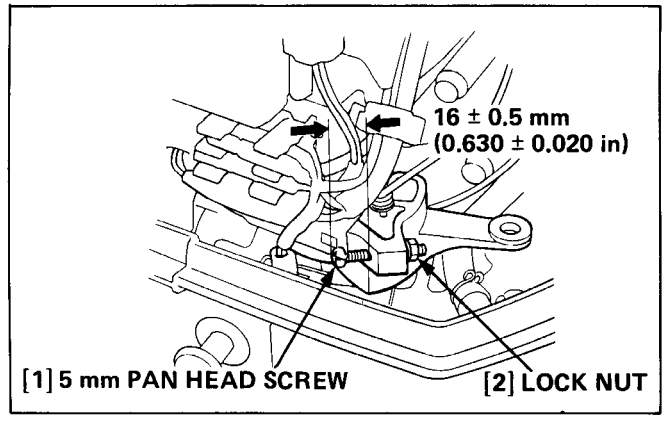


- INDICATOR LAMP

Check the oil pressure switch (P. 7-6) and CDI unit (P. 7-12). 12).
If they are normal but the indicator lamp does not turn on while the engine is running, it indicates faulty indicator lamp.

c. THROTTLE LEVER 5 mm PAN HEAD SCREW ADJUSTMENT (BF9.9A only)

Loosen the lock nut and adjust the 5 mm pan head screw length to 16 ± 0.5 mm (0.630 ± 0.020 in).

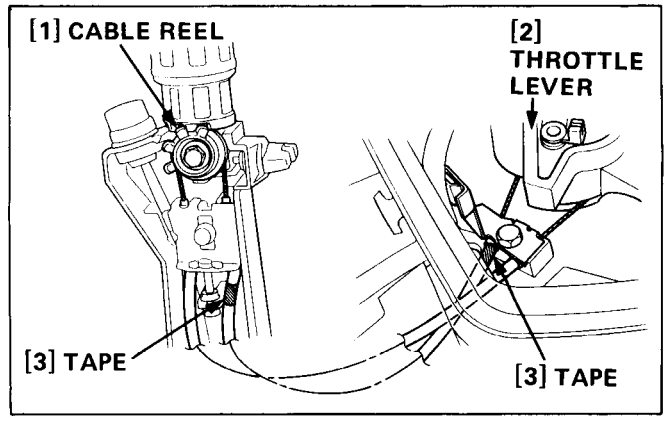


d. THROTTLE CABLE INSTALLATION

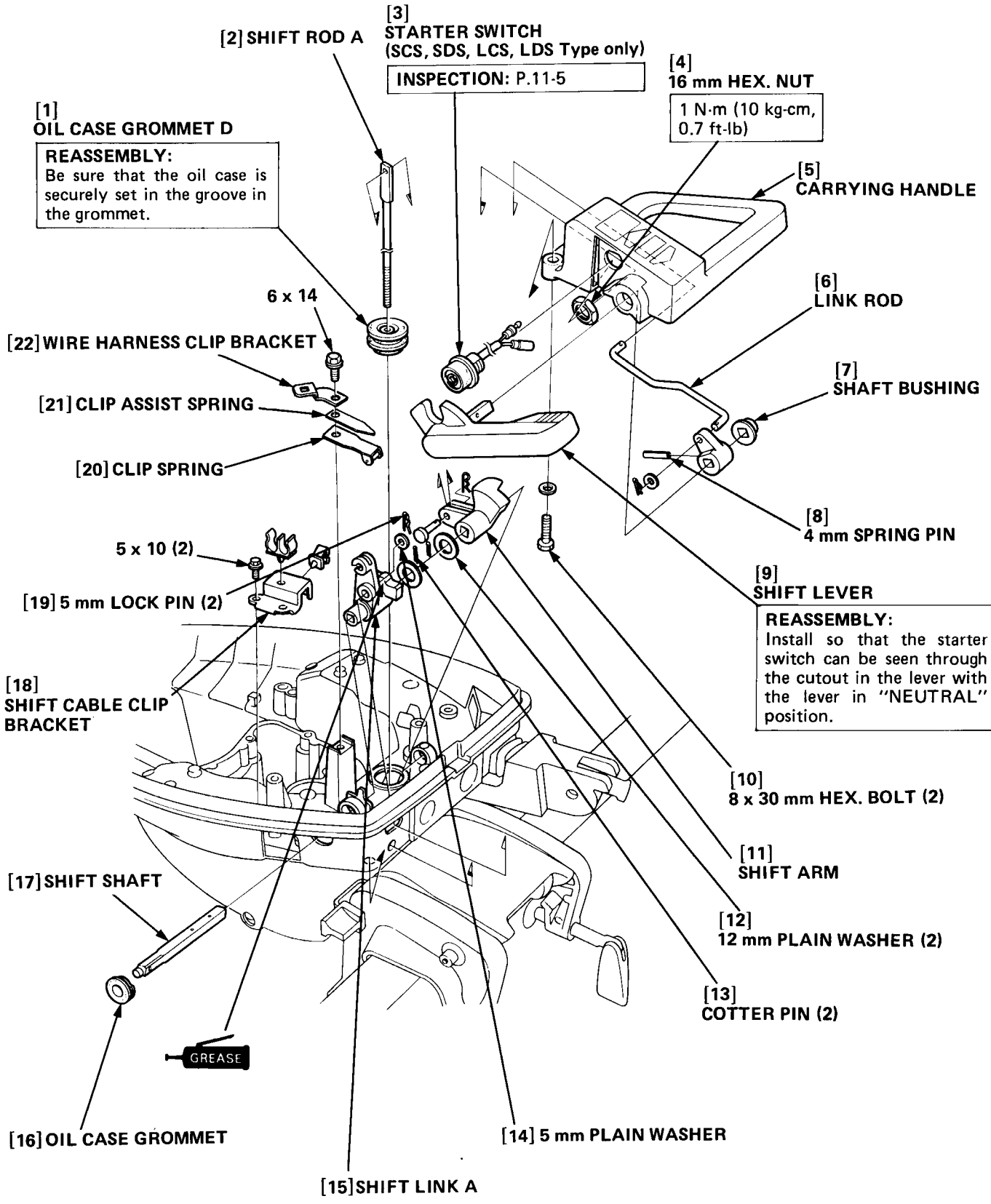
1) Wind both ends of one throttle cable with a tape.
2) Connect the two throttle cables to the throttle lever.
3) Connect the throttle cables to the cable reel as shown.

CAUTION

- **Be sure to connect the cable ends properly. Do not confuse the two cables and never connect the ends to the other way around. The throttle system does not operate properly.**



SHIFT LEVER

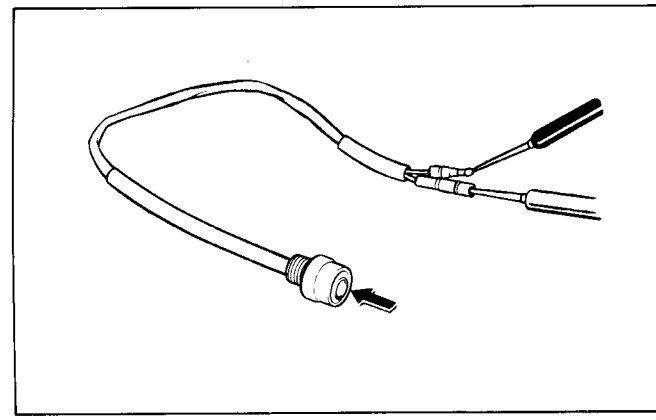

[1]
OIL CASE GROMMET D
REASSEMBLY:
Be sure that the oil case is securely set in the groove in the grommet.
[2] SHIFT ROD A
[3]
STARTER SWITCH
(SCS, SDS, LCS, LDS Type only)
INSPECTION: P.11-5
[4]
16 mm HEX. NUT
1 N·m (10 kg-cm, 0.7 ft-lb)
[5]
CARRYING HANDLE
[6]
LINK ROD
[7]
SHAFT BUSHING
[8]
4 mm SPRING PIN
[9]
SHIFT LEVER
REASSEMBLY:
Install so that the starter switch can be seen through the cutout in the lever with the lever in "NEUTRAL" position.
[10]
8 x 30 mm HEX. BOLT (2)
[11]
SHIFT ARM
[12]
12 mm PLAIN WASHER (2)
[13]
COTTER PIN (2)
[14] 5 mm PLAIN WASHER
[15] SHIFT LINK A
[16] OIL CASE GROMMET
[17] SHIFT SHAFT
[18]
SHIFT CABLE CLIP BRACKET
[19] 5 mm LOCK PIN (2)
5 x 10 (2)
[20] CLIP SPRING
[21] CLIP ASSIST SPRING
[22] WIRE HARNESS CLIP BRACKET
6 x 14
GREASE

b. INSPECTION

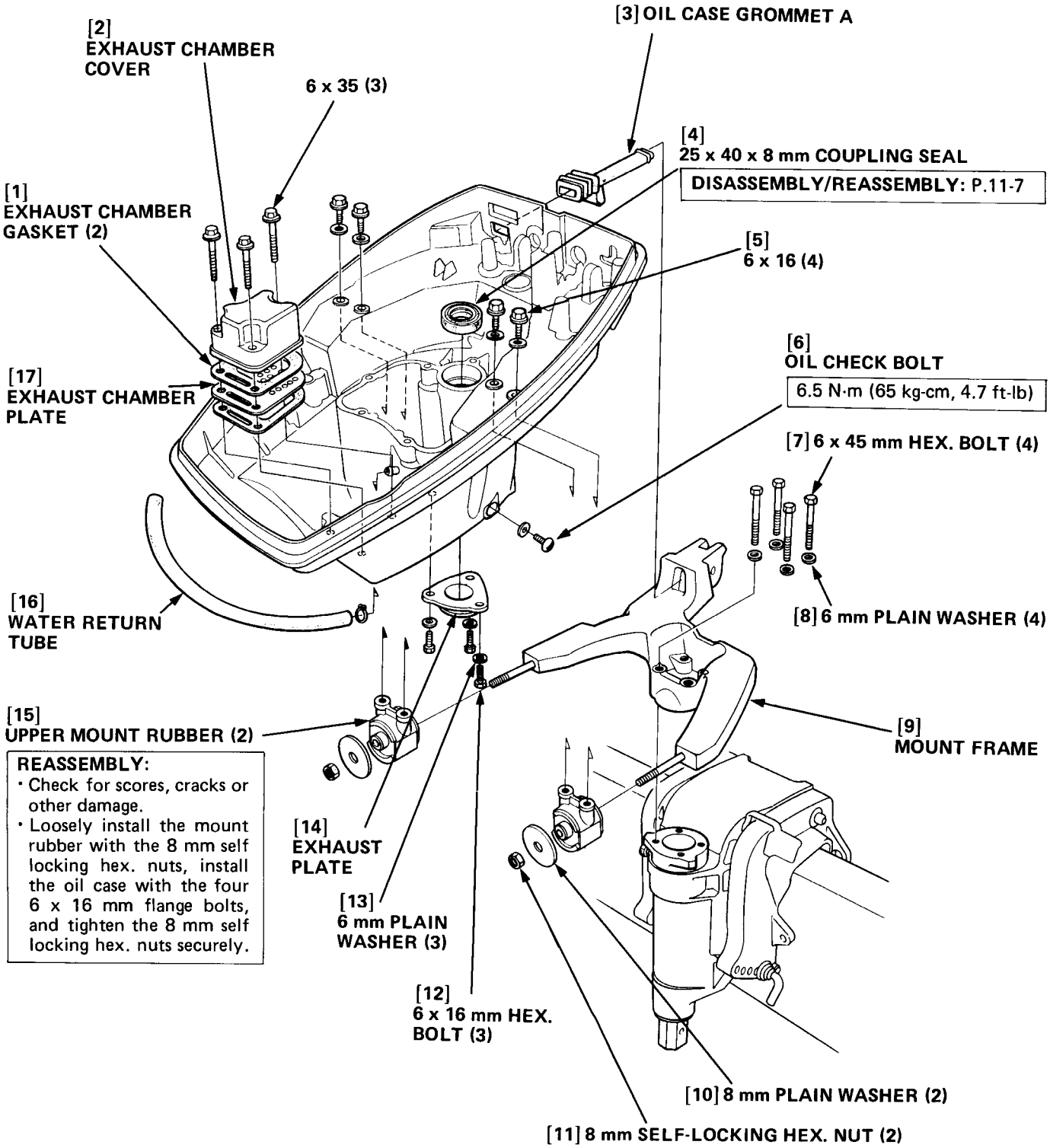
- STARTER SWITCH (SCS, SDS, LCS, LDS Type only)

Attach the tester leads to the starter switch leads and check for continuity when the switch is pressed or released.

SWITCH	CONTINUITY
PRESSED	YES
RELEASED	NO

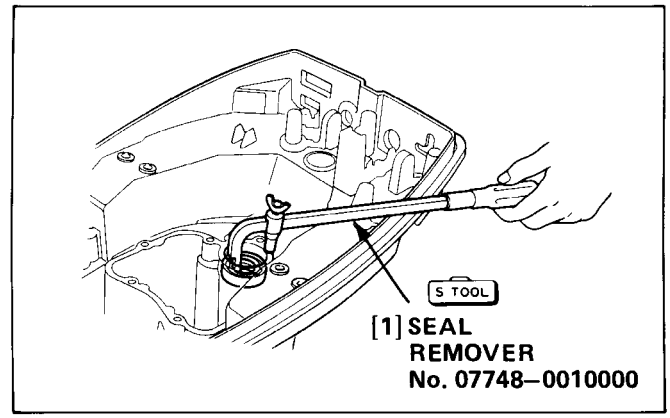


OIL CASE, MOUNT FRAME

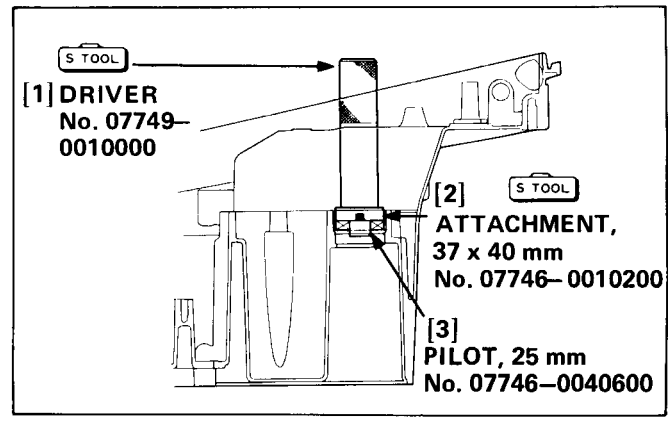


25 x 40 x 8 mm COUPLING SEAL

REMOVAL:
Remove the seal out of the oil case with the seal remover (special tool).



INSTALLATION:
Drive a new coupling seal into the oil case with the driver, 37 x 40 mm attachment and 25 mm pilot (special tools).
tools).

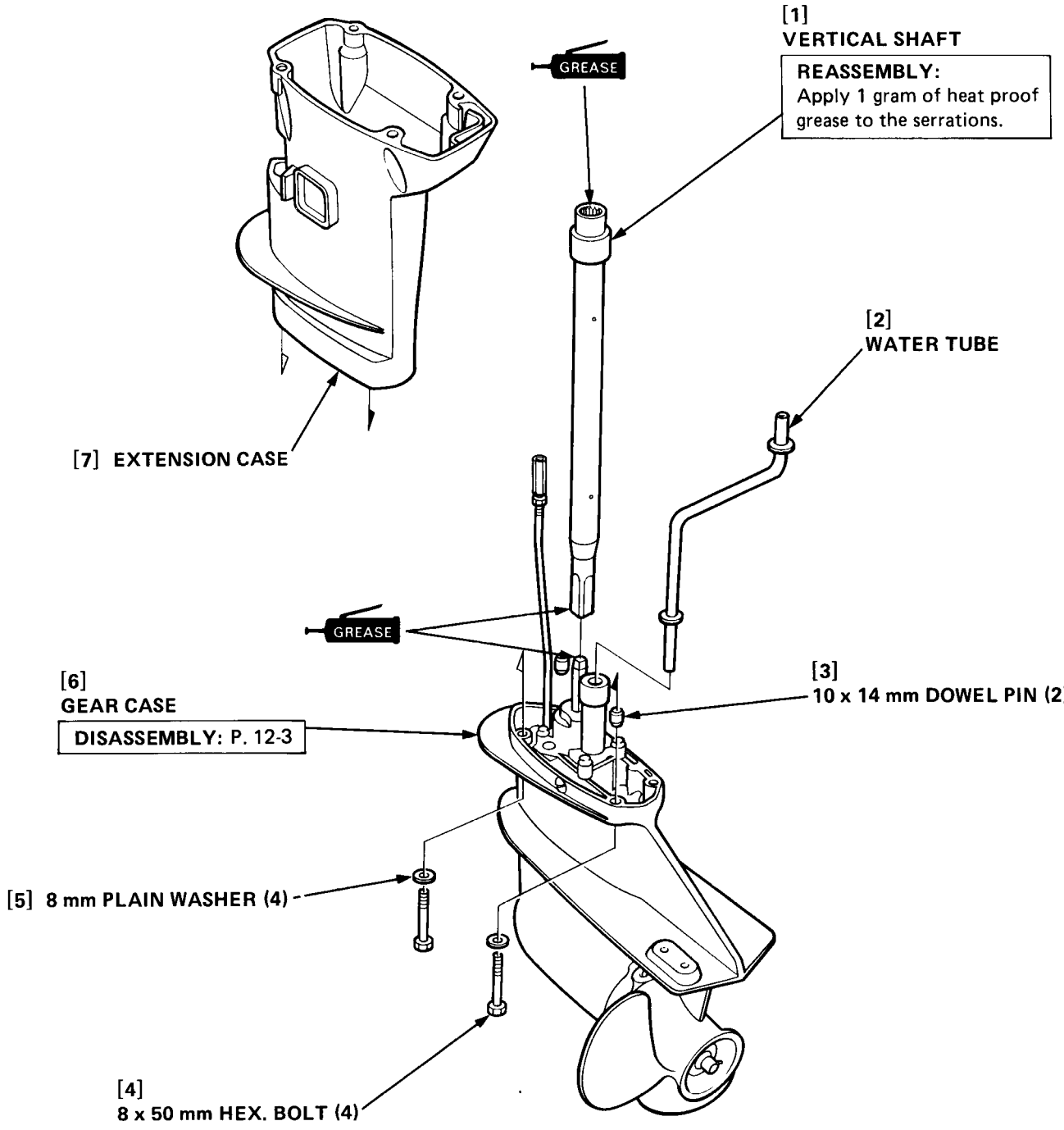


EXTENSION CASE, GEAR CASE, WATER PUMP

EXTENSION CASE

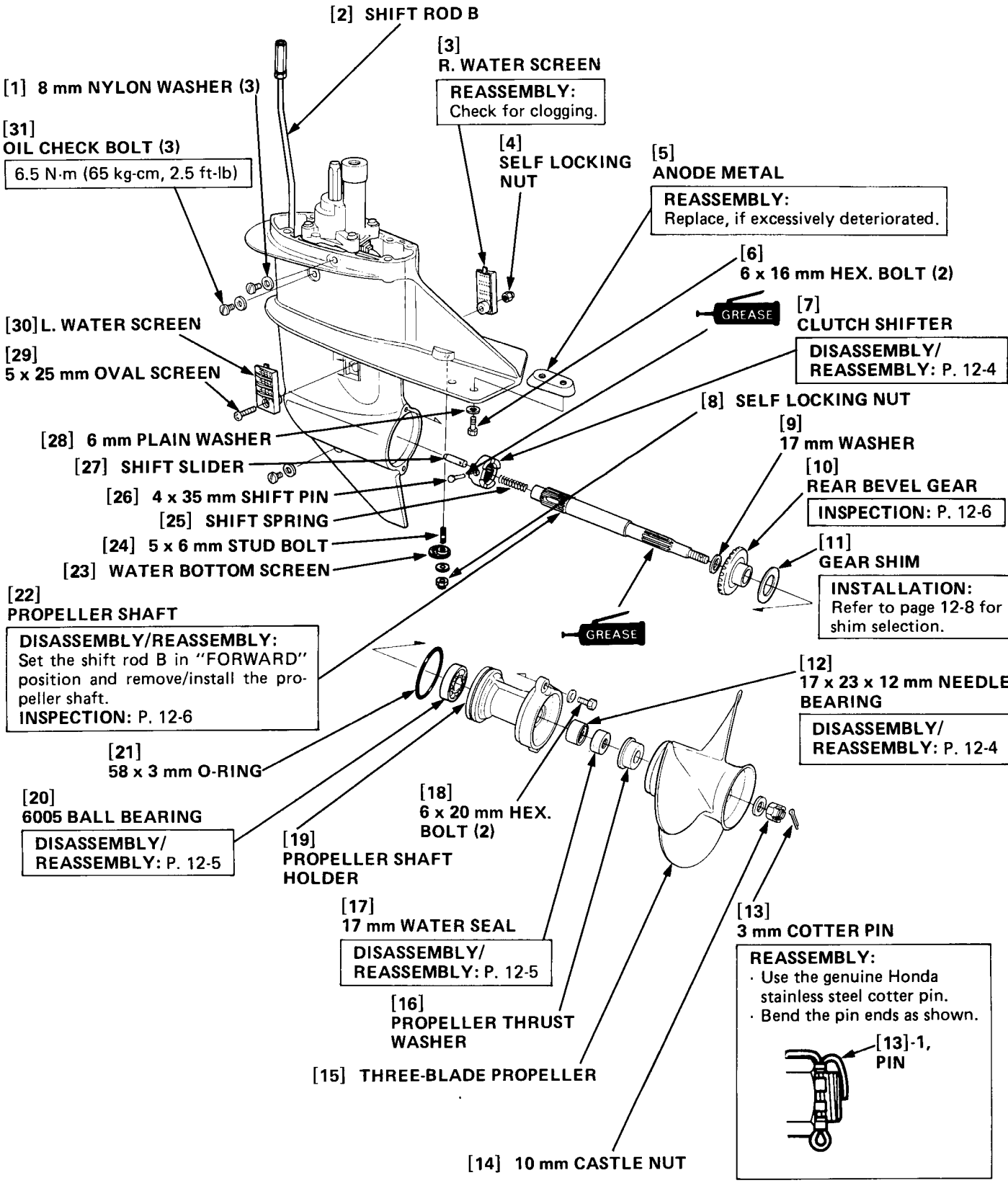
REMOVAL/INSTALLATION

1) Remove the right and left lower mounting housings (P. 10-2).
2) Disconnect the shift rod joint from the shift rod joint A.
3) Remove the four 8 x 50 mm hex. bolts and remove the extension case from the oil case (P. 10-2).



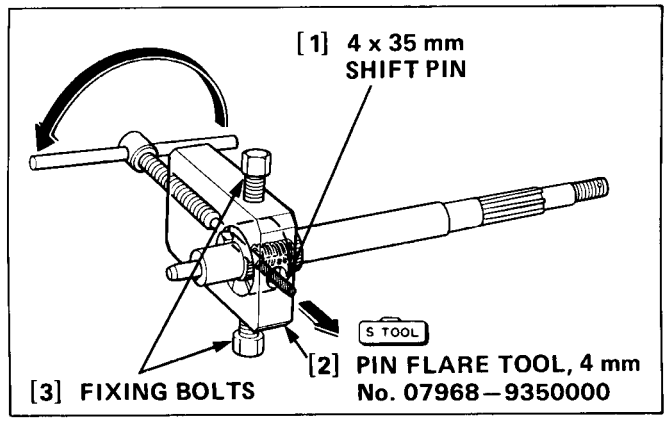
GEAR CASE

a. DISASSEMBLY/REASSEMBLY

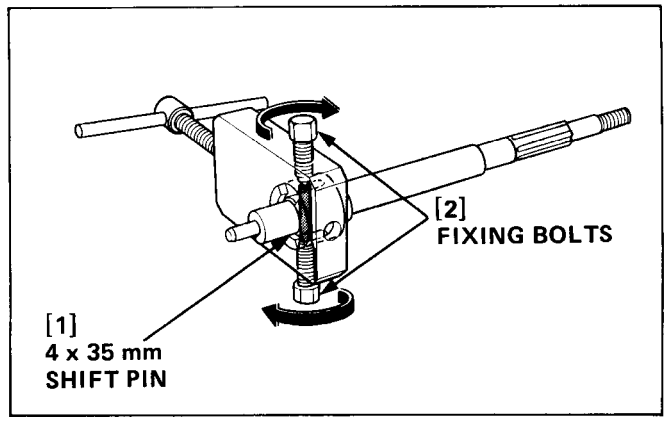


- CLUTCH SHIFTER

REMOVAL:
Align the pin driver of the pin flare tool (special tool) with the 4 x 35 mm shift pin and tighten two fixing bolts to hold the clutch shifter.
Turn the handle of the tool and remove the 4 x 35 mm shift pin.
Remove the clutch shifter from the tool.

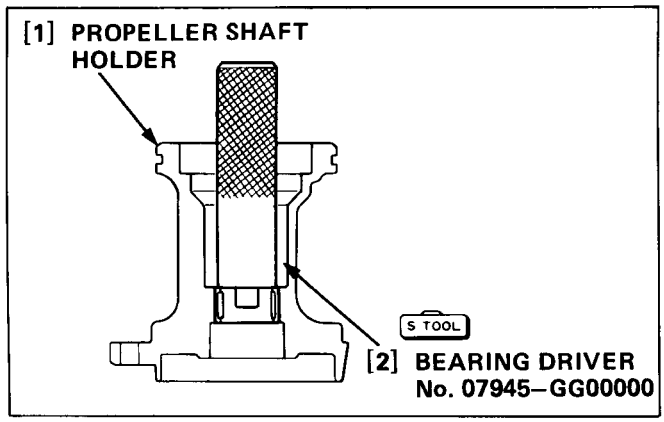


INSTALLATION:
Install the shift spring in the propeller shaft and align the holes in the clutch shifter, propeller shaft, and shift slider.
Insert a new 4 x 35 mm shift pin into the clutch shifter and tighten the flare tool fixing bolts to flare the pin ends.

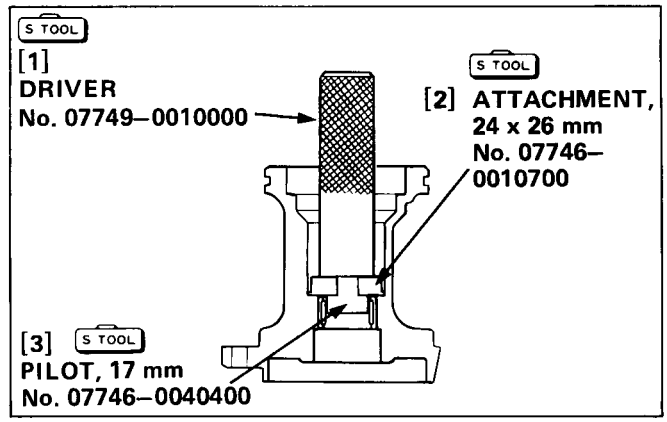


- 17 x 23 x 12 mm NEEDLE BEARING

REMOVAL:
Drive the 17 x 23 x 12 mm needle bearing out of the propeller shaft holder using the bearing driver (special tool).

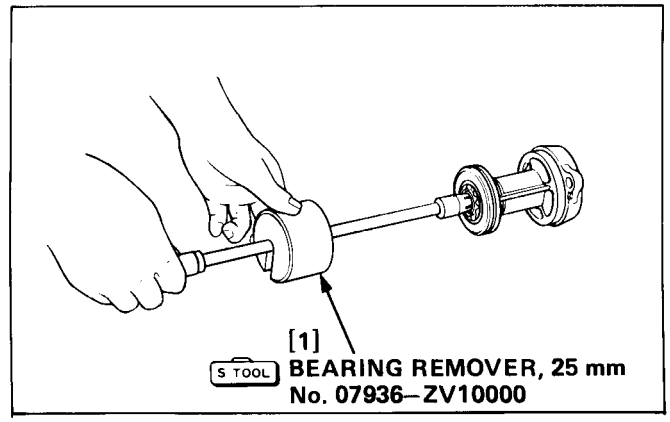


INSTALLATION:
Coat a new bearing with oil and drive it into the propeller shaft holder using the driver, 24 x 26 mm attachment, and 17 mm pilot (special tools).

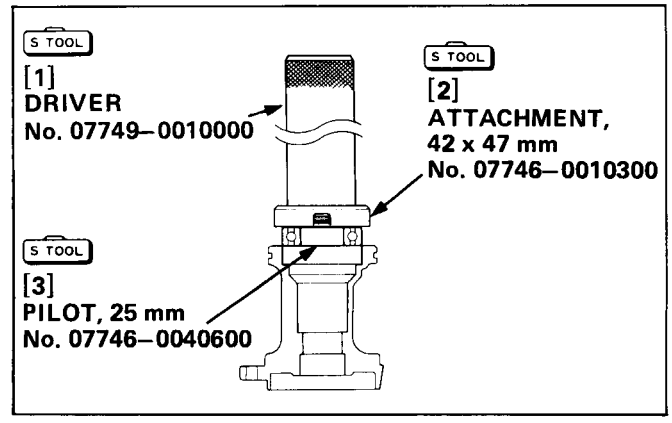


• 6005 BALL BEARING

REMOVAL:
Drive the 6005 ball bearing out of the propeller shaft holder using the 25 mm bearing remover (special tool).

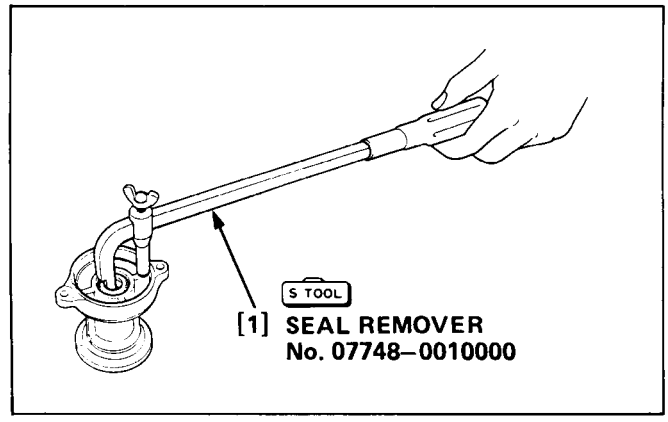


INSTALLATION:
Coat a new bearing with oil and drive it into the propeller shaft holder using the driver, 42 x 47 mm attachment, and 25 mm pilot (special tools).

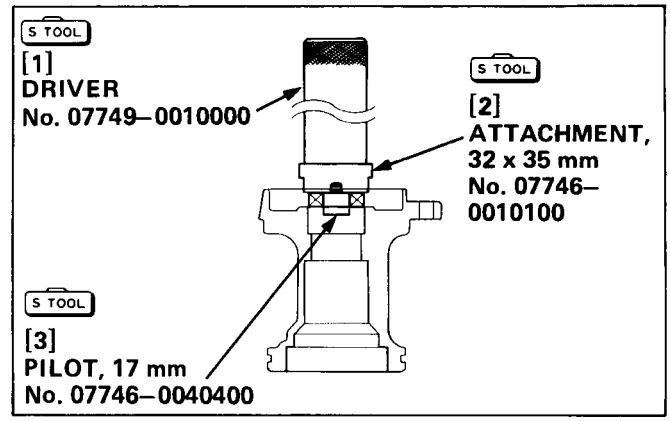


• 17 mm WATER SEAL

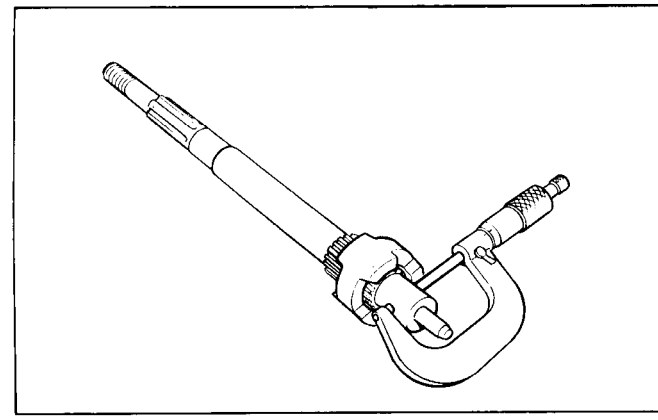
REMOVAL:
Drive the 17 mm water seal out of the propeller shaft holder using the seal remover (special tool).



INSTALLATION:
Coat a new 17 mm water seal with oil and drive it into the propeller shaft holder using the driver, 32 x 35 mm attachments, and 17 mm pilot (special tools).

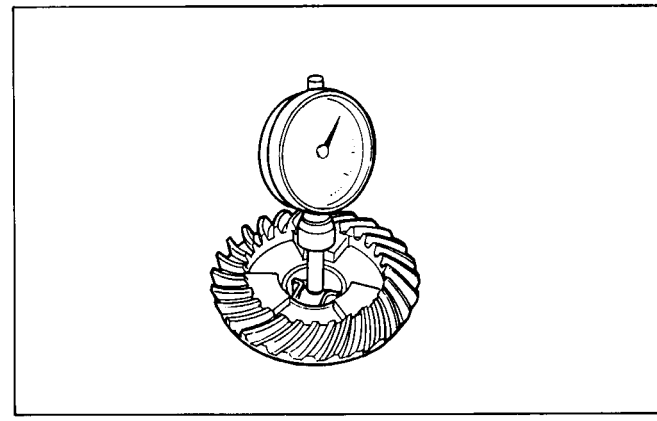


b. INSPECTION



- PROPELLER SHAFT O.D. (Front bevel gear side)

Standard	Service limit
16.984 mm (0.66866 in)	16.95 mm (0.66732 in)

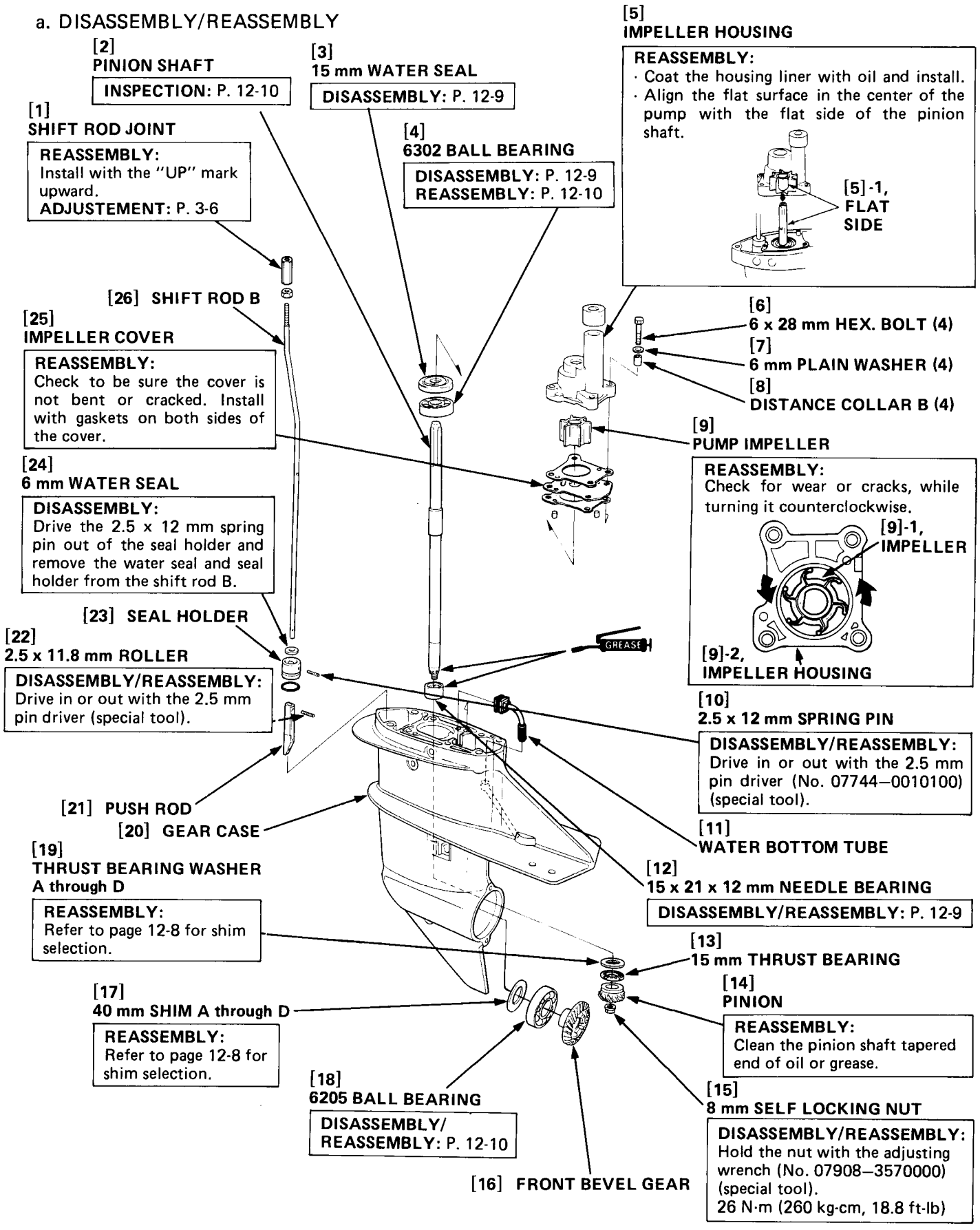


- FRONT BEVEL GEAR I.D.

Standard	Service limit
17.000 mm (0.66929 in)	17.04 mm (0.67086 in)

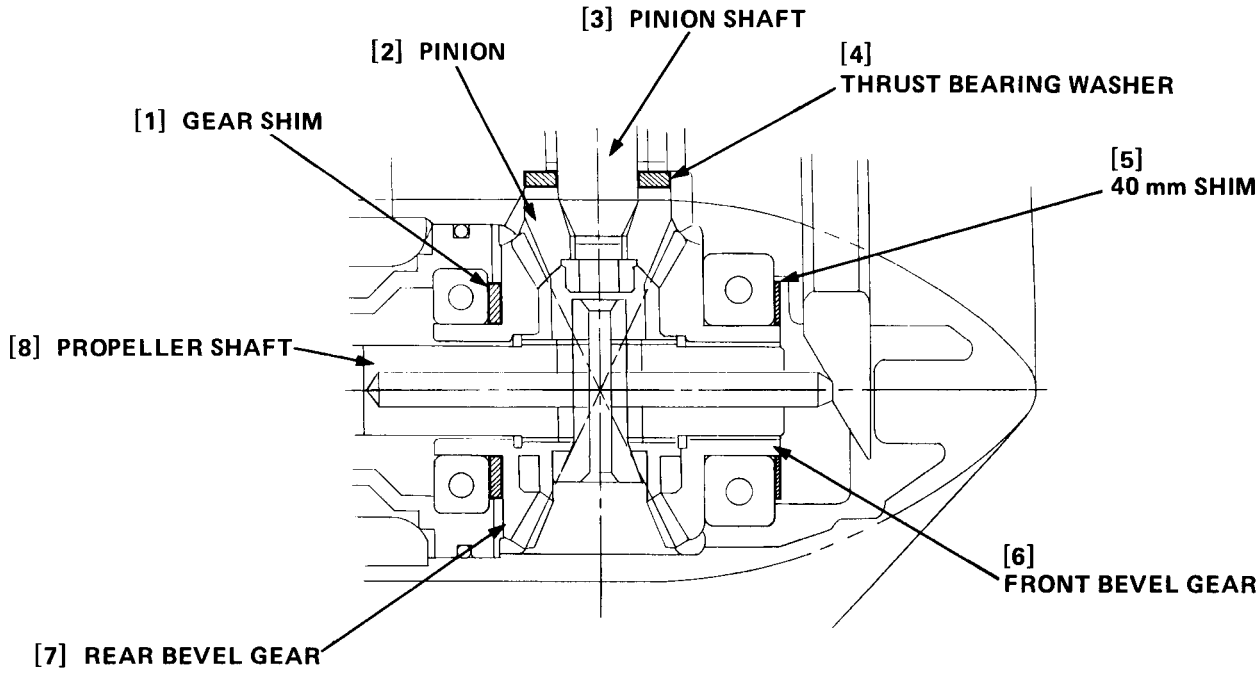
PINION SHAFT, WATER PUMP

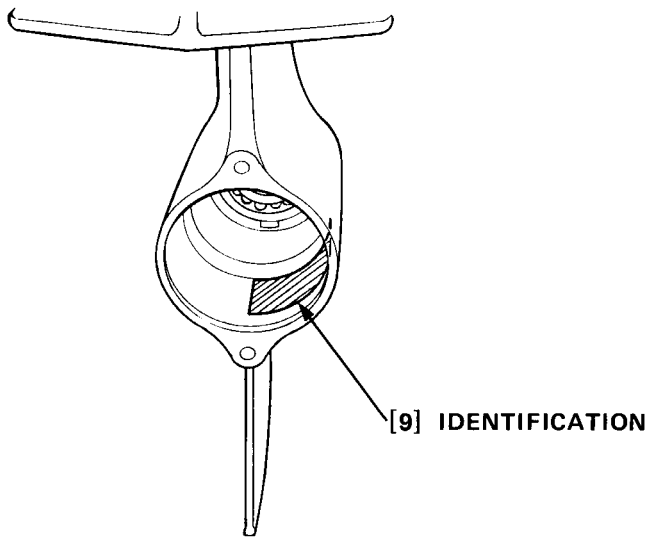
a. DISASSEMBLY/REASSEMBLY



• SHIM/WASHER SELECTION

Select the shims and washers in accordance with the identifications on the gear case, whenever you replace the gear case.





• THRUST BEARING WASHER

Identification	Size	No. of washer
A	3.00 mm	1
B	3.03 mm	1
C	3.06 mm	1
D	3.09 mm	1

• 40 mm SHIM

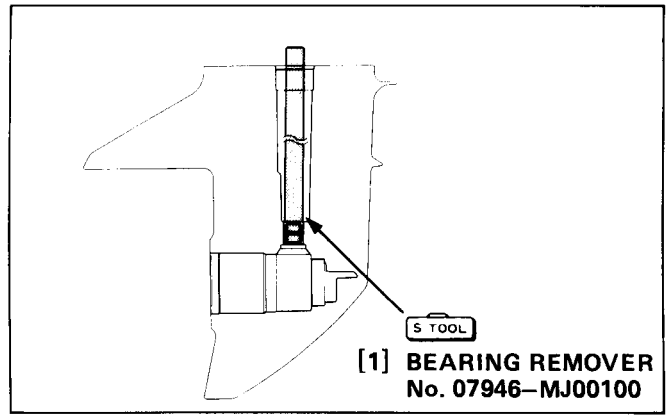
Identification	Size	No. of shim
イ	0.10 mm	1
ロ	0.12 mm	1
ハ	0.15 mm	1
ニ	0.08 mm	1
	0.10 mm	1

• GEAR SHIM

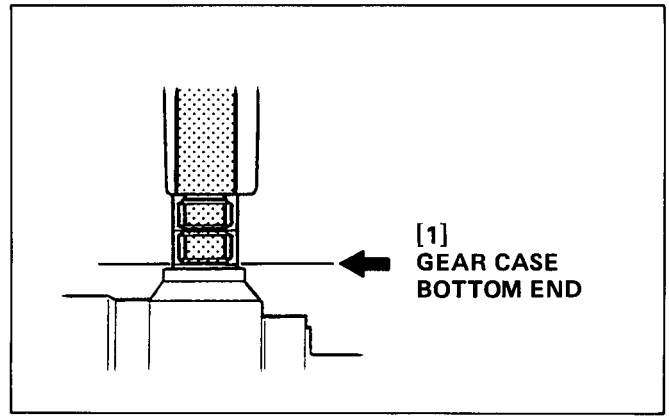
Identification	Size	No. of shim
1	0.10 mm	1
2	0.15 mm	1

• 15 x 21 x 12 mm NEEDLE BEARING

REMOVAL:
Drive out the 15 x 21 x 12 mm needle bearing using the bearing remover (special tool).

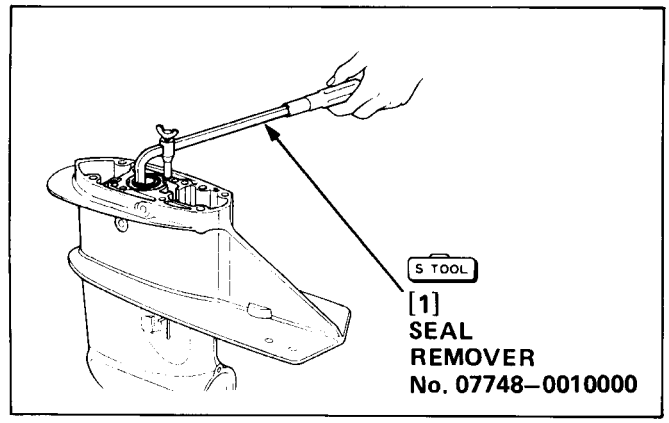


INSTALLATION:
Drive in the needle bearing using the bearing driver (special tool).
Be sure that the bearing is not out of the bottom end of the gear case.



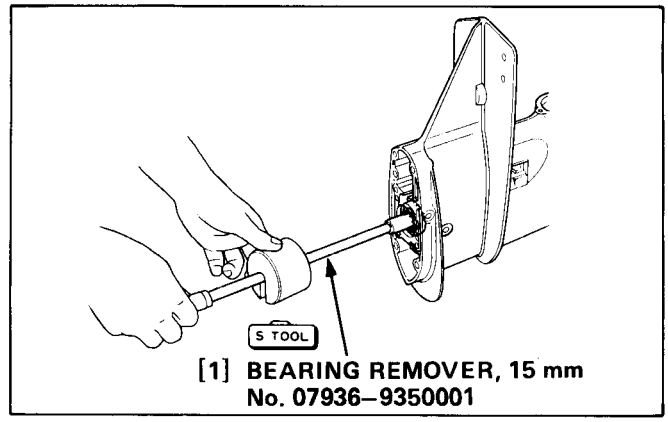
• 15 mm WATER SEAL

REMOVAL:
Remove the water seal using the seal remover (special tool).

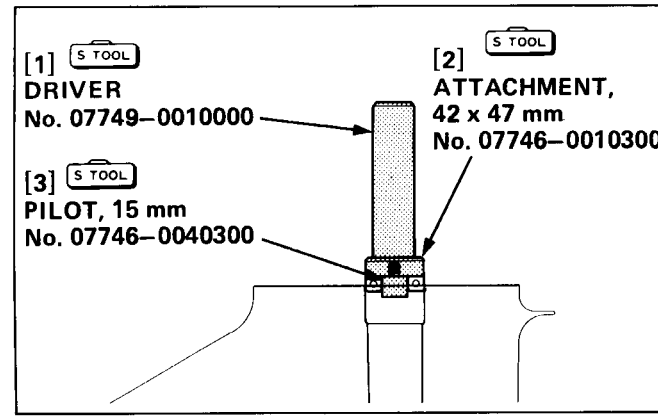


• 6302 BALL BEARING

REMOVAL:
Remove the ball bearing using the 15 mm bearing remover (special tool).

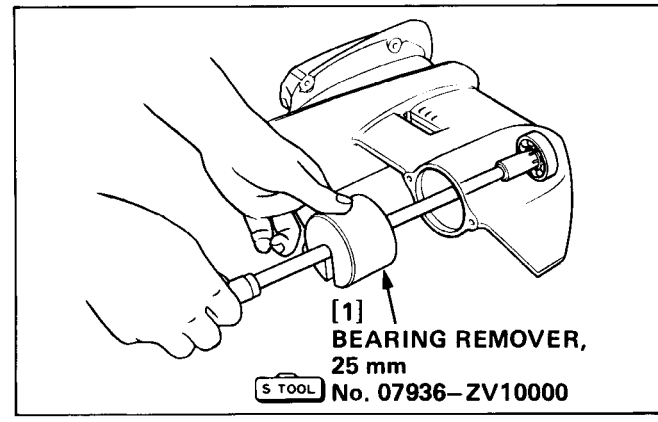


INSTALLATION:
Drive a new bearing into the gear case using the driver, 42 x 47 mm attachment, and 15 mm pilot (special tools).

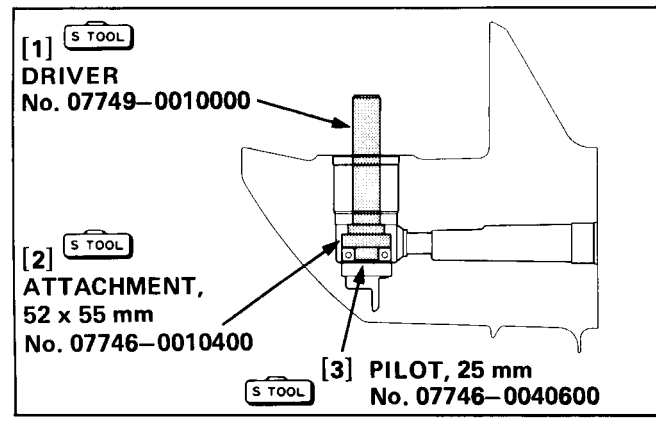


- 6205 BALL BEARING

REMOVAL:
Drive out the 6205 ball bearing using the 25 mm bearing remover (special tool).



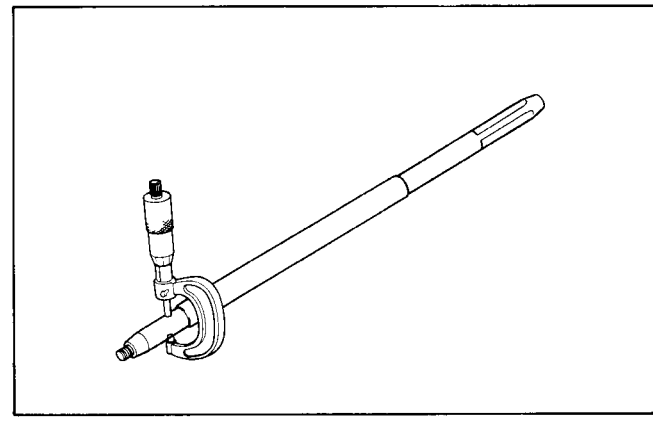
INSTALLATION:
Drive a new bearing into the gear case using the driver, 52 x 55 mm attachment, and 25 mm pilot (special tools).



b. INSPECTION

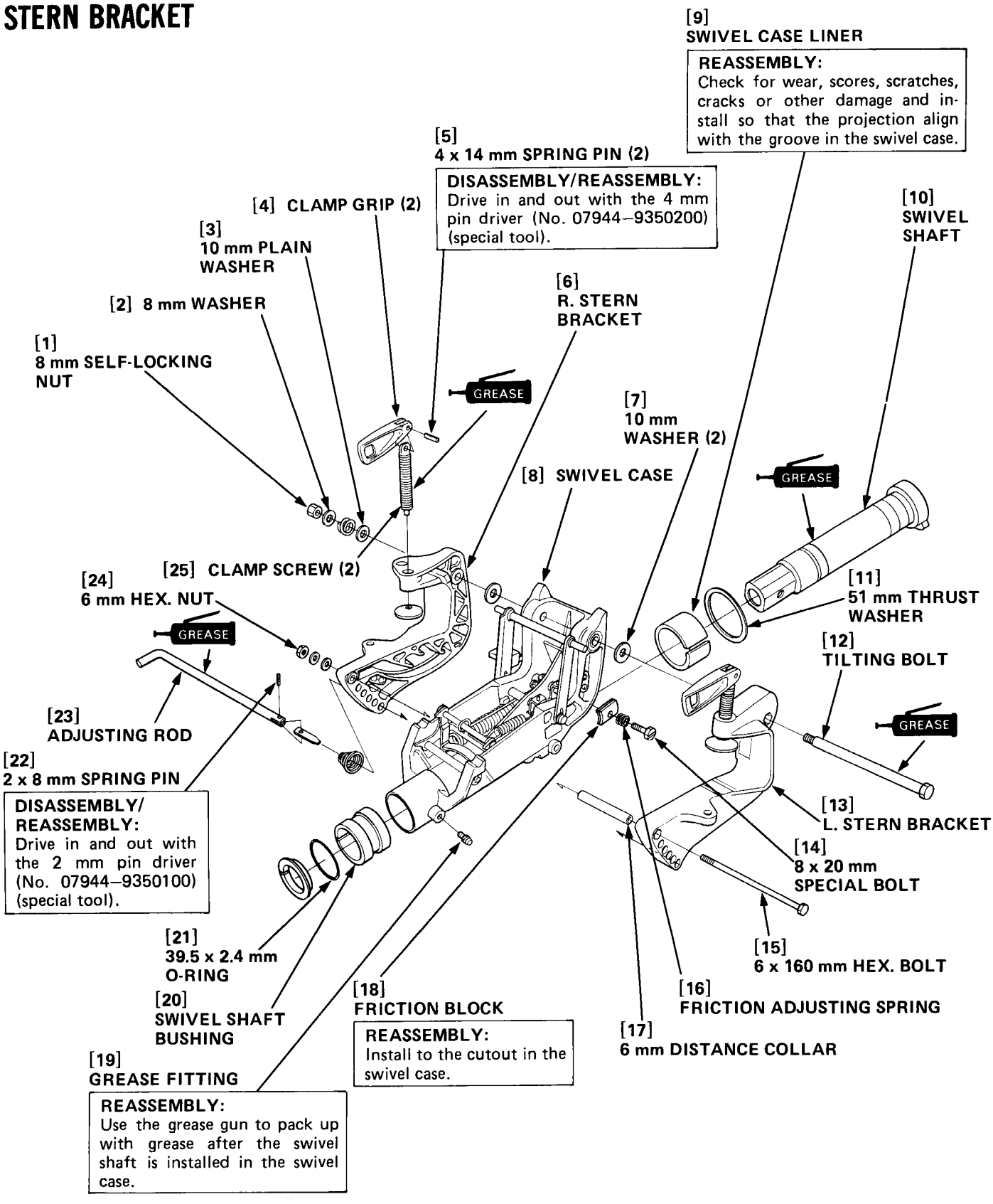
- PINION SHAFT O.D.

Standard	Service limit
14.994 mm (0.5903 in)	14.96 mm (0.5890 in)

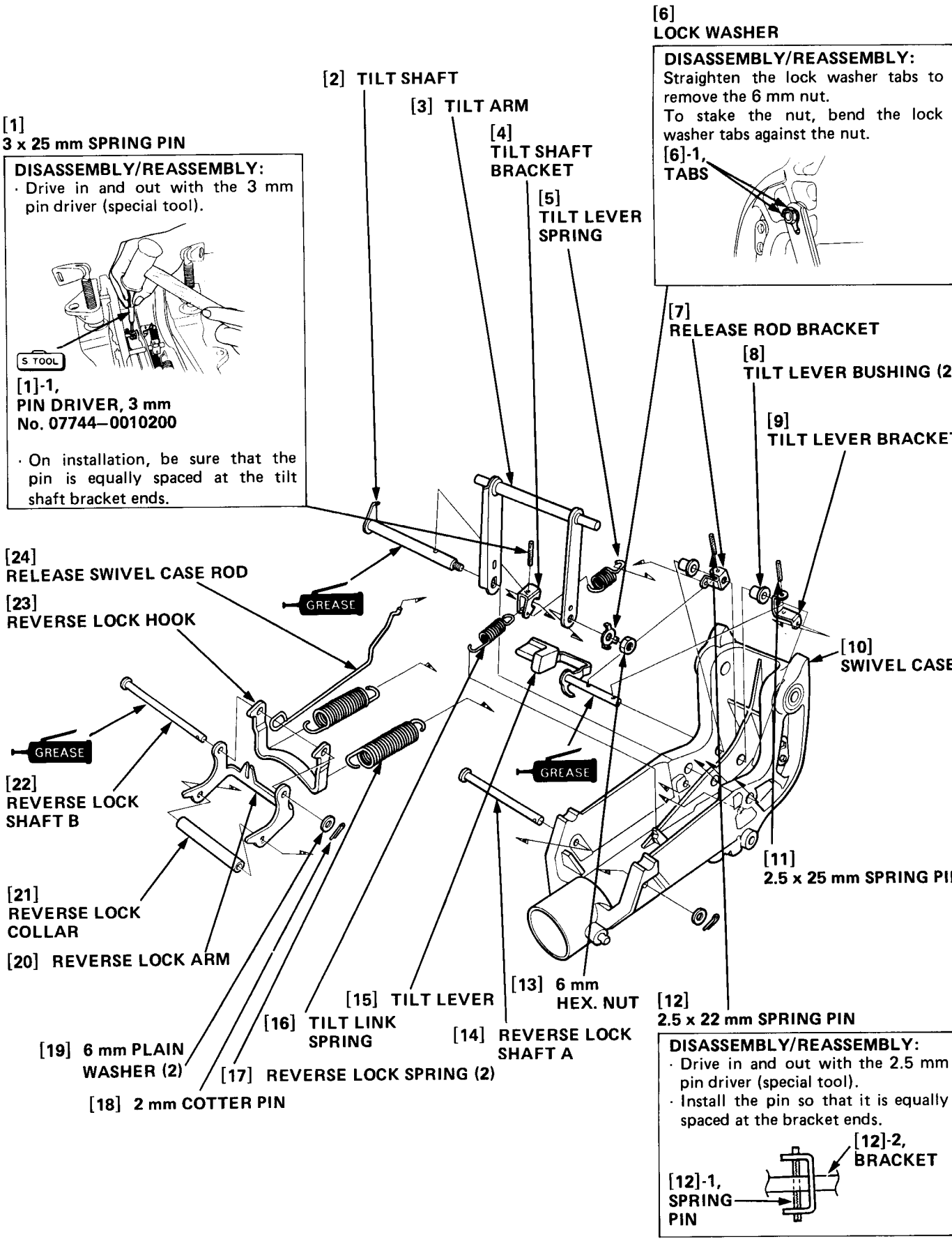


STERN BRACKET, SWIVEL CASE

STERN BRACKET



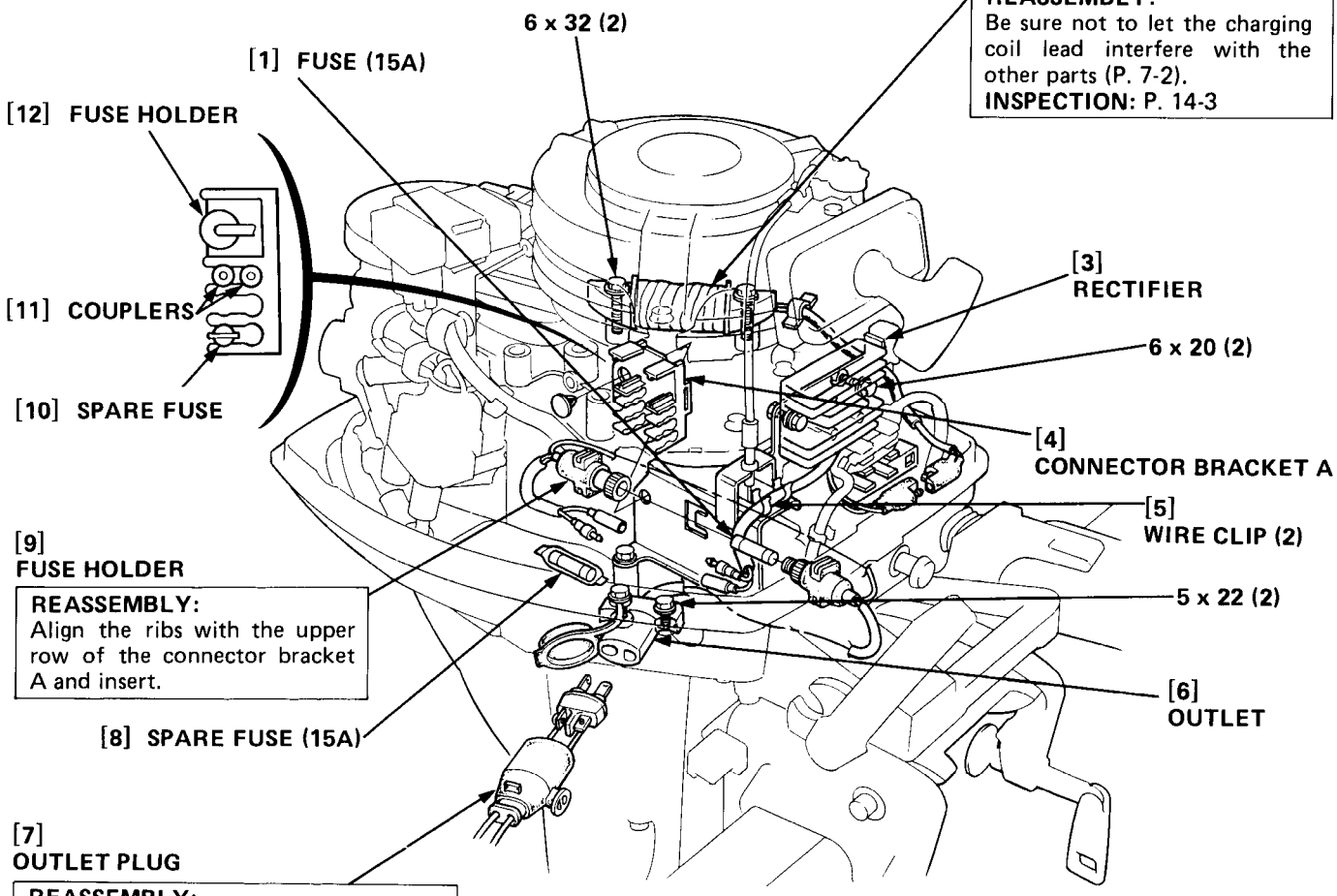
SWIVEL CASE


[1]
3 x 25 mm SPRING PIN
DISASSEMBLY/REASSEMBLY:
· Drive in and out with the 3 mm pin driver (special tool).
S TOOL
[1]-1,
PIN DRIVER, 3 mm
No. 07744–0010200
· On installation, be sure that the pin is equally spaced at the tilt shaft bracket ends.
[2] TILT SHAFT
[3] TILT ARM
[4]
TILT SHAFT
BRACKET
[5]
TILT LEVER
SPRING
[6]
LOCK WASHER
DISASSEMBLY/REASSEMBLY:
Straighten the lock washer tabs to remove the 6 mm nut.
To stake the nut, bend the lock washer tabs against the nut.
[6]-1,
TABS
[7]
RELEASE ROD BRACKET
[8]
TILT LEVER BUSHING (2)
[9]
TILT LEVER BRACKET
[10]
SWIVEL CASE
[11]
2.5 x 25 mm SPRING PIN
[12]
2.5 x 22 mm SPRING PIN
DISASSEMBLY/REASSEMBLY:
· Drive in and out with the 2.5 mm pin driver (special tool).
· Install the pin so that it is equally spaced at the bracket ends.
[12]-2,
BRACKET
[12]-1,
SPRING
PIN
[13] 6 mm
HEX. NUT
[14] REVERSE LOCK
SHAFT A
[15] TILT LEVER
[16] TILT LINK
SPRING
[17] REVERSE LOCK SPRING (2)
[18] 2 mm COTTER PIN
[19] 6 mm PLAIN
WASHER (2)
[20] REVERSE LOCK ARM
[21]
REVERSE LOCK
COLLAR
[22]
REVERSE LOCK
SHAFT B
[23]
REVERSE LOCK HOOK
[24]
RELEASE SWIVEL CASE ROD
GREASE
GREASE
GREASE

OPTIONAL PARTS

LAMP OUTLET KIT

a. INSTALLATION

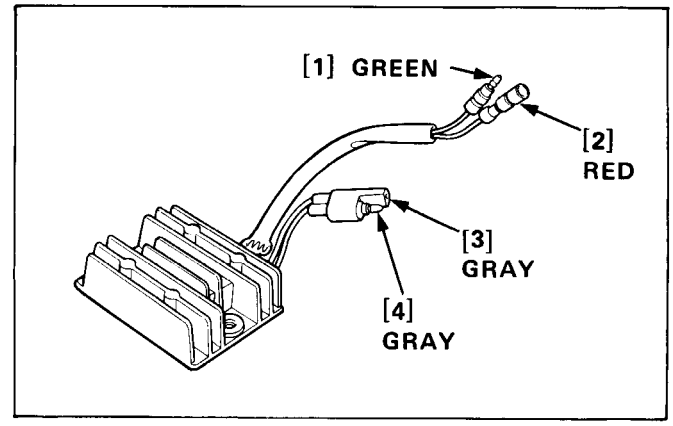


b. INSPECTION

- RECTIFIER

Check for continuity between each lead.

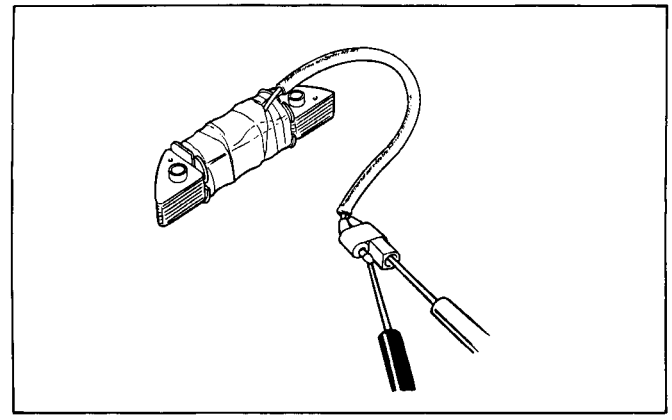
Tester terminal		Continuity
Positive (+)	Negative (−)	
Red	Gray, Gray	No
Gray, Gray	Red	Yes
Green	Gray, Gray	Yes
Gray, Gray	Green	No



- CHARGING COIL

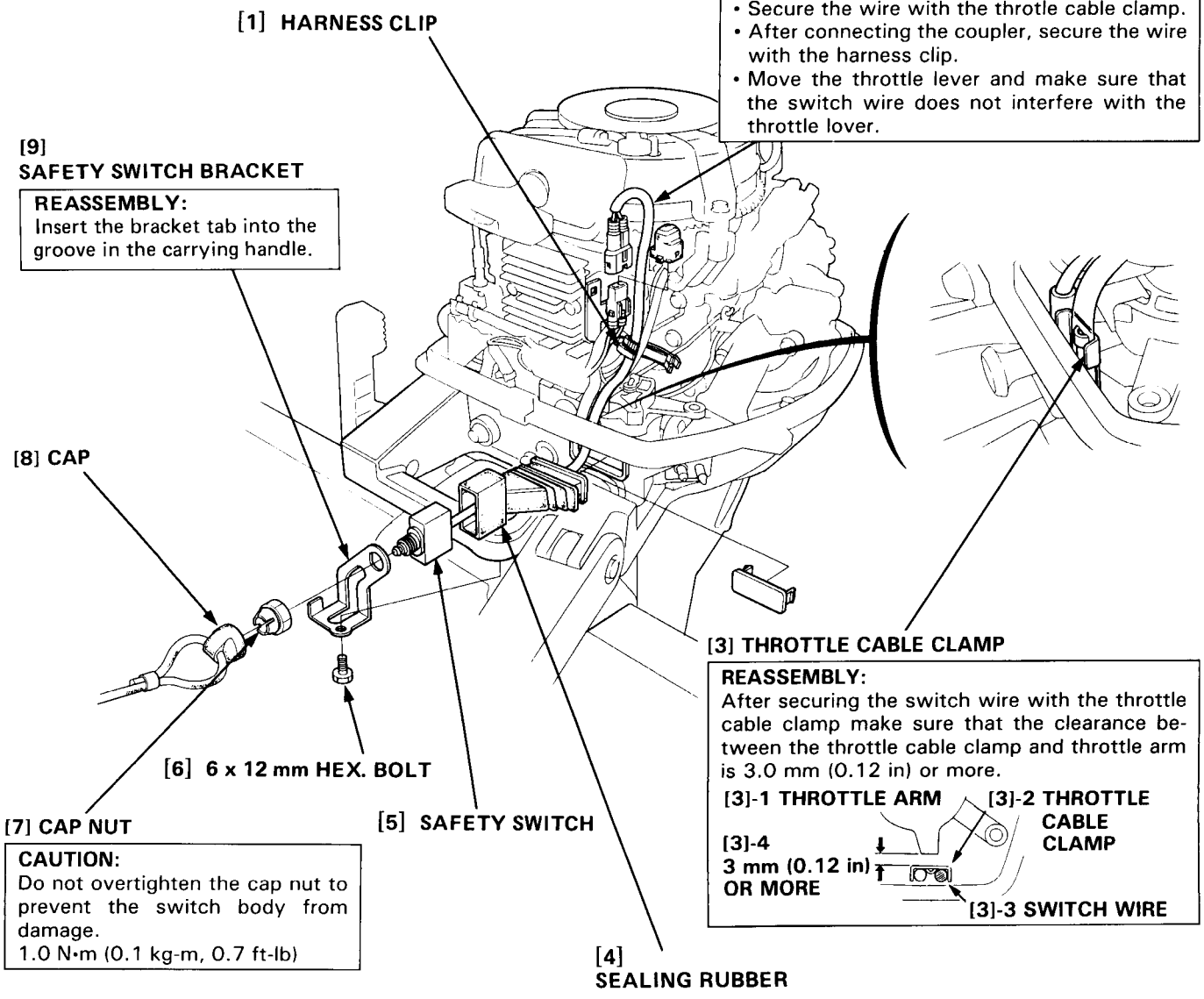
Attach the tester leads to the charging coil lead terminals and measure the resistance.

Resistance	0.33–0.41 Ω



SAFETY SWITCH KIT

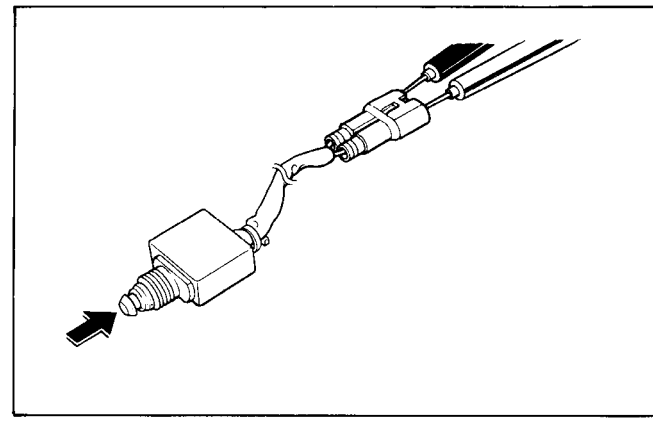
a. INSTALLATION



b. INSPECTION

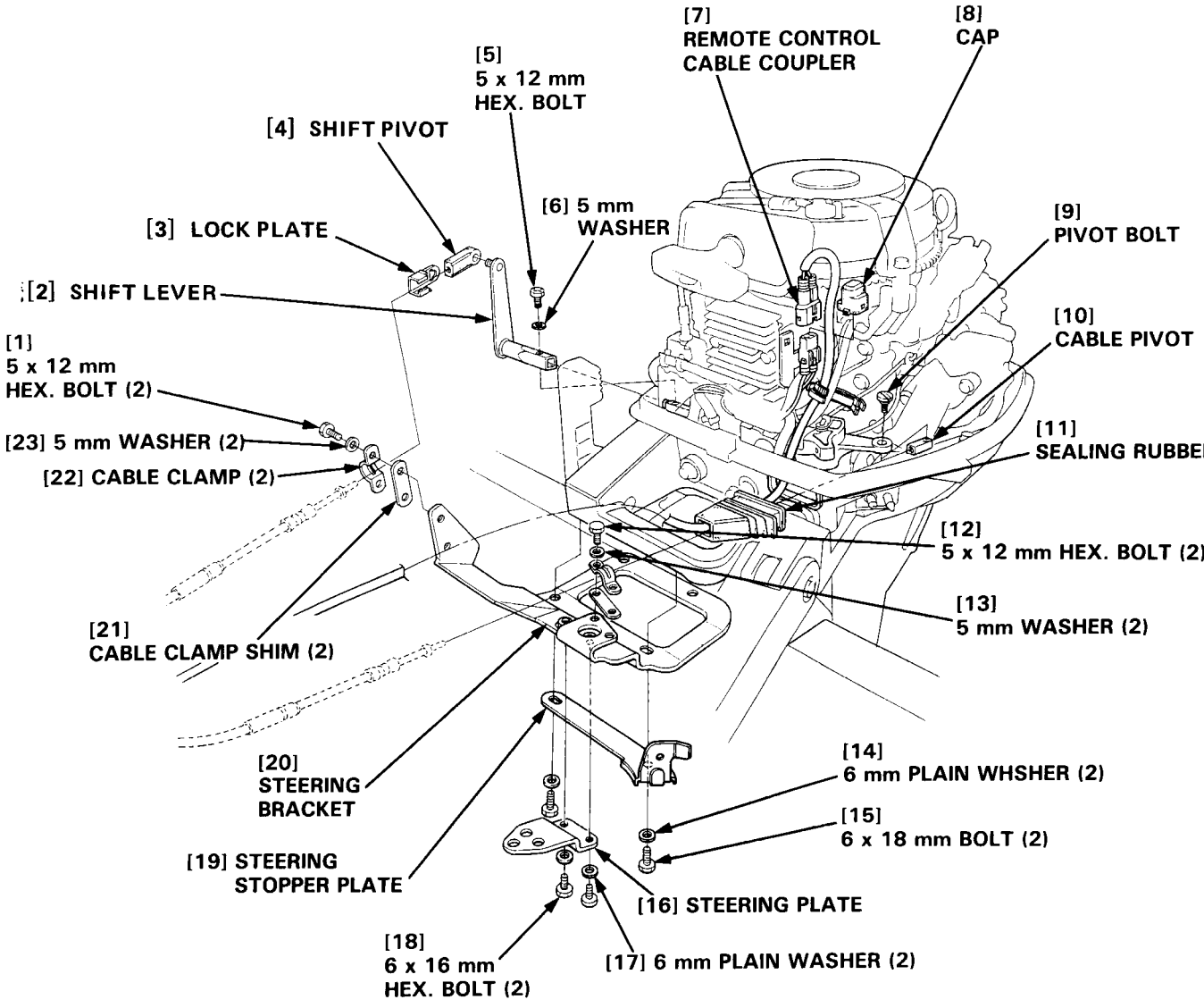
- SAFETY SWITCH

Check the safety switch leads for continuity.
There should be no continuity while the switch is pressed in and continuity while the switch is released.

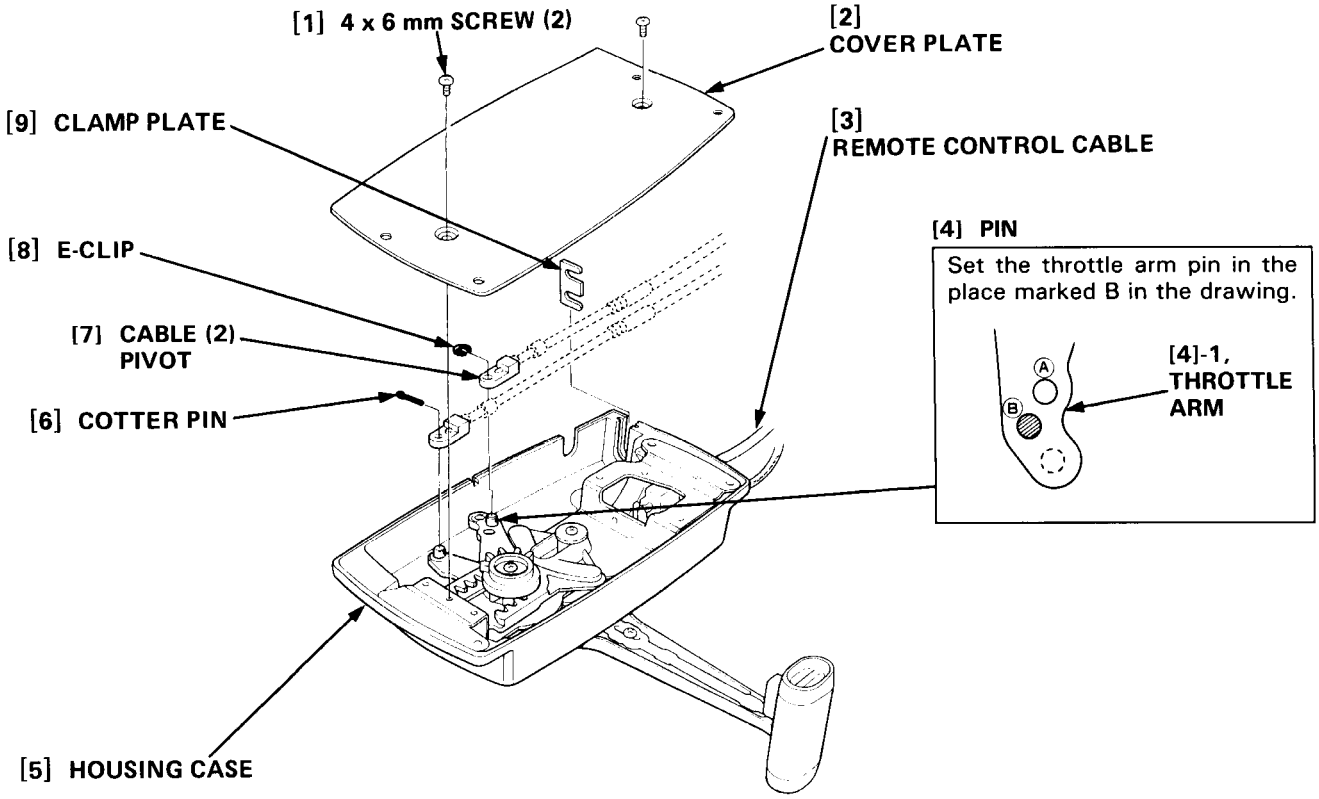


REMOTE CONTROL KIT

OUTBOARD MOTOR SIDE:



REMOTE CONTROL KIT SIDE:



a. CABLE CONNECTION

The cable is not provided with the remote control kit. Cables listed below are recommended for this remote control kit.

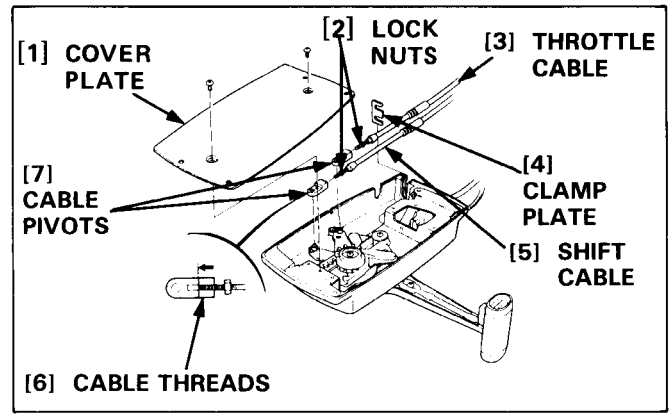
RECOMMENDED CABLE:
NIPPON CABLE SYSTEM INC. C43T95 (10-32UNF)
NHK MOSE CO., LTD. 33C (10-32UNF)

NOTE

- Connect the cable to the remote control kit first, then to the outboard motor.

• REMOTE CONTROL BOX SIDE

1) Remove the cover plate, screw the threaded end of the cable into the cable pivot until the cable end is flash with the stepped face of the cable pivot.
Insert the clamp plate into the groove in each cable and install the plate on the case.

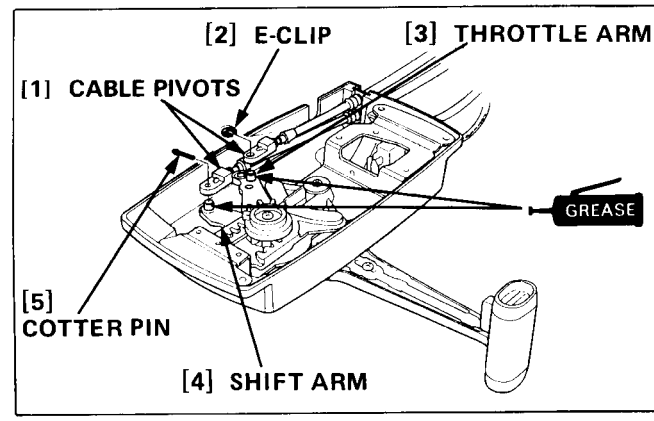


2) Install the shift cable pivot on the shift arm and secure it with a cotter pin. Tighten the lock nut.

3) Install the throttle cable pivot on the throttle arm and secure it with a E-clip. Tighten the lock nut.

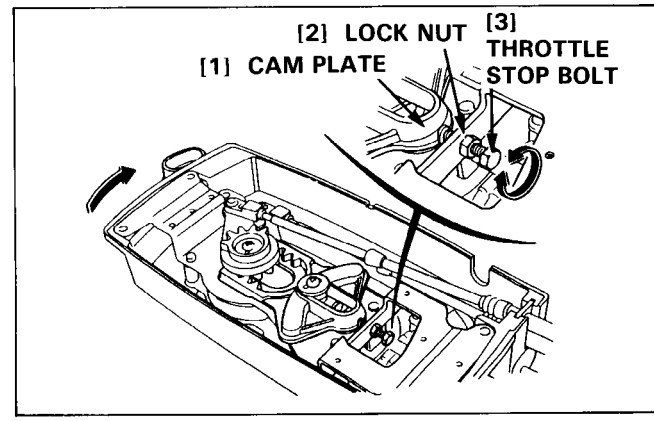
NOTE

- Apply grease to the sliding surface of the shift and throttle arm pins.



4) After the all cable connections are complete, adjust the throttle stop bolt as following:

Loosen the throttle stop lock nut and back off the throttle stop bolt. Move the remote control lever as far as it goes to FORWARD (full throttle position).
While holding the remote control lever, turn in the throttle stop bolt until it contacts the cam plate. Tighten the lock nut securely.
Install the cover plate.



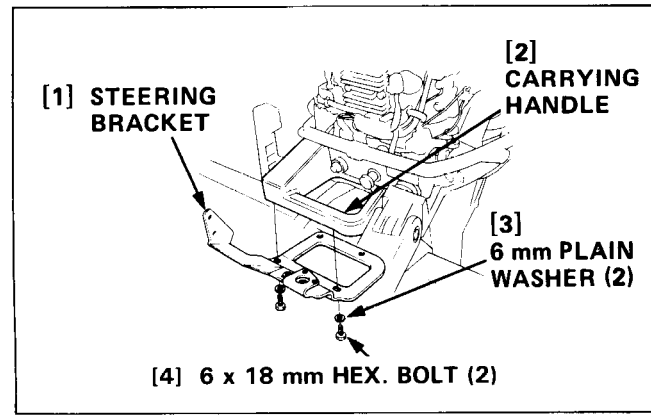
• OUTBOARD MOTOR SIDE

1) Remove the engine cover.
Remove the 8 x 30 mm carring handle mounting bolts and washers. Set the steering bracket and loosely install the 8 mm bolts and washers and 6 mm washers and bolts.

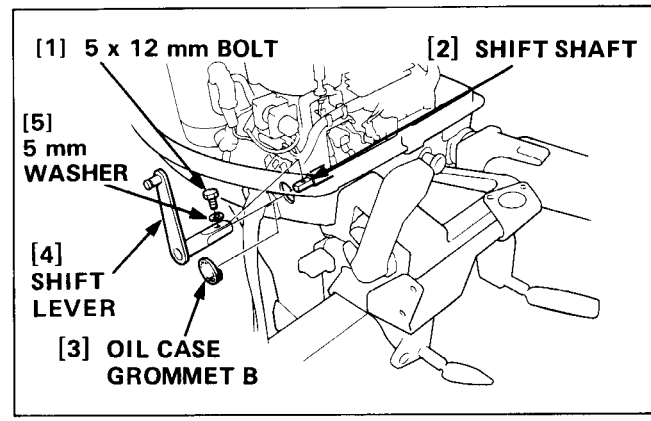
NOTE

- Do not press on the carring handle while removing the 8 mm bolts.

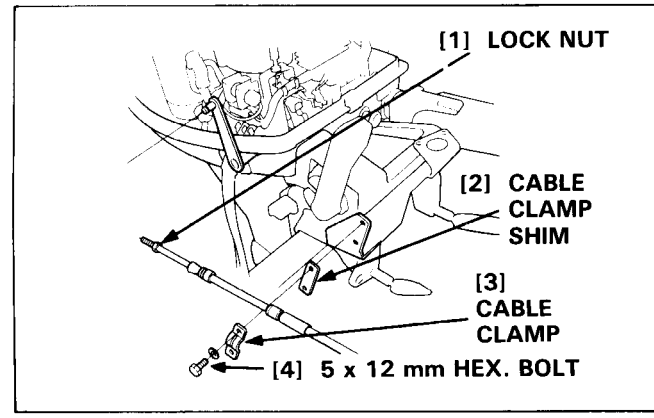
Tighten the 8 mm bolts first, then tighten the 6 mm bolts securely.



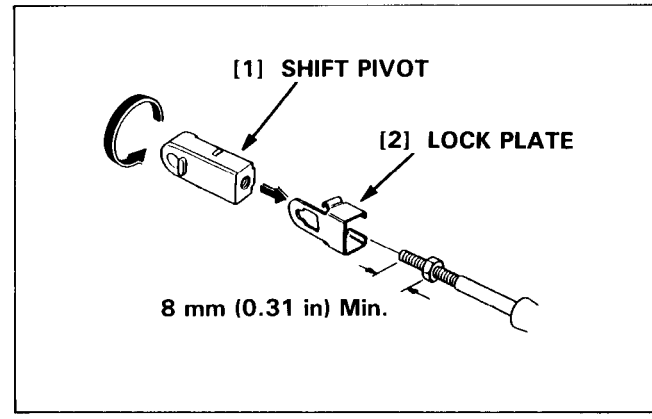
2) Remove the oil case grommet B.
Align the hole in the shift lever with the hole in the shift shaft and install the shift lever with the 5 x 12 mm bolt and 5 mm washer.



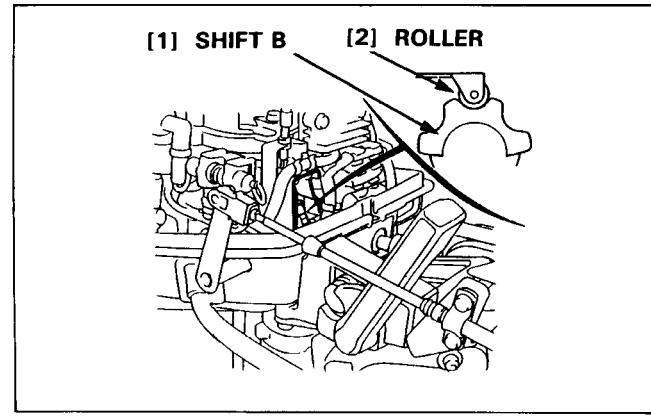
3) Align the projection on the cable clamp with the groove in the cable, attach the cable clamp shim against the cable clamp, and install them on the steering bracket with the washers and 5 x 12 mm hex. bolts.



4) Turn the cable lock nut in or out until there is 8 mm (0.31 in) from the cable end.
Set the lock plate on the shift pivot. Screw the shift pivot about 10 turns until it contacts the lock nut.



5) Apply waterproof grease to the shift arm pin and install the shift pivot on the shift arm.
Move the remote control lever to FORWARD, NEUTRAL and REVERSE, and check that the roller sits squarely between the appropriate teeth on the shift B in each potion.

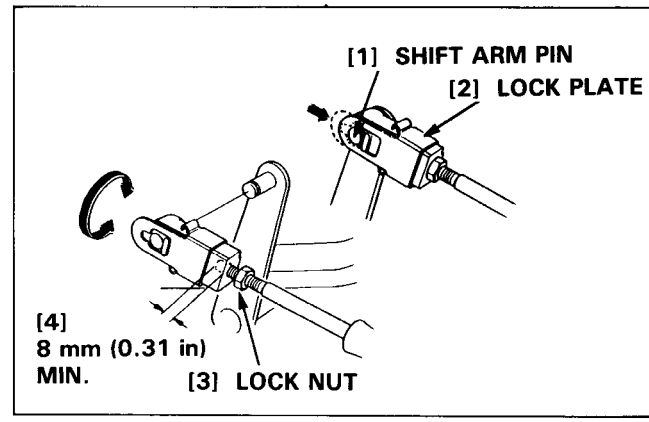


6) If not, remove the shift pivot from the shift lever and adjust the cable length by turning in the shift pivot.
Make sure that the cable end is screwed into the shift pivot by 8 mm (0.31 in) min.
If not, adjust cable pivot position at the remote control box side (page 14-7).

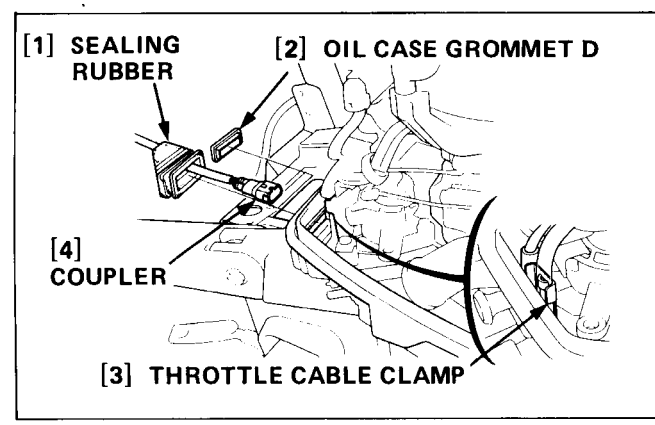
7) After adjustment, tighten the lock nut securely.

TORQUE: 1.0—1.8 N·m (0.10—0.18 kg-m, 0.7—1.3 ft-lb)

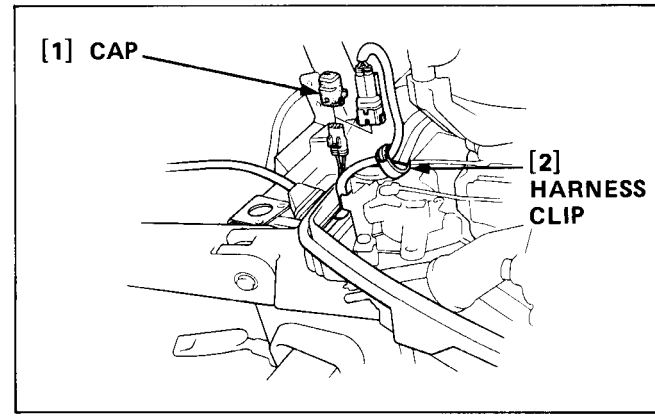
Install the lock plate so that the shift arm pin in the cutout of the lock plate. Be sure that the lock plate surface is aligned with the groove of the shift arm pin.



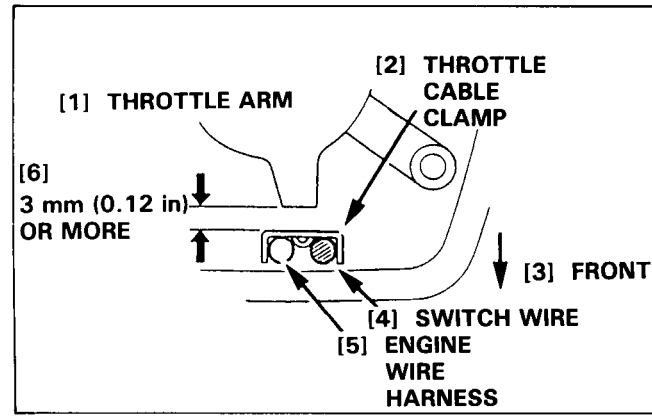
8) Remove the oil case grommet D, pass the remote control coupler through the sealing rubber, and install the sealing rubber to the oil case.
Hold the remote control cable with the throttle cable clamp.



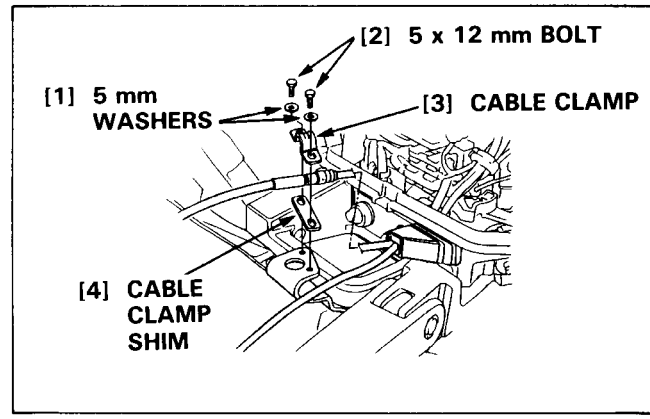
9) Remove the cap from the neutral starting bracket side coupler and connect the coupler to the remote control coupler.
Secure the cable with the harness clip.



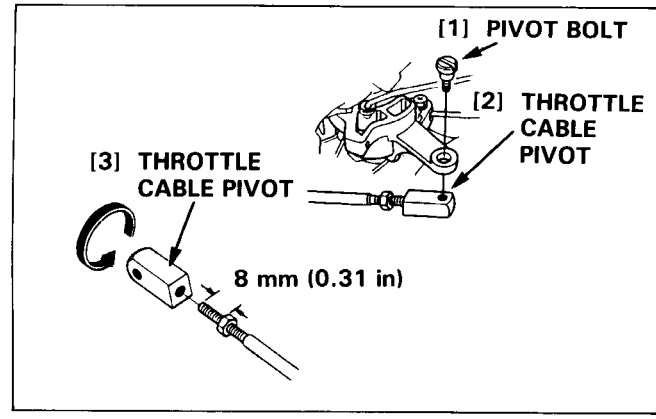
10) Move the throttle lever and make sure that the switch wire does not interfere with the throttle lever and that the clearance between the throttle cable clamp and throttle arm is 3.0 mm (0.12 in) or more.



11) To free the throttle grip, turn the friction knob counter-clockwise.
Align the projection of the cable clamp with the groove of the cable, attach the cable clamp shim against the cable clamp and install them on the steering bracket.
Set the switch wire clip on the inside of the cable clamp as shown and secure them with the 5 mm washers and bolts.



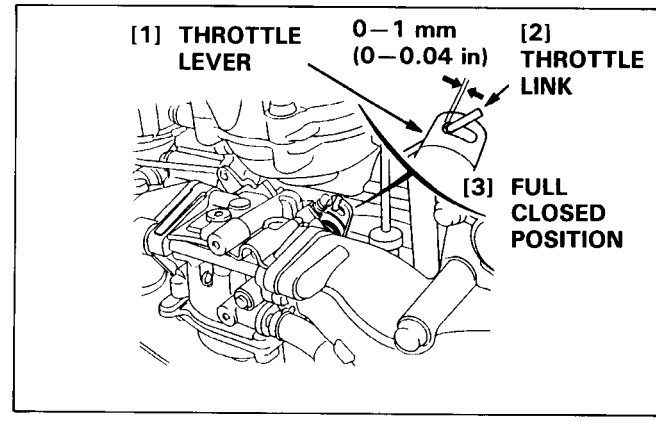
12) Turn the lock nut in or out until there is 8 mm (0.31 in) from the cable end. Screw the throttle cable pivot in about 10 turns until it contacts the lock nut.
Apply waterproof grease to the sliding surface of the pivot bolt. Install the throttle cable pivot to the throttle arm with the pivot bolt.



13) Move the remote control lever as far as it goes to forward and check that the throttle link is full open position.
Set the remote control lever to the NEUTRAL position and check that the throttle is full closed position (There should be clearance between the throttle link and throttle lever as shown).

14) If not, remove the cable pivot and adjust the cable length by turning the cable pivot.
After adjustment, tighten the lock nut.

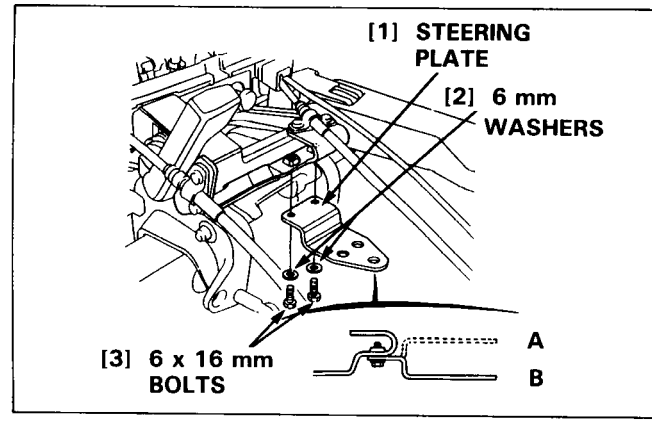
TORQUE: 1.0—1.8 N·m
(0.10—0.18 kg-m, 0.7—1.3 ft-lb)



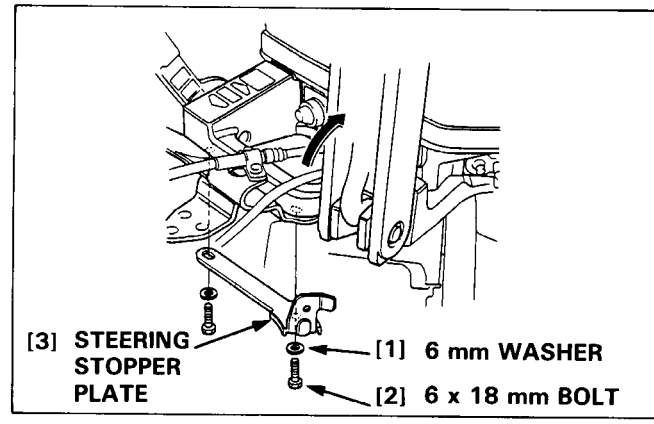
15) Install the steering plate on the steering bracket with 6 x 16 mm bolts and 6 mm washers.

NOTE

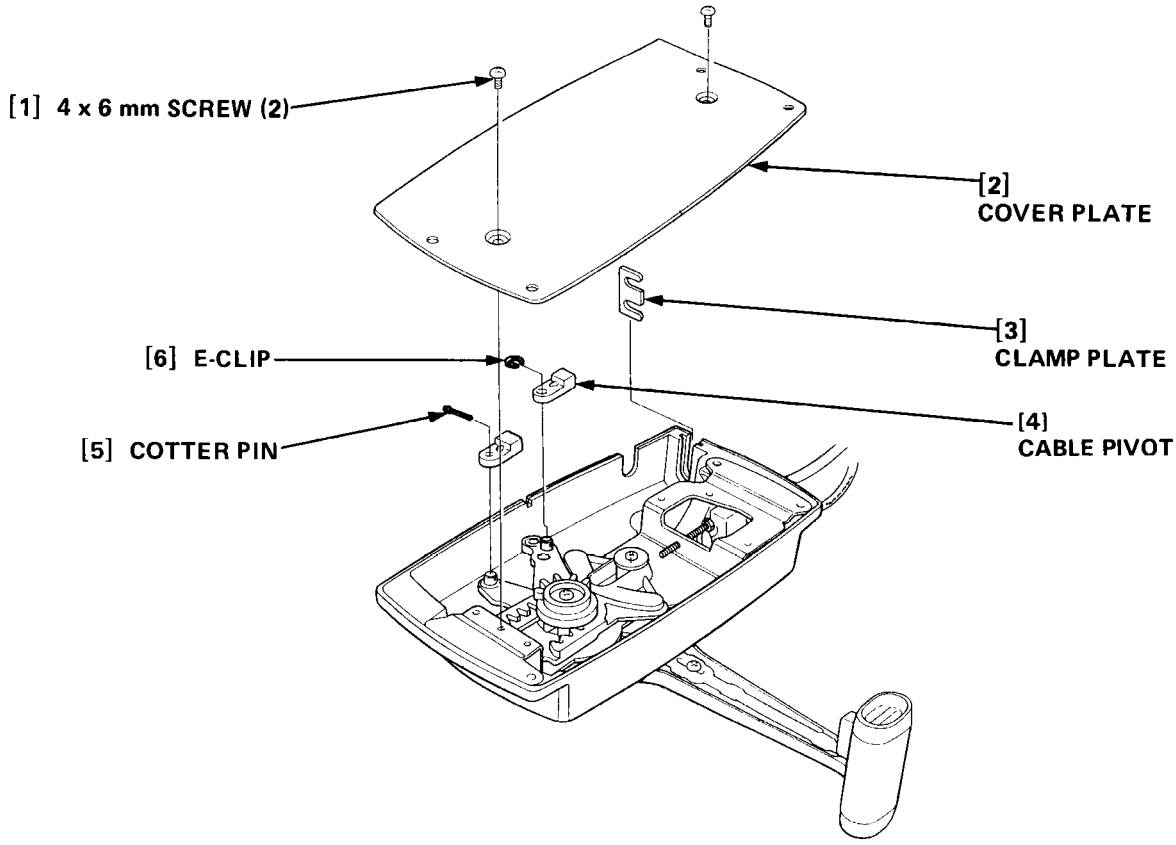
- Installation direction of the steering plate varies according to the type of steering system as below.
  A: Ball post type
  B: Rope type

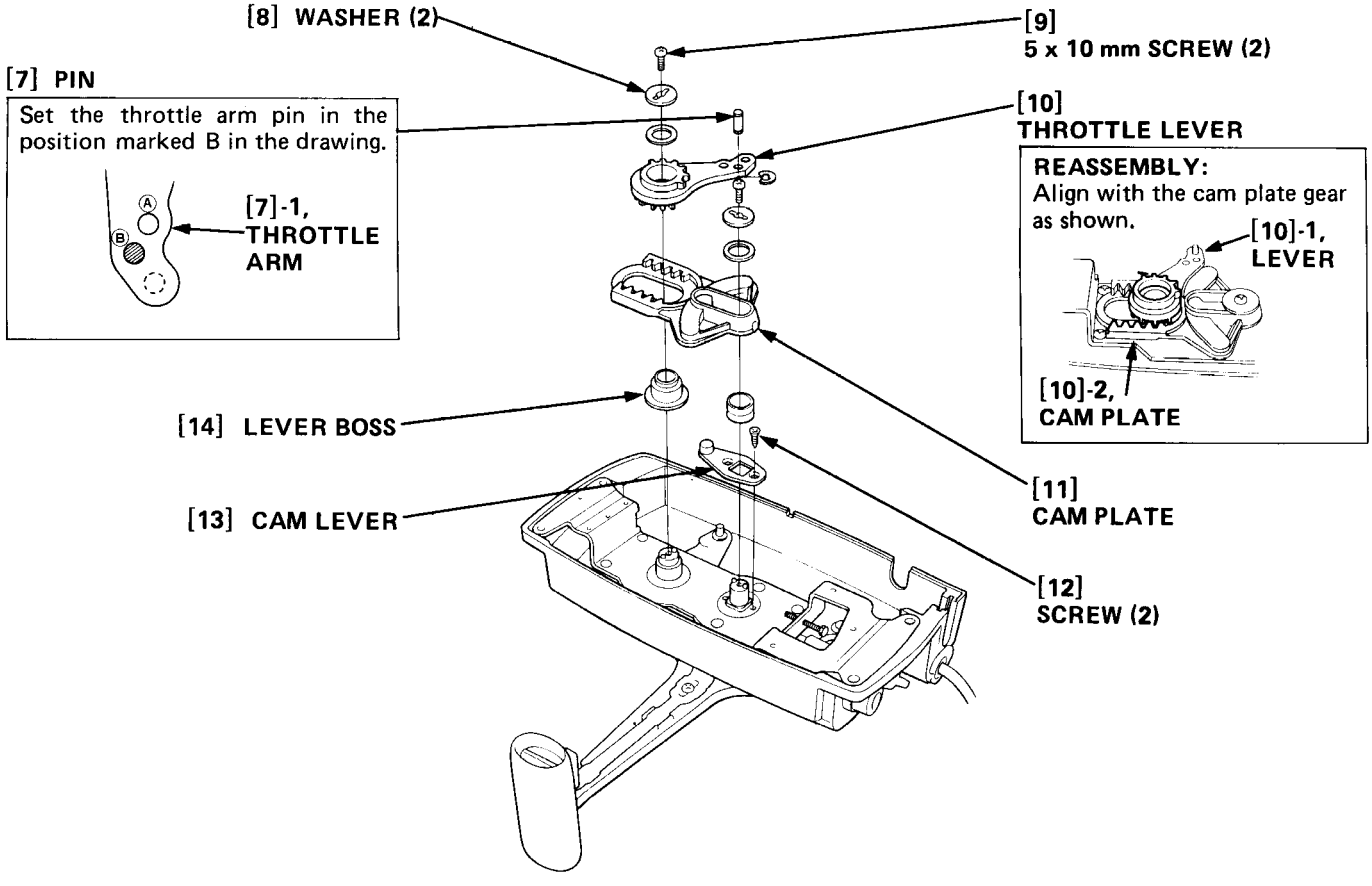


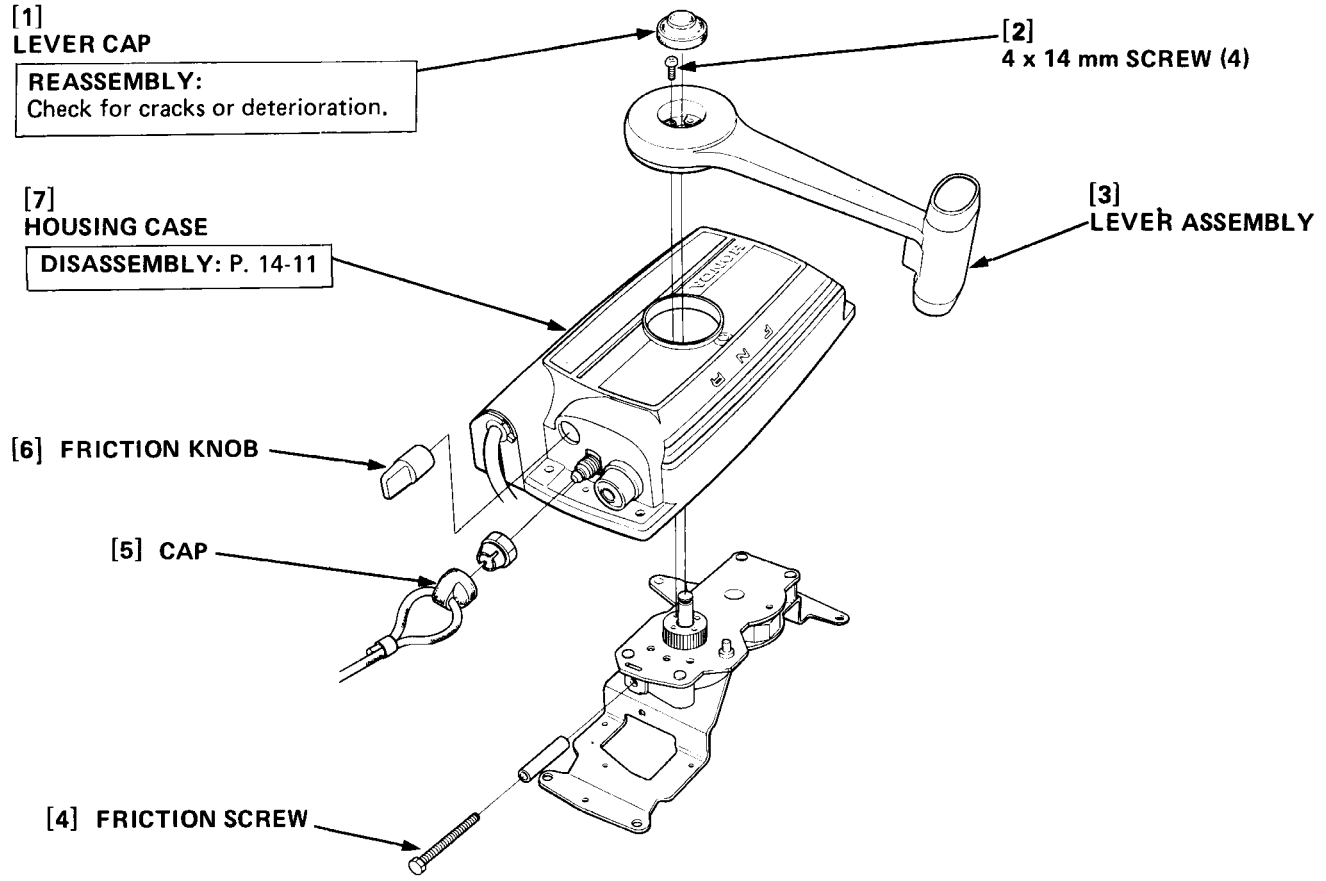
16) Operate the steering and be sure it works properly.
Check to see whether the handle interferes with the boat.
If interferes, remove the 6 mm steering bracket mounting bolts, raise the handle uplight, and tighten the steering stopper plate.



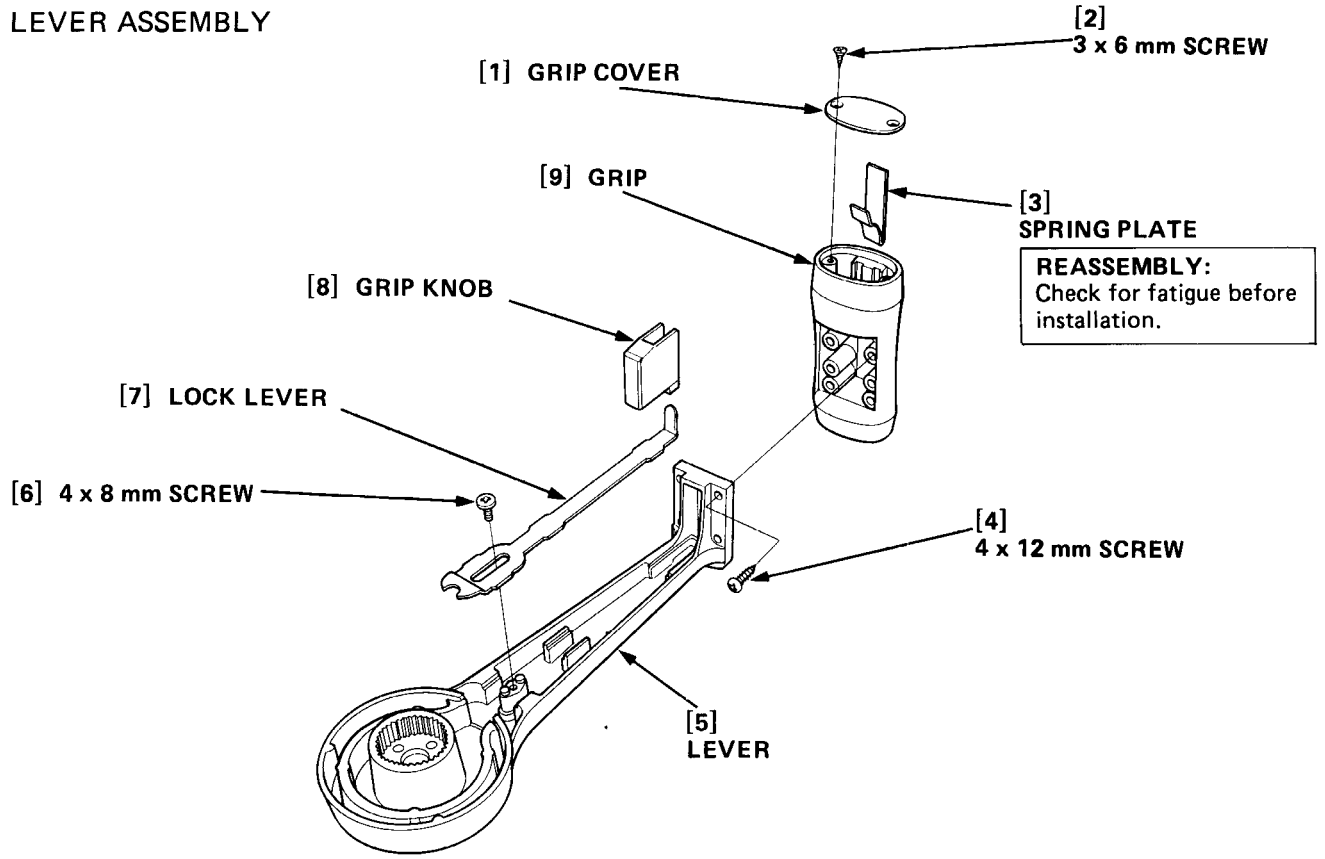
b. DISASSEMBLY/REASSEMBLY

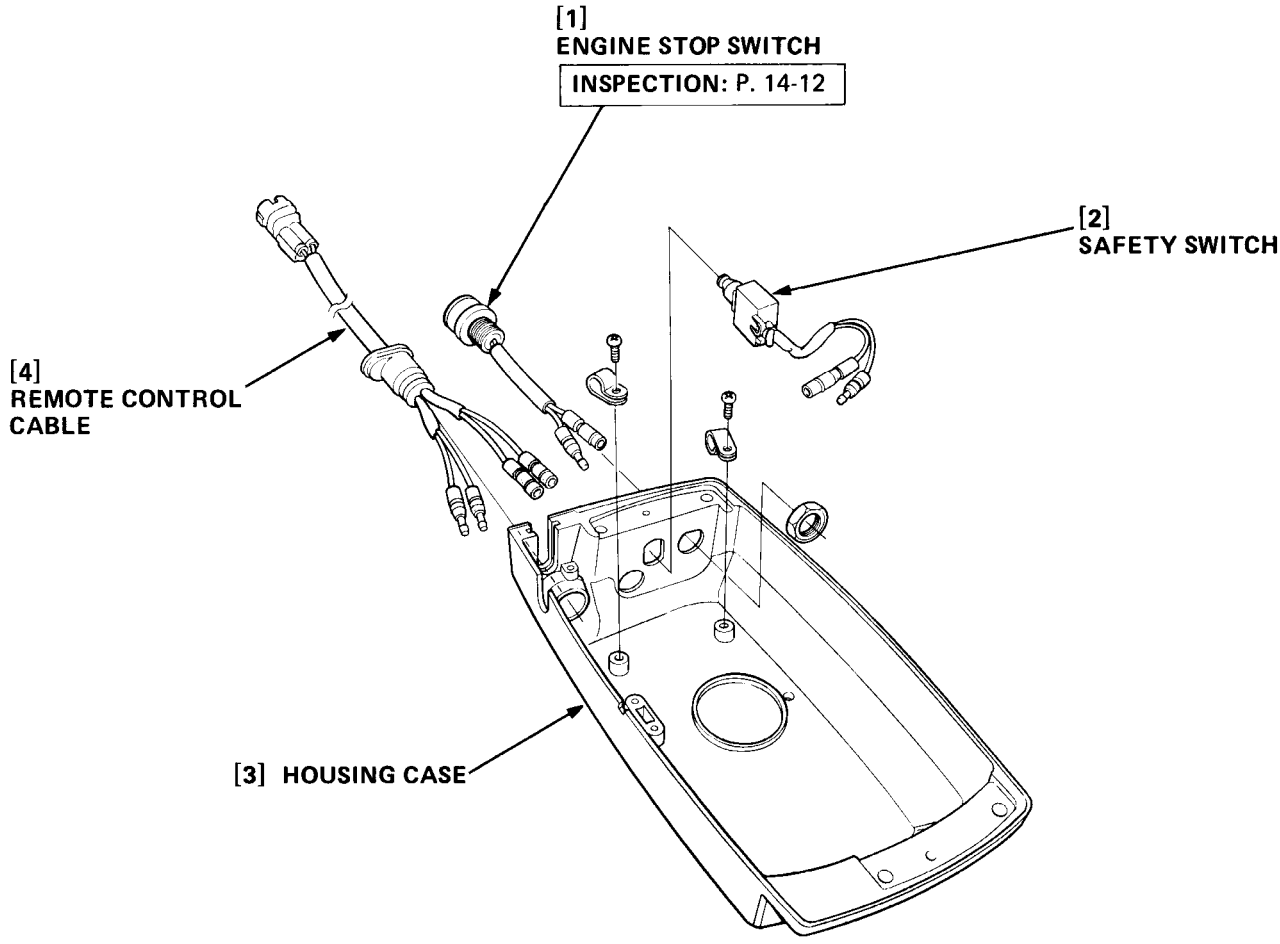






- LEVER ASSEMBLY

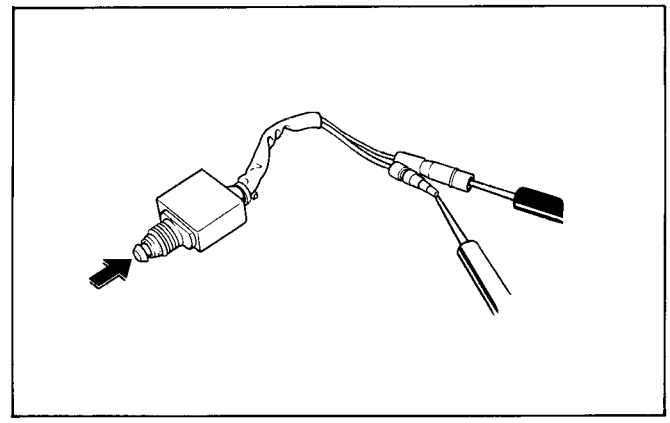




b. INSPECTION

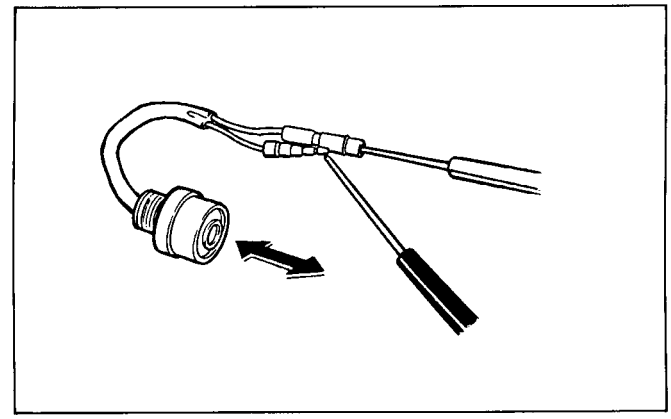
- SAFETY SWITCH

Check the safety switch for continuity.
There should be no continuity between the leads while the switch is pressed in and continuity while the switch is released.



- ENGINE STOP SWITCH

Check the engine stop switch for continuity.
There should be continuity between the leads while the switch is pressed in and no continuity while the switch is released.



OPERATION

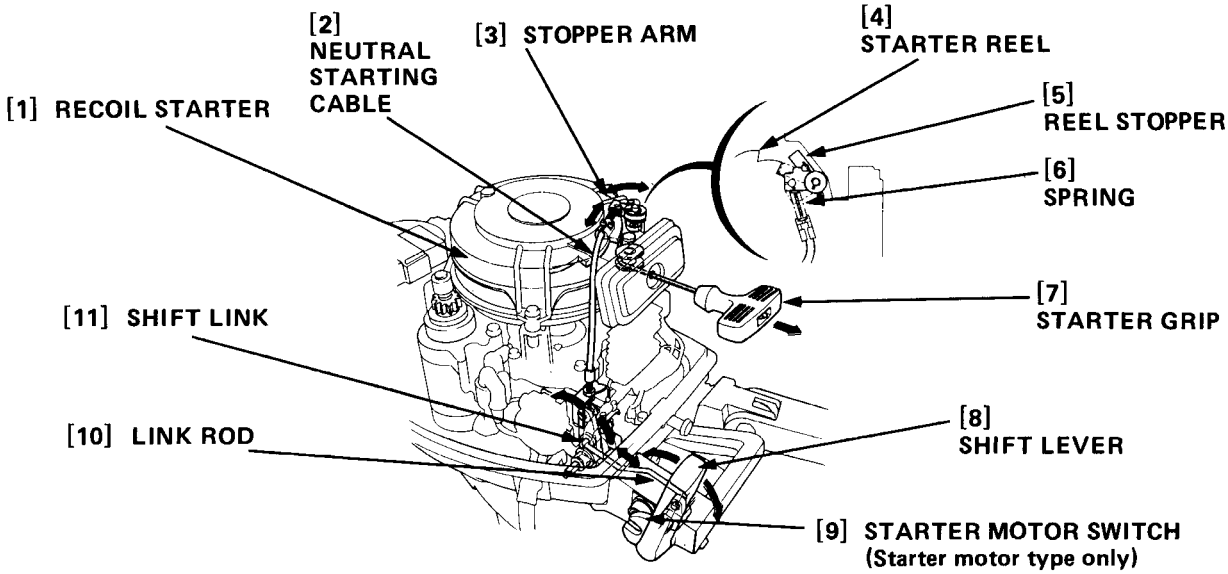
MECHANICAL TYPE NEUTRAL START SYSTEM

<OUTLINE>

When the shift lever is not in the neutral position, the recoil starter will not rotate, and the engine cannot be started.
Starter motor type: The starter switch can be operated only when the shift lever is in the neutral position.

<CONSTRUCTION>

The shift lever is connected via a link rod to the shift link. One end of the neutral starting cable is connected to the shift link arm; another to the stopper arm on the recoil starter. When the shift lever is in forward or reverse, the shift link cam moves along the circumference, pulls the starting cable to activate the stopper arm and reel stopper, and prevents engagement of the starter reel cable.



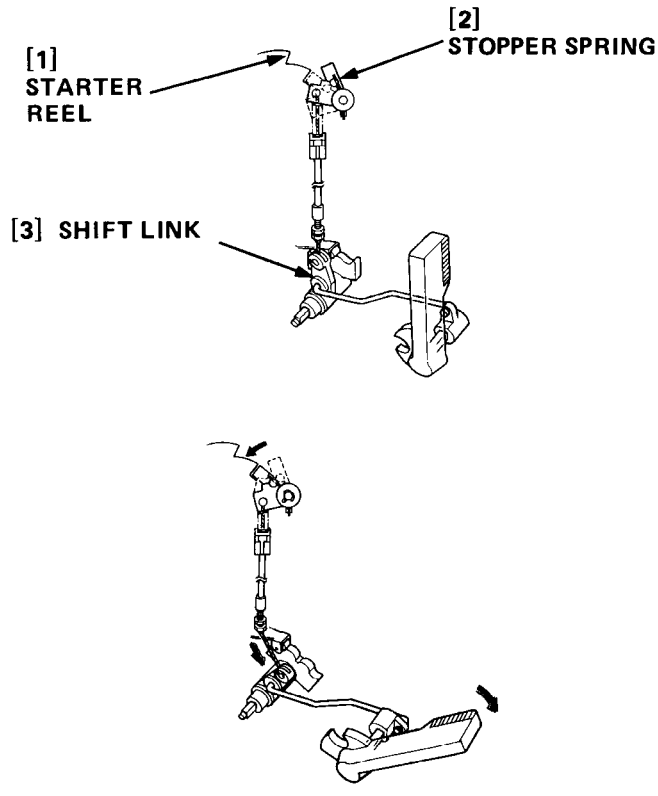
<OPERATION>

WHEN SHIFT LEVER IS IN NEUTRAL POSITION

The shift link arm is not activated. The stopper arm reel and reel stopper are pushed outward by the spring on the starting cable, so that the reel stopper does not engage with the starter reel claw. When the starter grip is pulled, the starter reel rotates to start the engine.

WHEN SHIFT LEVER IS IN FORWARD OR REVERSE POSITION

When the shift link arm is activated, the starting cable is pulled and interlocks to pull the stopper arm. The reel stopper is held inward by the stopper spring, so that it engages with the starter reel, interlocking with the stopper arm. The starter grip cannot be pulled in this state. The starter reel does not rotate, and the engine will not start.

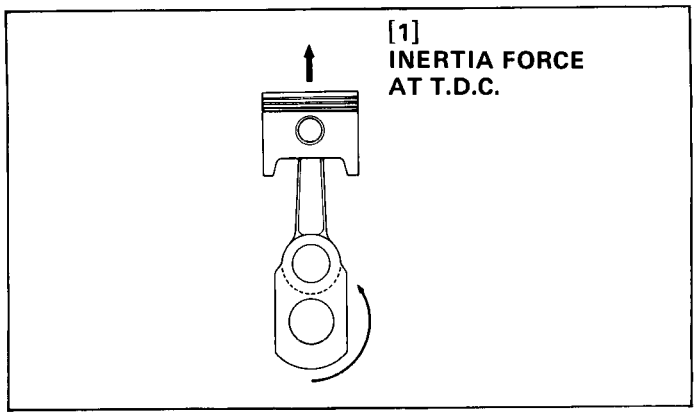


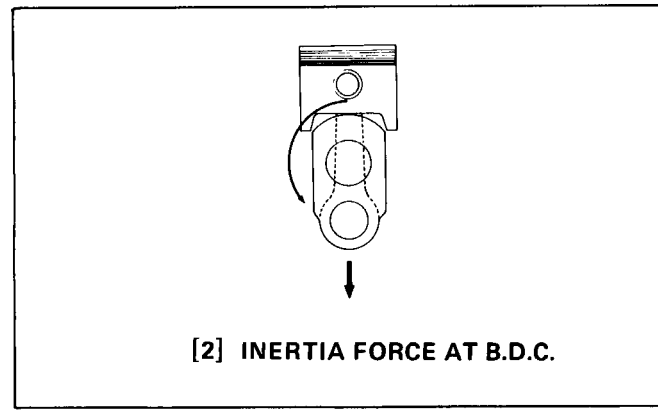
TWO-SHAFT BALANCER SYSTEM

<OUTLINE>

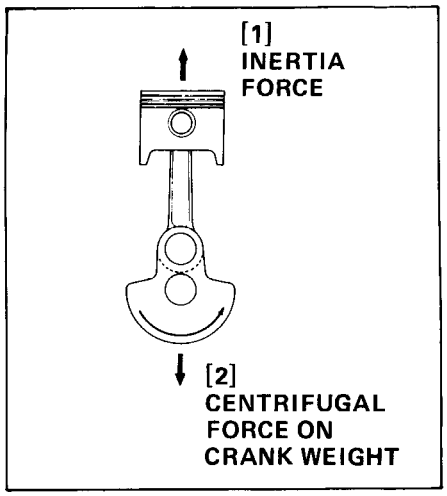
The Honda Outboard Motor BF9.9A/15A have 2-cylinder, 4-stroke engines.
2-cylinder, 4-stroke engines generally have a cranking angle of 360°, because of their constant interval ignition. Without a balancer, there is a primary inertia force.
With a two-shaft balancer offset at the top of the cylinder barrel, the primary inertia force reciprocal can be counteracted.

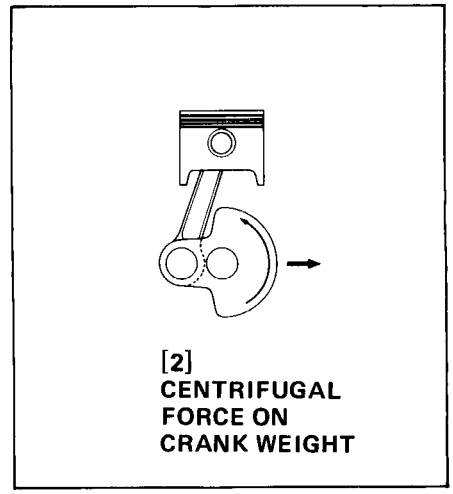
BALANCER
The vibration source of the engine is reciprocal inertia force generated when the connecting rods go up and down.

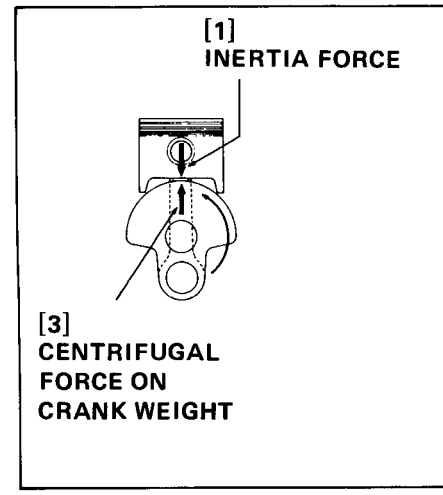




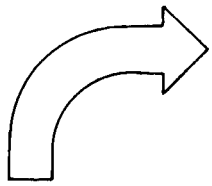
A crank weight is generally mounted to reduce the inertia force. Mounting the crank weight as shown allows the weight's centrifugal force to reduce the inertia force of the rods.
However, crank weights produce their own horizontal vibration. The balancer system counteracts inertia force as well as the crank weight's horizontal vibration.

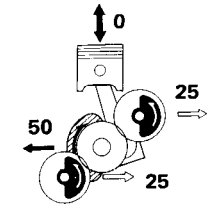




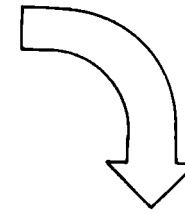


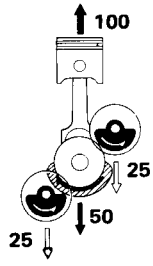
• OPERATING PRINCIPLE OF THE TWO-SHAFT BALANCER



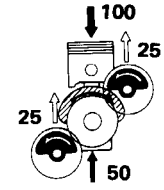


[1] WHEN CRANK ANGLE IS 90°
The upward or downward inertia force on the piston is zero, but the inertia force (50%) is applied horizontally on the crank weight. Therefore, by applying two balancers of 25% to the 50% opposite direction, the imbalance inertia force will be zero.

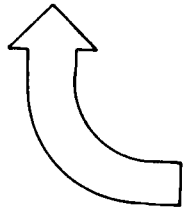


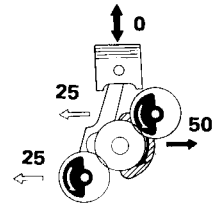


[4] WHEN CRANK ANGLE IS 0°
The inertia force (100%) applied upward or downward to the piston is counteracted by downward inertia force on the crank weight. The remaining force will be 50%. This will be further counteracted by the downward inertia force on the two 25% balancers, so that the entire imbalance inertia force will be zero.

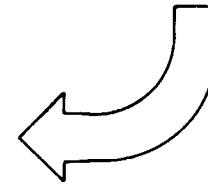


[2] WHEN CRANK ANGLE IS 180°
The inertia force on the piston is 100% downward. The remaining 50% imbalance, which was counteracted by the inertia force on the crank weight, will be counteracted by the balancer in the same way as with a crank angle of 0°.





[3] WHEN CRANK ANGLE IS 270°
The inertia force on the crank weight is counteracted by the balancer in the same way as with a crank angle of 90°. The inertia force on the piston at this position is zero.



MAJOR MECHANISMS

- COOLING SYSTEM

a. COOLING PATH

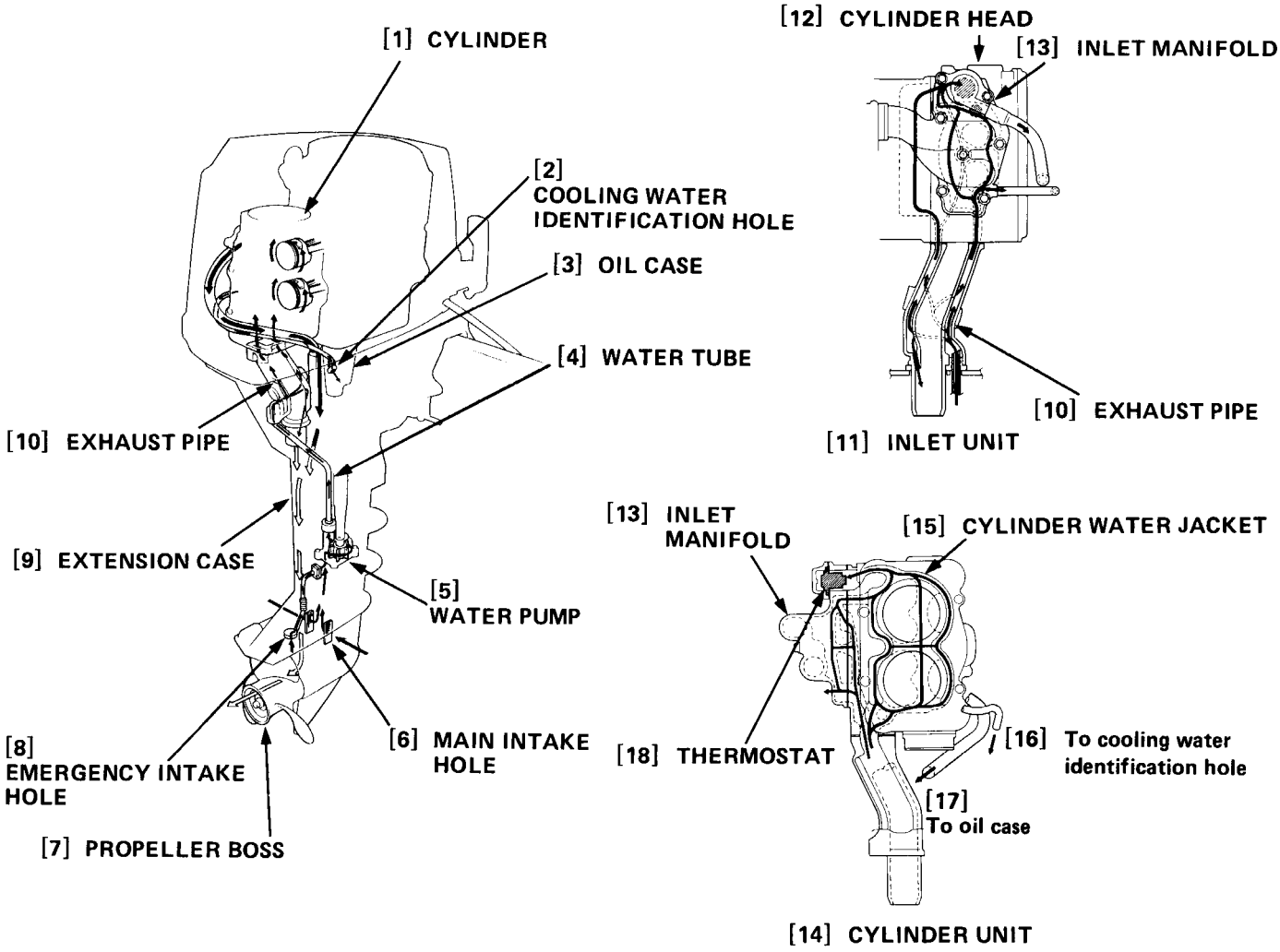
Water is taken through the intake holes (main intake hole and emergency intake hole) on the gear case, and pumped upward by the water pump, to each jacket such as water tube ④, exhaust pipe ⑩, water jacket around the cylinder ①, cylinder head ⑫ and inlet manifold ⑬. Thus cooling each part, the water goes through thermostat ⑱ and cools oil case ③ before passing the extension case and is then exhausted through the propeller boss.
Some of the water pumped to the exhaust pipe ⑩, goes through the inlet manifold ⑬ and is exhausted through the cooling water identification hole. It is also pumped into the exhaust pipe to cool the exhaust gas.

b. WATER PUMP

The water pump is installed in the gear case. It is an impeller type pump driven by a pinion shaft.

c. THERMOSTAT

The thermostat, also attached to the water jacket (inlet manifold) outlet, maintains the water temperature inside the water jacket in a constant range by opening and closing the valve according to the temperature of engine cooling water. If the temperature is too low the thermostat closes the valve and the water inside the jacket is held until the temperature reaches a certain value. The water pump then will again be activated to pump water and exhaust it through the valve hole of the thermostat, the cooling water identification hole, the exhaust pipe cooling hole and the impeller housing hole.



• LUBRICATING SYSTEM

Lubrication of the 4-stroke engine of the Honda Outboard Motor BF9.9A/15A is of the forced pressure splash type using a trochoid pump.

a. LUBRICATING PATH

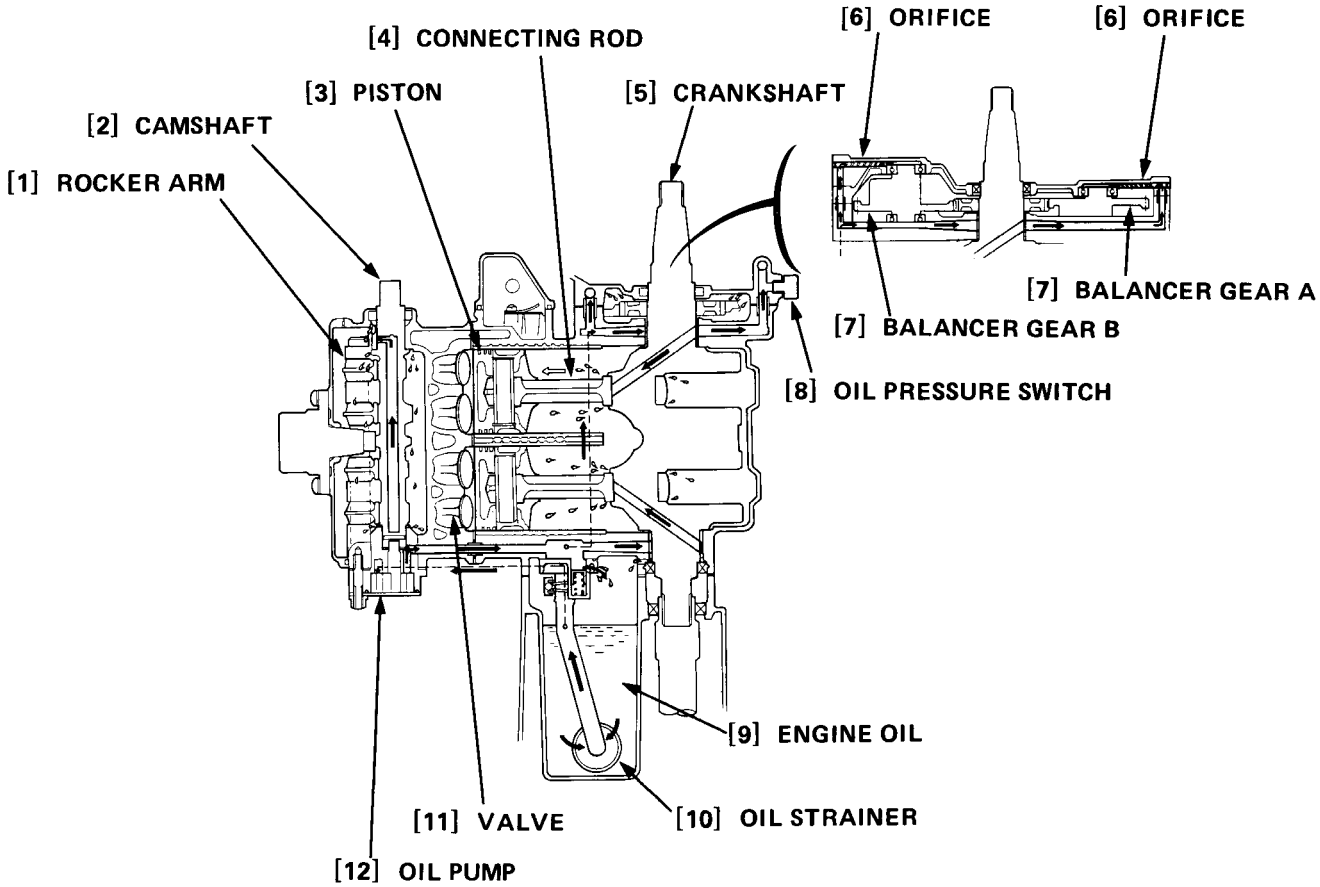
The engine oil (9) inside the oil case is lifted by the pump (12) . Half of the oil goes through the inside of the camshaft (2) and lubricates the valve (11) and rocker arms (1). The other half goes through the oil passage in the inner cylinder wall and lubricates the crank chamber. The oil lifted to the crank top enters the upper journal, goes through the inside of the crankshaft (5) and exits from the crank pin hole. The oil that went through the passage in the middle of the cylinder enters the lower journal, passes through the inside of the crankshaft and exits from the lower crank pin hole. The oil from the crank pin hole pours out from the large end of the connecting rod (4) and splash-lubricates the piston (3) and cylinder. Also, the oil lifted to the crank top goes through the orifice (6) and lubricates balancer gears A and B (7) . In this lubrication channel, an oil strainer (10) is provided to eliminate foreing matter metal residue, etc., so that each part is always be supplied with clean oil.

b. OIL PUMP

The trochoid pump consists of inner rotor, outer rotor and body. The pump lifts and delivers the oil using the change in volume between the inner rotor which is driven by the camshaft, and the outer rotor.

c. OIL PRESSURE WARNING UNIT

With 4-stroke engines constant engine oil pressure is essential. To confirm this an oil pressure switch and an indicator lamp are provided.



Paper book Part no. 66ZV400Z

PREFACE

This supplement describes the major differences between Honda BF9.9A·15A Outboard Motors (Serial No. 1100001-1199999) and BF9.9A·15A Outboard Motors (Serial No. 1200001 and subsequent).
For service information which is not covered in this supplement, please refer to the base shop manual, part number 66ZV400Z.

HONDA MOTOR CO., LTD.
SERVICE PUBLICATIONS OFFICE

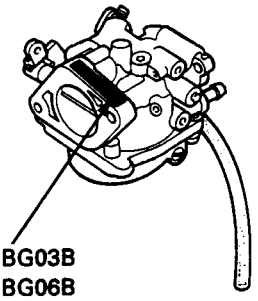
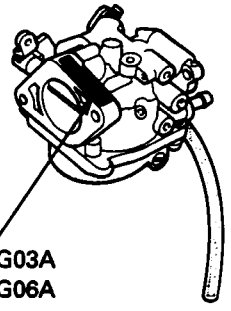
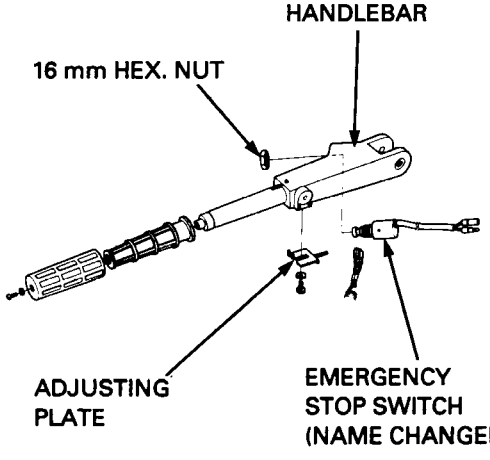
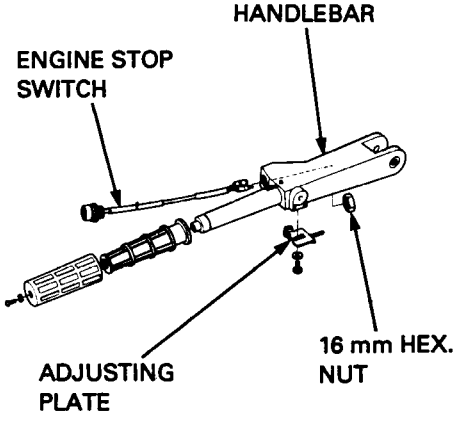
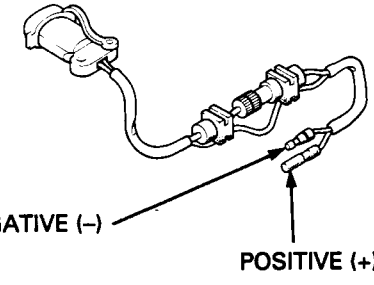
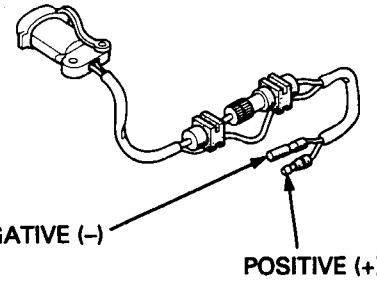
CONTENTS

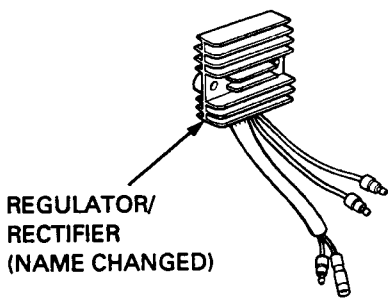
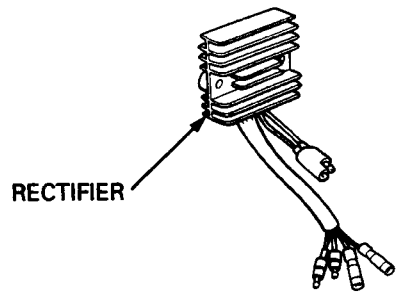
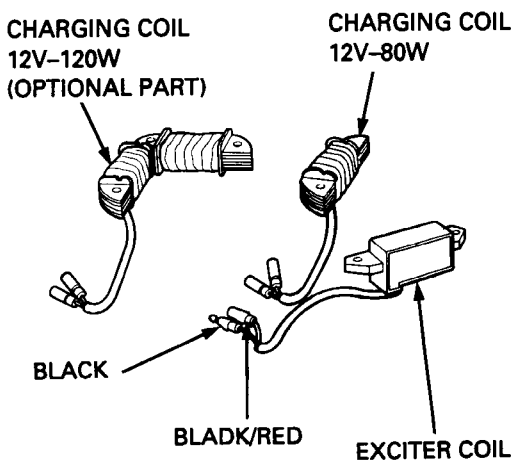
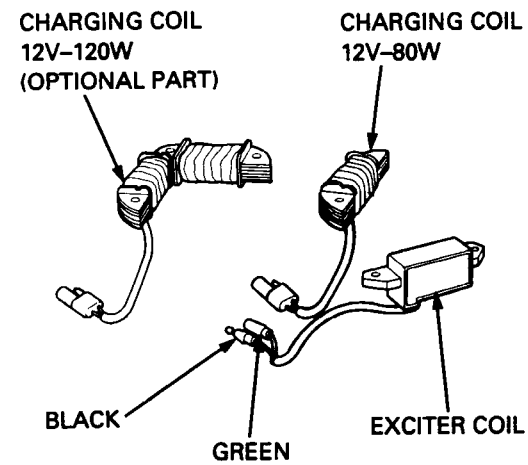
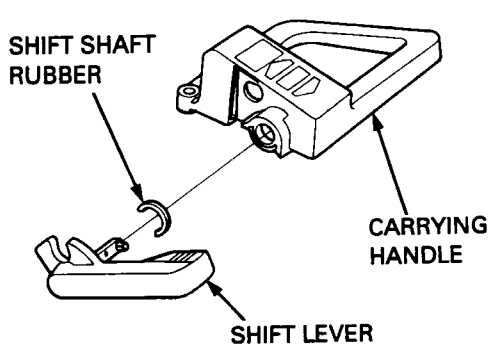
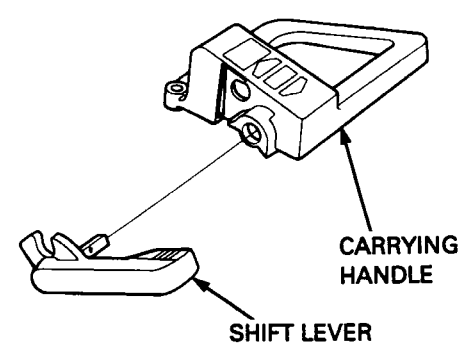
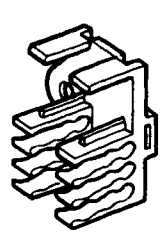
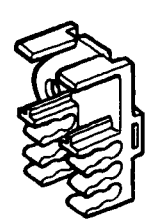
■ As the marked sections contain no changes they are not covered in this manual.

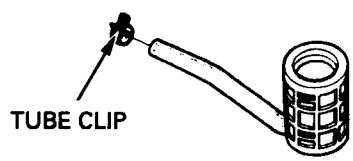
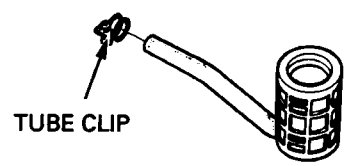
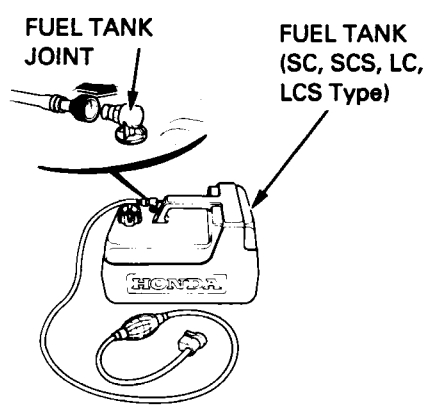
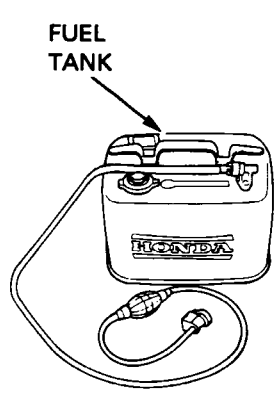
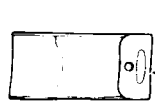
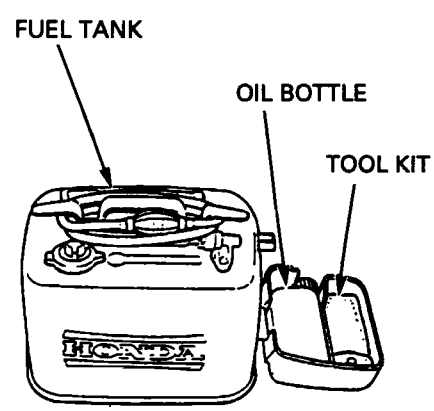
Data of Issue: Feb., 1991

OUTLINE OF CHANGES

• CHANGE LOCATIONS

Model / Item	Frame serial number: 1200001 and subsequent	Frame serial number: 1000001 – 1199999
Carburetor assembly	 BF9.9A: BG03B BF15A : BG06B	 BF9.9A: BG03A BF15A : BG06A
Handlebar/ Emergency stop switch		
Oil check bolt		
Charge receptacle		

Item \ Model	Frame serial number: 1200001 and subsequent	Frame serial number: 1000001 – 1199999
Rectifier		
Charging coil/ Exciter coil		
Shift lever/ Carrying handle		
Connector bracket A		

Item \ Model	Frame serial number: 1200001 and subsequent	Frame serial number: 1000001 – 1199999
Anode metal		
Tube clip		
Fuel tank/ Fuel tank joint/ Tool kit	  	

SPECIFICATIONS

SPECIFICATIONS

DIMENSIONS AND WEIGHTS

Item \ Model / Description code / Type	BF9.9A				BF15A			
	BABS		BABL		BAAS		BAAL	
	SC, SD	SCS, SDS	LC, LD	LDS	SC, SD	SCS, SDS	LC, LD	LCS, LDS
Overall length Overall width	550 mm (21.7 in) 320 mm (12.6 in)							
Overall height	1,050 mm (41.3 in)		1,180 mm (46.5 in)		1,050 mm (41.3 in)		1,180 mm (46.5 in)	
Dry weight	42 kg (92.6 lb)	46 kg (101.4 lb)	43 kg (94.8 lb)	47 kg (103.6 lb)	42 kg (92.6 lb)	46 kg (101.4 lb)	43 kg (94.8 lb)	47 kg (103.6 lb)
Operating weight (incld. oil)	43 kg (94.8 lb)	47 kg (103.6 lb)	44 kg (97.0 lb)	48 kg (105.8 lb)	43 kg (94.8 lb)	47 kg (103.6 lb)	44 kg (97.0 lb)	48 kg (105.8 lb)
Transom height	440 mm (17.3 in)		570 mm (22.4 in)		440 mm (17.3 in)		570 mm (22.4 in)	
Transom angle Tilting Swivel angle	5 stage adjustment (4°–8°–12°–16°–20°) 3 stage adjustment (30°, 45° and 70°) 40° (Right, Left)							

ENGINE

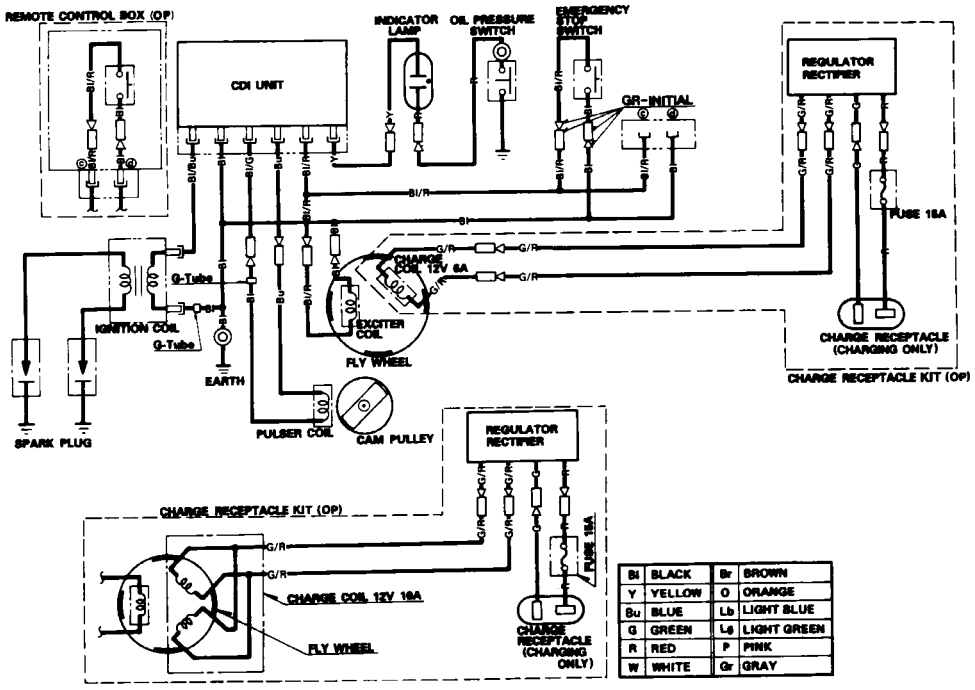
Type Total piston displacement Bore x stroke	2 cylinder, in-line, 4 stroke, water-cooled, OHC 280 cm³ (17.1 cu in) 58 x 53 mm (2.3 x 2.1 in)	
Maximum horsepower	7.28 kw (9.9HP) 5,500 rpm (Propeller shaft)	11.03 kw (15HP) 6,200 rpm (Propeller shaft)
Maximum torque	17.4 N·m (1.74 kg-m, 12.66 ft-lb) (Propeller shaft)	19.8 N·m (1.98 kg-m, 14.32 ft-lb) (Propeller shaft)
Compression ratio	8.6 : 1	
Fuel consumption ratio	270 g/PSh (0.60 lb/hp·h)	264 g/PSh (0.58 lb/hp·h)
Cooling system Ignition system Ignition timing	Forced water circulation by impeller pump with thermostat CDI 5°–35° B.T.D.C	
Spark plug	DR-5HS (NGK), X16FSR-U (ND)	DR-6HS (NGK), X20FSR-U (ND)
Carburetor Lubrication system Lubricant capacity Starting system Stopping system Fuel Fuel tank capacity Fuel pump Exhaust system	Horizontal type, butterfly valves Pressure lubrication by trochoid pump 1.1 ℓ (2.33 US pt, 1.94 Imp pt) Recoil starter (SC, SD, LC, LD Type) recoil starter and electric starter (SCS, SDS, LCS, LDS Type) Grounding of primary circuit Regular automotive gasoline (86 pump octane; unleaded preferred) 13.0 ℓ (3.43 US gal, 2.86 Imp gal) Mechanical plunger type Underwater type	

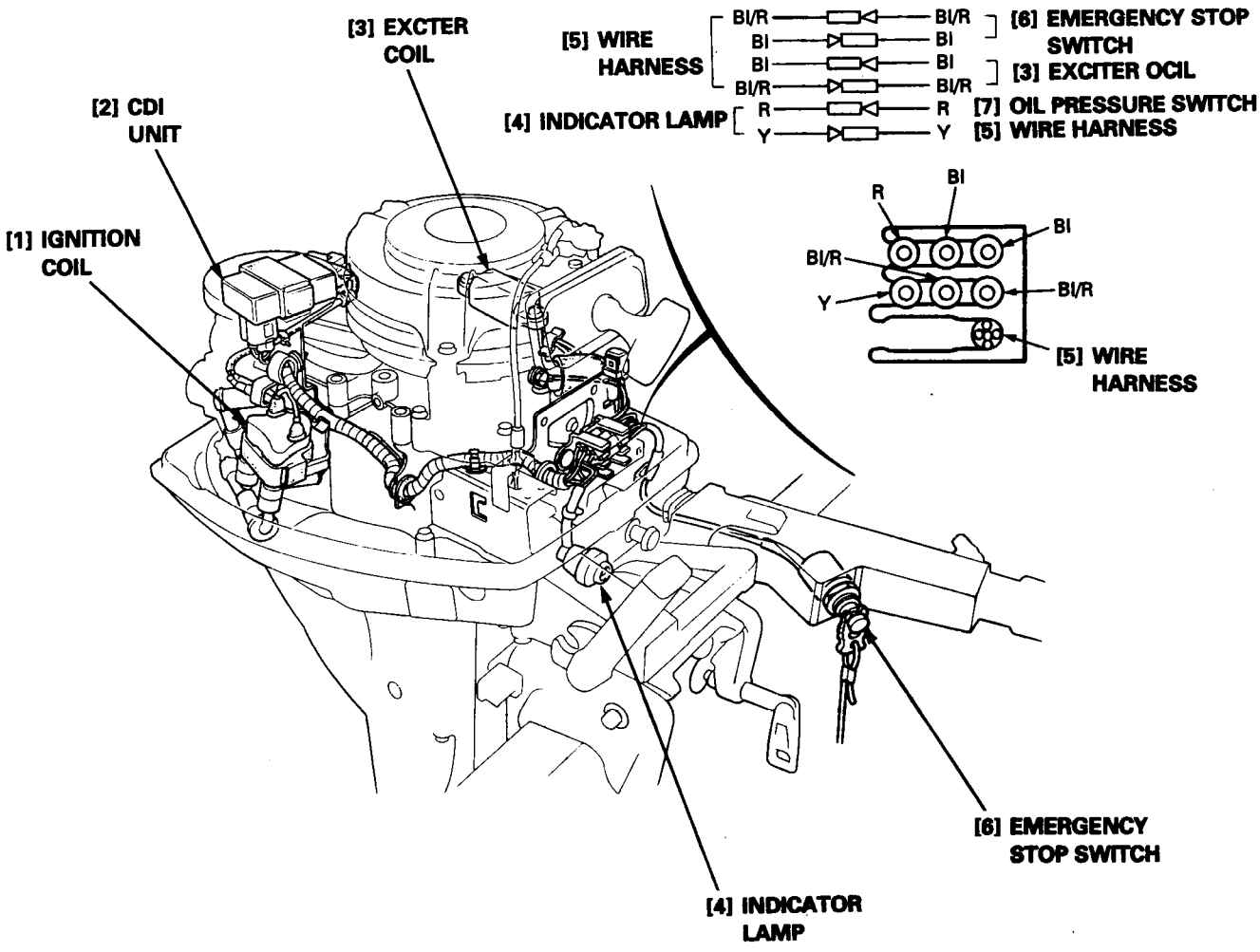
LOWER UNIT

Clutch	Dog clutch (Forward – Neutral – Reverse)
Gear ratio	0.48 (13/27)
Gear case oil capacity	0.24 ℓ (0.254 US qt, 0.211 Imp qt.)
Propeller	
No. of blades-Dia. x Pitch	3–240 mm x 240 mm (S), 3–240 mm x 220 mm (L)
Rotating direction	Clockwise (viewed from rear)

WIRING DIAGRAM

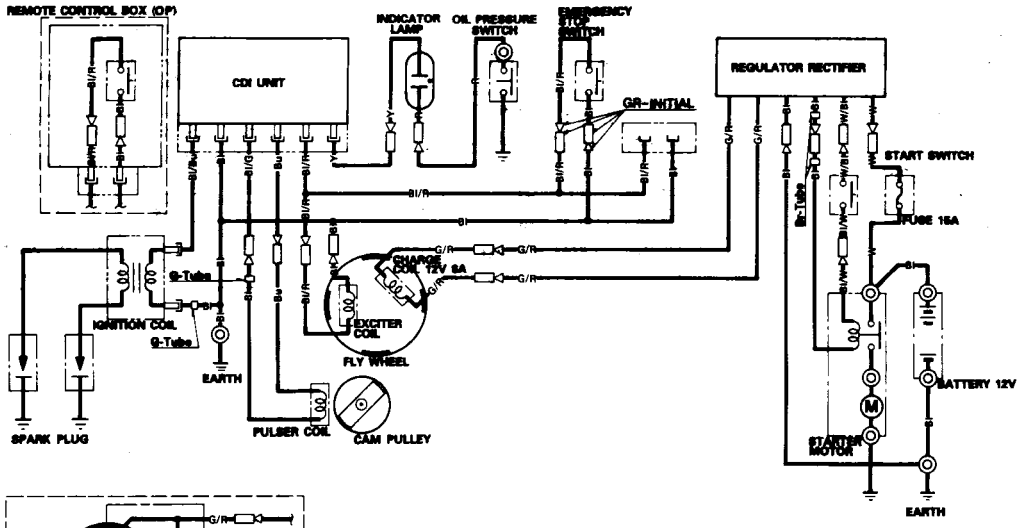
(Without electric starter)

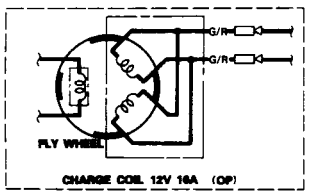




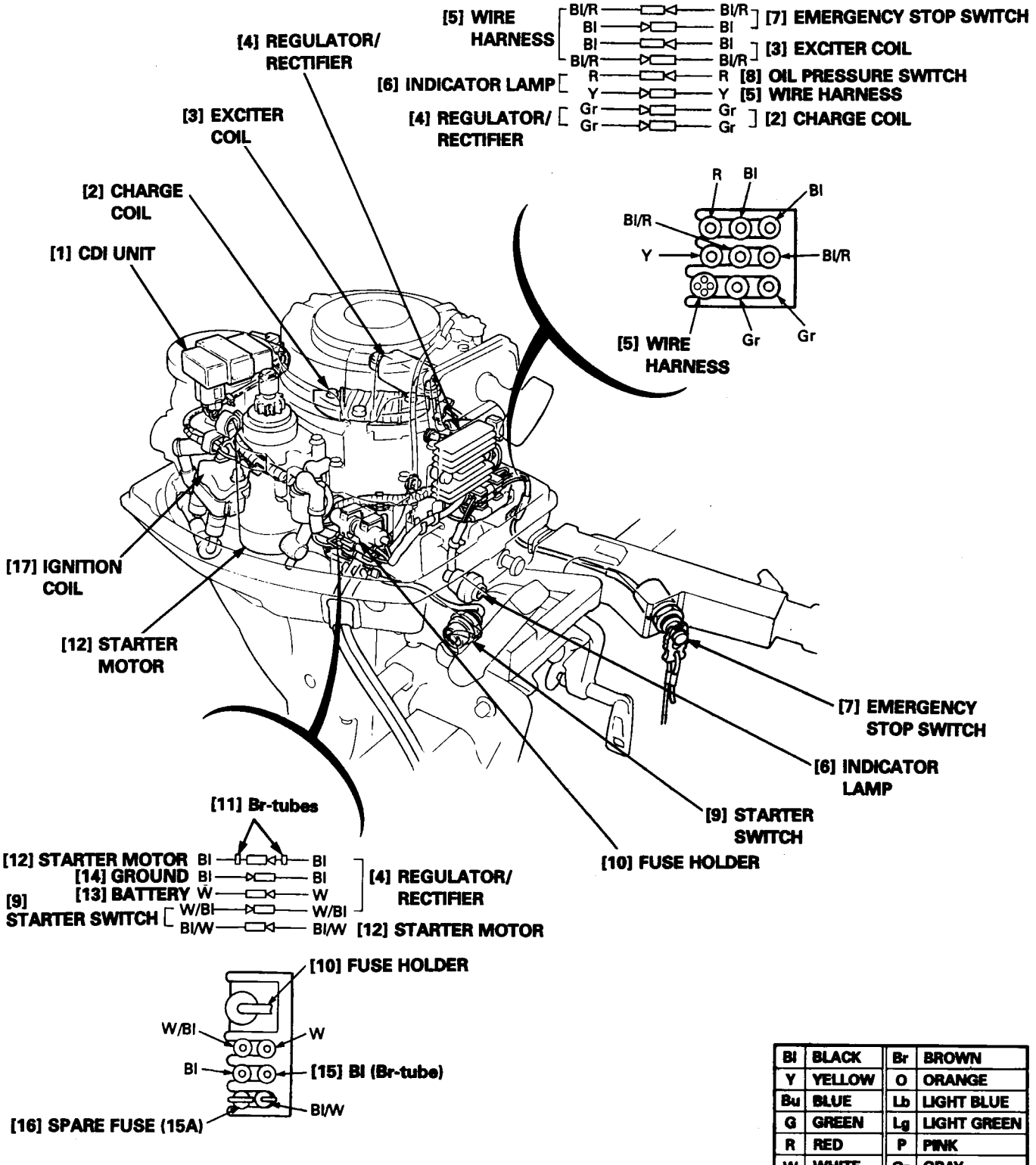
Bl	BLACK	Br	BROWN
Y	YELLOW	O	ORANGE
Bu	BLUE	Lb	LIGHT BLUE
G	GREEN	Lg	LIGHT GREEN
R	RED	P	PINK
W	WHITE	Gr	GRAY

(With electric starter)

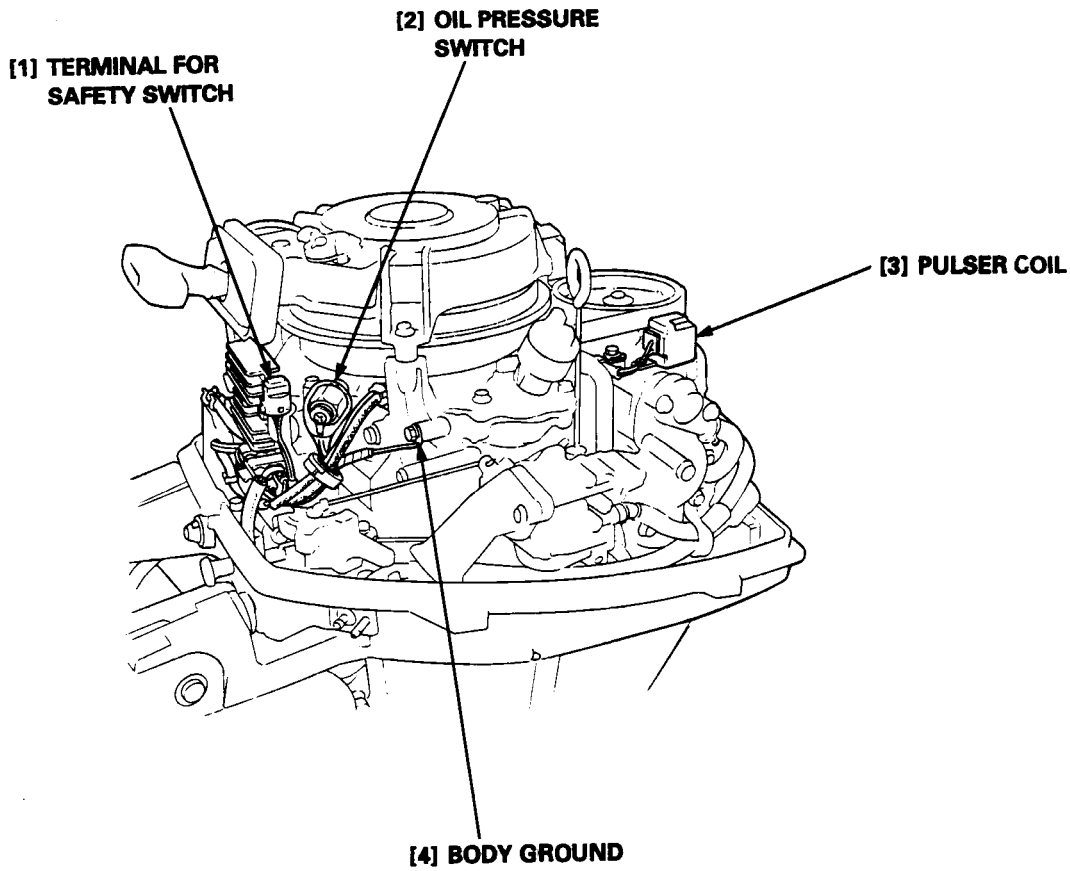




Bl	BLACK	Br	BROWN
Y	YELLOW	O	ORANGE
Bu	BLUE	Lb	LIGHT BLUE
G	GREEN	Lg	LIGHT GREEN
R	RED	P	PINK
W	WHITE	Gr	GRAY



BI	BLACK	Br	BROWN
Y	YELLOW	O	ORANGE
Bu	BLUE	Lb	LIGHT BLUE
G	GREEN	Lg	LIGHT GREEN
R	RED	P	PINK
W	WHITE	Gr	GRAY


[1] TERMINAL FOR SAFETY SWITCH
[2] OIL PRESSURE SWITCH
[3] PULSER COIL
[4] BODY GROUND

FLYWHEEL, ELECTRICAL

REGULATOR/RECTIFIER

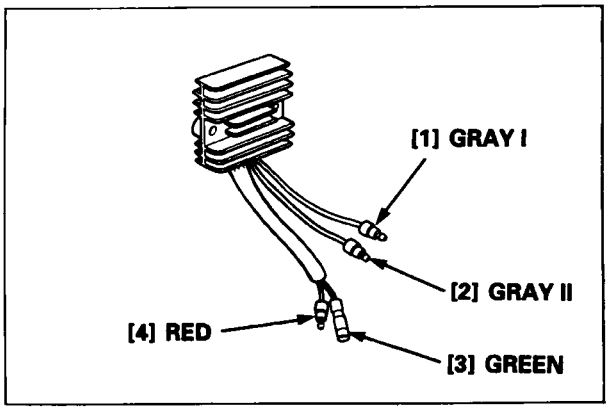
b. INSPECTION

Measure the resistance between each terminal.
Replace the regulator/rectifier if the measurement is out of the specification listed in the table below.

SANWA: SP10D kΩ range
KOWA : TH–5H Ω x 100 range

Unit: Ω

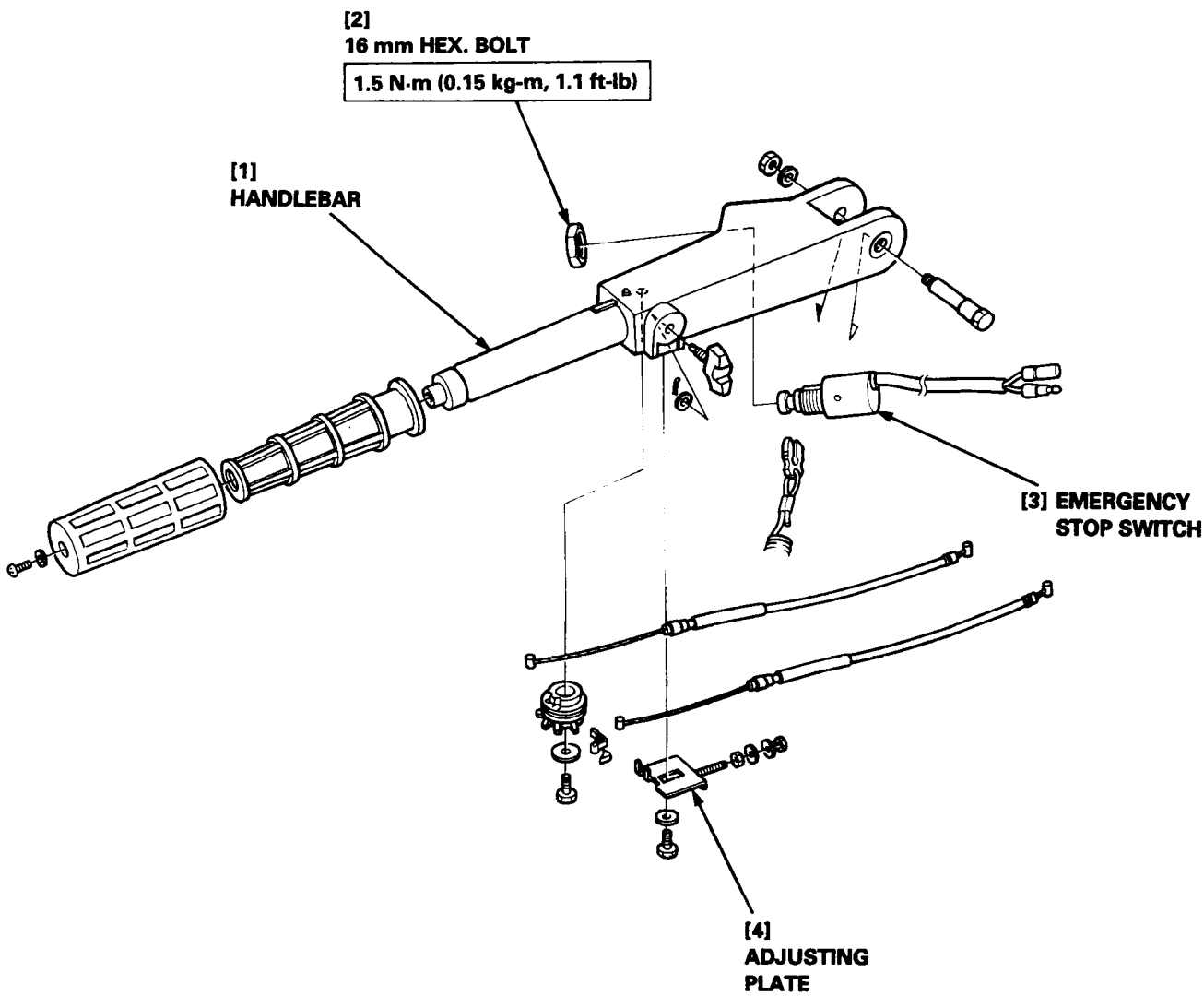
Red tester lead \ Black tester lead	Gray I	Gray II	Red	Green
Gray I		∞	∞	∞
Gray II	∞		∞	∞
Red	1k-200k	1k-200k		500-100k
Green	100-50k	100-50k	∞	



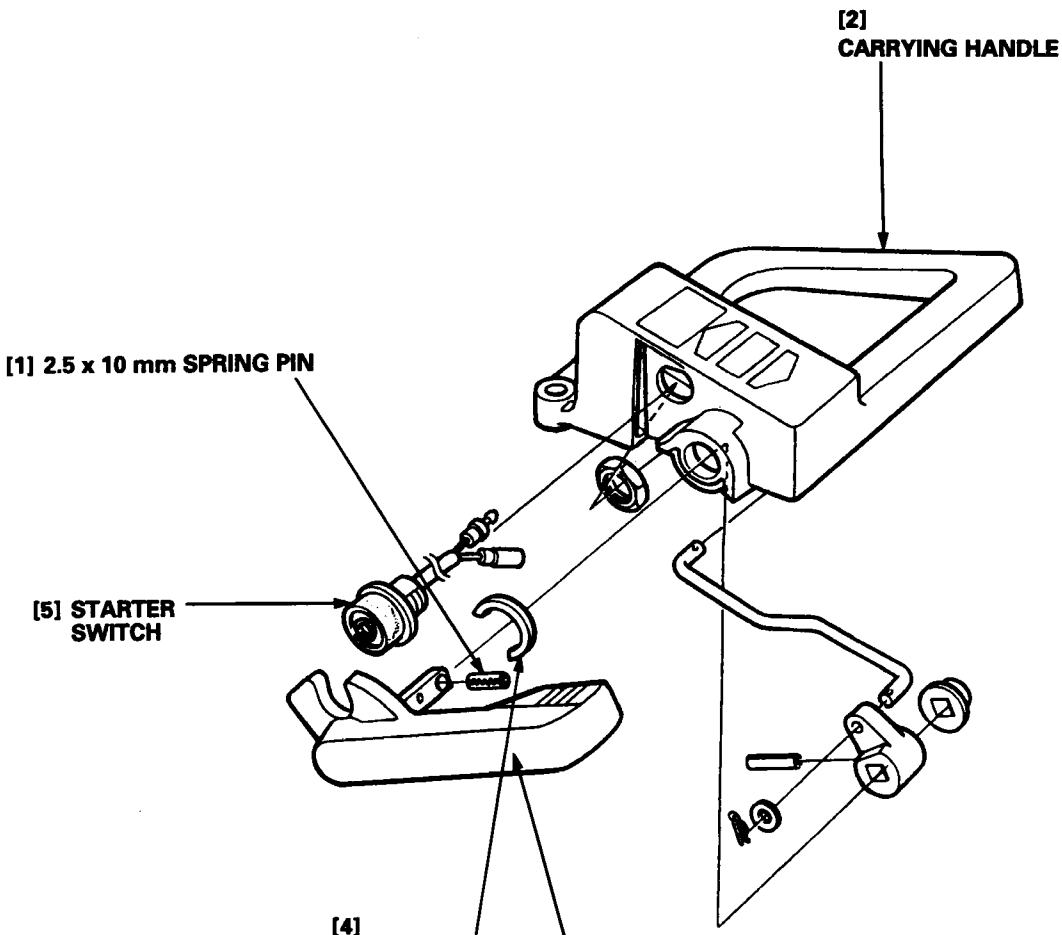
HANDLEBAR, SHIFT LEVER

HANDLEBAR

a.DISASSEMBLY/REASSEMBLY



SHIFT LEVER



REASSEMBLY:
Install so that the starter switch can be seen through the cutout in the lever with the lever in "NEUTRAL" position.

REMOTE CONTROL KIT

a. CABLE CONNECTION

OUTBOARD MOTOR SIDE

1) Remove the oil case grommet B.
   Align the hole in the shift lever with the hole in the shift shaft and install the shift lever with the 5 x 12 mm bolt and 5 mm washer.

   TORQUE: 5 N·m (0.5 kg-m, 3.6 ft-lb)